Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

Print ISSN: 0367-4444
Online ISSN: 2232-7266

Specijalno izdanje

Special Issue

Oktobar/October 2014

Prirodno-matematički fakultet Sarajevo
Faculty of Science Sarajevo

Glasnik hemičara i tehnologa Bosne i Hercegovine

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Congress of Chemists and Chemical Engineers of Bosnia and Herzegovina with International Participation

BOOK OF ABSTRACTS

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Print ISSN: 0367-4444
Online ISSN: 2232-7266

Zmaja od Bosne 33-35, BA-Sarajevo
Bosnia and Herzegovina
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Časopis izlazi polugodišnje, a kompletna tekst verzija objavljenih radova je dostupna na http://www.pmf.unsa.ba/hemija/glasnik.

The journal is published semiannual, and full text version of the papers published are available free of cost at http://www.pmf.unsa.ba/hemija/glasnik.

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Organizing committee‘s Welcome

On behalf of the Organizing and Scientific Committees, Society of Chemists and Technologists of Canton Sarajevo and the Faculty of Science, University of Sarajevo, we welcome you to **Congress of Chemists and Chemical Engineers of Bosnia and Herzegovina with International participation**, at the Radon Plaza Hotel, Sarajevo, Bosnia and Herzegovina.

The topics of the Conference will cover different areas of chemistry with plenary lectures and session presentations discussing today’s research and advanced concept in all areas of chemistry, biochemistry and technology.

We encourage you to make the most of your conference experience by participating in different sessions, and networking with colleagues from around the world. We hope that you will have a fruitful, interactive and enjoyable Congress.

We are all looking forward to welcoming you in Sarajevo

Organizing Committee

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PROGRAMME

PROGRAMME	
Friday, 10.10.2014	
8:00-10:00	Registration of Participants
10:00-10:25	Opening Ceremony
10:30-11:15	Keynote lecture: Dr.sc. Marina Cindrić, Professor at University of Zagreb, Croatia; ***Solvent-induced transformations in feromagnetically coupled [Ni_4O_4] cluster***
11:30-12:15	Keynote lecture: Dr.sci. Mladen Miloš, Professor at University of Split, Croatia; ***Investigation of antioxidative and cell signaling properties of bioactive compounds from aromatic herbs***
12:15-12:30	Coffee break
12:30-12:50	Application of Six Sigma in Control of Enzymes Determination in Human Serum-Jozo Ćorić
13:00-13:20	Protective Effect of Cabbage Extract Against Amiodarone Induced Oxidative Stress in Rat Brain - Ismet Burcu Turkylimaz
13:30-13:50	Automated determination of active compounds in pharmaceutical formulations by flow injection analysis –Lea Kukoč Modun
14:00-14:45	Lunch
14:45-16:00	Poster sessions: OMC, BC
16:10-16:30	Anaerobic digestion of waste from leather industry: biogas production potential by bench and pilot scale experiments - Melina Dzajic Valjevac
16:40-17:00	Automated microfluidic synthesis of N-succinimidyl 4-[18F] fluorobenzoate: a protein labelling agent - Rumeysa Tutar
17:10-17:30	Electrochemical synthesis and study of polyanilines with covalently attached acidic groups - Gutić Sanjin
17:40-18:00	Determination of water content with 774 KF Automated Oven Sample Processor in samples that are Maillard reaction producing Josip Jurković
18:00-19:15	Poster sessions: AEC
Saturday, 11.10.2014	
10:00-10:45	Keynote lecture: Dr.sci. Željko Jaćimović, Professor at Universityof Montenegro, Montenegro; ***Complexes of transition metals with pyrazole derived ligands: synthesis, physico-chemical characterization and potential application***
11:00-11:45	Keynote lecture: Dr.sci. Levent Toppare, Professor at Middle East Technical University, Ankara, Turkey; ***Conducting polymers and their applications***
12:00-12:45	Keynote lecture: Dr.sci. Roderick W. Bates, Professor atNanyang Technological University, Singapore; ***Catalysis: «Awakening Affinities» for Organic Synthesis***
12:45-13:00	Coffee break
13:00-13:20	Spectrometric Characterization ofIron Nanoparticles Preparation using Chelating Ligands – Sanda Rončević
13:30-13:50	Hydrothermal growth of ZnO nanorods on Zn substrates and their application in degradation of azo dyes under ambient conditions – Igor Djerdj

14:00-14:20	Supercritical fluids as a tool of process intensification and sustainable technologies – Maša Knez Hrnčić
14:30-14:50	Preliminary chemical analysis of new discovered siderite meteorites from Croatia and Bosnia and Herzegovina- Budimčić Jelena
15:00-15:45	Lunch
15:45-17:00	Poster sessions: IC, BB
17:00-17:20	Atomic spectrometry as a tool for archaeological material description - Nemet Ivan
17:30-17:50	Content of Fe, Cu and Pb in human teeth enamel and dentin in relation to the age – Almir Olovčić
18:00-18:20	A New Approach for The Synthesis of Ceramic Materials –Yusuf Nur
18:20-19:35	Poster sessions: TRC, EC, CE, CAC, PTC
19:35-20:00	Closing Ceremony
Sunday, 12.10.2014	

Sightseeing tours,Sarajevo

PL: Plenary lecture, OL: Oral presentations, PP: Poster presentations

Sessions:

1.	Analytical and Environmental Chemistry	AEC
2.	Biochemistry and Biotechnology	BB
3.	Inorganic Chemistry	IC
4.	Biological Chemistry	BC
5.	Organic and Medicinal Chemistry	OMC
6.	Physical and Theoretical Chemistry	PTC
7.	Chemistry of Advanced Materials	CAM
8.	Chemical Engineering	CE
9.	Education in Chemistry	EC
10.	Topics related to Chemistry	TRC

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2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Plenary lectures

PL-01

Solvent-induced Transformations in Feromagnetically Coupled $[Ni_4L_4]$ Cluster

Marina Cindrić

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To date several magnetic systems with SMM-type behaviour based on polynuclear complexes of the Mn, Fe, Ni, V and Co or mixed metals have been described. Their synthesis poses a number of challenges, often related with inability to predict the exact cluster structure due to potentially variable outcomes of self–assembly process. Owing to a wide range of their potential applications, *e.g.* in data storage, memory devices, switches and sensors, considerable attention has been devoted to the targeted synthesis of such systems. The importance and great influence of the solvent on modulation of the SMM's magnetic features was first described in 1999 by Olivier Khan[1], who introduced the concept of a "magnetic sponge" to describe magnetic materials that can reversibly release and reabsorb both coordinated and uncoordinated solvent molecules. Importantly, it was shown that these processes are accompanied by the structural changes related to a cleavage/formation of the coordination bonds which subsequently also affect the magnetic properties. [2,3] Among different cluster types that can exhibit SMM features, cubane–like magnetic clusters with $[Ni_4(\mu_3–O)_4]$ core are especially well–studied class. The cubane–like core of nearly all investigated tetranuclear Ni(II) complexes includes four identical μ_3–O bridges originating from –OH or –OR moieties. Previous studies have unveiled that the symmetry of $[Ni_4O_4]$ core and the differences in the Ni–μ_3–O–Ni angles play a crucial role in the intramolecular magnetic interactions. Namely, it was shown that the ferromagnetic interactions are associated with the core angles close to 90°, whereas the antiferromagnetic interactions involve larger angles. This was also corroborated by the latest investigation of $[Ni_4L_4(solv)_4]$ type of complexes which exhibit a switching of the spin ground state from S = 4 to S = 0 at ambient temperature, triggered by the reversible exchange of the coordinated solvent molecules (MeOH *vs.* H_2O).[4] Although the structural alterations induced by such solvent exchange were subtle, substantial changes of the physical and chemical properties have been established.

Our latest investigations were directed to synthetic procedures, interconversion scenarios of reabsorption and exchanging solvent molecules, structural and magnetic studies of a new family of Ni(II) compounds based on cubane–like clusters. Depending on synthetic conditions different cubane–like clusters $[Ni_4L_4(ROH)_4]$, $[Ni_4L_4(H_2O)_2]$, $[Ni_4L_4(ROH)_2(R'OH)_2]$ and $[Ni_4L_4(ROH)_2]$ (H_2L = tridentate Schiff base ligand, *N*–(2–hydroxy–5–methylphenyl)salicylideneimine, R = -CH_3, -C_2H_5, -C_3H_7, -C_4H_9 i –C_5H_{11}) were isolated. The exhibited solvent–induced transformations of the clusters have been studied by SCXRD (at 150 K and at 296 K) and PXRD, TG/DSC, DVS, SQUID magnetometry, Hot–stage microscopy, IR as spectroscopic method and quantum chemical calculations. All experiments are showed possibility to come again to the well–defined initial state exposing clusters to methanol vapours, in turn.

Do danas je u literaturi opisano nekoliko SMM (*single molecule magnets*) magnetskih sustava građenih od polinuklearnih kompleksa Mn, Fe, Ni, V ili Co. Razvoj sintetskih postupaka koji bi vodili nastanku klasterskih molekula ciljanih magnetskih svojstava i građe predstavlja veliki izazov budući da ovi sustavi nalaze primjenu u elektornici, na pr. u sustavima za pohranu podataka, senzorima, memorijskim jedinicama. Utjecaj otapala na promjenu magnetskih svojstava kod molekulskih magneta prvi puta je opisao 1999. O. Khan[1] koji je opisujući utjecaj reverzibilne izmjene otapala na magnetska svojstva uveo koncept "magnetske spužve". Navedeni procesi praćeni su i strukturnim promjenama uslijed pucanja i nastajanja koordinativnih veza što upućuje na usku povezanost strukture s magnestkim svojstvima. Od u literaturi opisanih klasterskih sustava interesantnu skupinu čine klasteri nikla(II) koji sadrže $[Ni_4(\mu_3–O)_4]$ jezgru. Ovi spojevi pobuđuju pažnju zbog svoje građe ali i zbog magnetskih svojstava.

Istraživanja su pokazala da simetrija $[Ni_4O_4]$ jezgre kao i $Ni–\mu_3–O–Ni$ kutevi igraju presudnu ulogu u intramolekulskim magnetskim interakcijama.[2,3] Također je ustanovljeno da su feromagnetske interakcije prisutne u slučaju kada su kutevi unutar tetranuklearne jezgre oko 90°, dok do antiferomagnetskih interakcija dolazi pri višim vrijednostima kuteva. Najnovija istraživanja klastera ovog tipa upućuju na moguću izmjenu osnovnog spinskog stanja Ni(II) iz S = 4 u S = 0 pri sobnoj temperature pod utjecajem reverzibilne izmjene molekula otapala.[4]

Naša istraživanja su pokazala kako sintetski uvjeti utječu na nastanak klastera opće formule $[Ni_4L_4(ROH)_4]$, $[Ni_4L_4(H_2O)_2]$, $[Ni_4L_4(ROH)_2(R'OH)_2]$ i $[Ni_4L_4(ROH)_2]$. Također je ustanovljena mogućnost reverzibilne izmjene koordiniranog i kristalizacijskog otapala što je praćeno i reverzibilnom promjenom magnetskih svojstava. Klasteri su priređeni u reakcijama Ni(II) acetat s *N*-(2-hidroksi)-5-metilfenil)salicilaldiminom, H_2L, ($L^{2-} = C_6H_5(O)–C=N–(O)C_6H_4CH_3$) i upotrebom različitih alkohola kao otapala (ROH, R = $-CH_3$, $-C_2H_5$, $-C_3H_7$, $-C_4H_9$ i $–C_5H_{11}$). Opažene promjene pod utjecajem reverzibilne izmjene otapala praćene su metodama termičke analize (TG/DSC), difrakcije rentgenskih zraka na monokristalnim i praškastim uzorcima, (SCXRD i PXRD), spektroskopskim metodama te SQUID metodom mjerenja magnetske susceptibilnosti.

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2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Plenary lectures

PL-02

Investigation of Antioxidative and Cell Signaling Properties of Bioactive Compounds from Aromatic Herbs

Mladen Miloš

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Reactive oxidizing species (ROS), which are generated during the natural process of aerobic metabolism in living cells, can significantly damage the vital macromolecules and change their functions. As a result of oxidative stress and inhibition of certain enzyme activities, may occur the chronic diseases such as cancers, atherosclerosis, rheumatic and neurodegenerative diseases, diabetes, etc. Today, it is suggested that the control of harmful oxidation processes in living organisms is possible by preventive consumption of different antioxidant compounds through diet. Therefore, there is great interest in the study of biologically active compounds derived from food.

The goal of such research is the isolation, fractionation and identification of chemical compounds and testing their biological activity such as antioxidant effect and inhibition of the enzyme activity of the selected enzyme (acetylcholinesterase, catalase, tyrosinase, superoxide dismutase, protein tyrosine kinase, etc.).

In order to achieve this specific objective the conventional extraction methods were used. Separation of the active components is done by fractionation using chromatographic techniques. The chemical composition and the content of the fractions were carried out by chromatography and mass spectrometry and spectroscopy (GC / MS, HPLC / MS, UV / VIS). Antioxidant activity was examined using standard methods: DPPH (free radical scavening), FRAP (ferric reducing ability of plasma), TBARS (thiobarbituric acid method), etc. The inhibition of enzyme activity was examined by corresponding UV / VIS spectrophotometric methods . Enzyme kinetics are mainly studied by Michaelis - Menten model.

Since many types of chronic illnesses are a result of disruption of signaling pathways which control the normal cell function, the investigation of biologically active compounds derived from food can be very interesting from several aspects. The possible identification of new antioxidant and inhibitor of the enzyme activities of selected enzymes could find application in the food and the pharmaceutical industry for the preparation of healthy food and natural remedies.

Reaktivni oksidacijski spojevi, koji se generiraju tijekom prirodnih procesa u metabolizmu aerobnih živih stanica, mogu znatno oštetiti vitalne makromolekule i promijeniti njihove funkcije. Kao posljedica oksidacijskog stresa i inhibicije određenih enzimskih aktivnosti, javljaju se kronične bolesti poput kancerogenih oboljenja, arteroskleroze, reumatskih i neurodegenerativnih oboljenja, diabetesa itd. Danas se sugerira da je kontrola štetnih oksidacijskih procesa u živim organizmima moguća preventivnim konzumiranjem različitih antioksidacijskih spojeva putem prehrane. Stoga postoji veliki interes za istraživanjem biološki aktivnih spojeva porijeklom iz hrane koja se konzumira. Cilj takvih istraživanja je izoliranje, frakcioniranje i identifikacija kemijskih sastojaka i ispitivanje njihove biološke aktivnosti poput antioksidacijskog učinka i

inhibicije enzimske aktivnosti odabranih enzima (kolinesteraze, katalaza, tirozinaza, superoksid dismutaza, protein tirozin kinaza i sl.).

U svrhu postizanja ovog specifičnog cilja koriste se konvencionalne metode ekstrakcije. Odvajanje aktivnih komponenti se vrši frakcioniranjem kromatografskim tehnikama, a određivanje kemijskog sastava i sadržaja u frakcijama provodi se kromatografijom i spektrometrijom masa i spektrofotometrijom (GC/MS, HPLC/MS, UV/VIS). Antioksidacijska aktivnost se ispituje standardnim metodama: DPPH (free radical scavening), FRAP (ferric reducing ability of plasma), TBARS (metoda s tiobarbiturnom kiselinom) i sl., a inhibicija enzimskih aktivnosti se ispituje odgovarajućim UV/VIS spektrofotometrijskim metodama. Enzimska kinetika se uglavnom proučava prema Michaelis-Mentenovom modelu.

Budući da su brojne vrste kroničnih oboljenja posljedica prekidanja signalnih putova koji nadziru normalan rad žive stanice, rezultati istraživanja biološki aktivnih spojeva porijeklom iz hrane mogu biti vrlo interesantni s više aspekata, a identifikacija novih antioksidansa i inhibitora enzimskih aktivnosti odabranih enzima mogla bi naći primjenu u prehrambenoj i farmaceutskoj industriji za pripravu zdrave hrane i prirodnih lijekova.

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2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Plenary lectures

PL-03

Complexes of transition metals with pyrazole derived ligands: synthesis, physico-chemical characterization and potential application

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Metal complexes with pyrazole and its derivatives have recently attracted the attention of many authors, which is supported by a large number of published scientific papers, as well as by several reviews. However, these compounds are interesting not only from a theoretical, but also practical aspect. Specifically, pyrazoles are the components of many drugs (especially antipyretics and antirheumatics, herbicides and fungicides, and some pyrazole derivatives can be used as extragents of various metal ions. Most recently, the knowledge about biocoordination chemistry of pyrazole and its derivatives has been expanded. Among these, some macrocyclic pyrazole ligands are significant in biochemistry of oxygen transport, as well as those which participate in the formation of three-dimensional structure around the active centre of copper proteins (enzymes). Bearing in mind the considerable interest that exists for complexes with pyrazole derivatives ligands, this paper is aimed to review the newly synthesized complexes (by our research group) of Cu (II), Zn (II), Cd (II), Hg (II), Ni (II), Co (II) with some *di*-and *tri*-substituted pyrazole derivatives, to describe the syntheses and physic-chemical characterization of complex compounds obtained. The potential anticancer activity has been investigated in the selected group of complex compounds (complexes with pyrazolone ligands). The second selected group of compounds was investigated in relation to the potential biological activity (fungicidal activity) on pathogenic fungi ***Phomopsis viticola*** **Sacc**, which is the cause of leaf spot disease of grapevine and ***Botryosphaeria dothidea*** that causes fruit rot of olives.

Kompleksi metala sa pirazolom i njegovim derivatima u novije vrijeme privlače pažnju mnogih autora, o čemu govori veliki broj objavljenih naučnih radova, kao i nekoliko radova preglednog karaktera. Inače, ova jedinjenja su interesantna ne samo sa teorijskog, već i praktičnog aspekta. Naime, pirazoli ulaze u sastav mnogih ljekova (naročito antipiretika i antireumatika), herbicida i fungicida, a neki derivati pirazola se mogu koristiti i kao ekstragenti različitih metalnih jona. U najnovije vrijeme proširena su saznanja i o biokoordinacionoj hemiji pirazola i njegovih derivata. Među ovima značajni su neki makrociklični pirazolski ligandi u biohemiji prenosa kiseonika, kao i oni koji učestvuju u formiranju trodimenzionalne strukture oko aktivnog centra bakar proteina (enzimi).

Imajući u vidu značajan interes koji vlada za komplekse sa ligandima derivatima pirazola, ovaj rad ima za predmet pregled novosintetizovanih kompleksa(od strane naše istraživačke grupe) Cu(II), Zn(II), Cd(II) Hg(II), Ni (II), Co(II) sa nekim *di*- i *tri*-supstituisanim derivatima pirazola opis sinteza i fizičko-hemijsku karakterizaciju dobijenih kompleksih jedinjenja.

Odabranoj grupi kompleksnih jedinjenja(kompleksi sa pirazolonskim ligandima) ispitivana je potencijalna anticancer aktivnost dok je drugoj odabranoj grupi jedinjenja ispitivana potencijalna biološka aktivnost (fungicidna aktivnost) na patogenene gljivice ***Phomopsis viticola* Sacc** uzročnika bolesti crne pjegavosti vinove loze i ***Botryosphaeria dothidea*** koja prouzrokuje trulež plodova masline.

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2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Plenary lectures

PL-04

Conducting Polymers and their Applications

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Conducting polymers attracted great attention in many research fields owing to their overwhelming characteristics like ease of processability, ability of conduct electricity, low cost, straight forward preparation techniques. Our research interests are conducting polymer based electrochromic devices, solar cells, organic light emitting diodes and biosensors. Polymers having one of the three complementary colors (red, green, and blue) in the reduced state and high transmissivity in the oxidized state are key materials towards use in electrochromic devices and displays. For potential application of electrochromic materials in display technologies, one should have to create the entire color spectrum and this can be only achieved by having materials with additive or subtractive primary colors in their neutral states. To obtain a green color there should be at least two simultaneous absorption bands. Although the neutral state color is of great importance, the transmittance in the oxidized state is crucial too.

Biosensors based on conducting polymers have advantages over conventional laboratory based assays. The conventional methods are time consuming, expensive, required well trained personnel and not used for real time measurements. Nevertheless, biosensors are inexpensive, portable with minimized design, easy to handle, selective and sensitive. In our group, a wide variety of biosensors were emerged as conducting polymer based enzyme biosensors. For these purposes, many conducting polymers which have specific groups were designed and synthesized. These polymers were utilized as immobilization matrices for biosensor construction. During immobilization, several modification structures were used in biosensor fabrication to achieve the most effective surface design for target biosensors.

Solar cells basically convert sunlight into electricity. With the absorption of light donor molecule's electrons are excited from HOMO to LUMO to generate excitons. Excitons dissociate into holes and electrons. Electrons move through the acceptor molecule while the holes travel along the donor molecule. Charge carriers reaching to respective electrodes are collected. OLEDs on the other hand work oppositely generating light upon potential application. Recent developments in The Center for Solar Energy Research and Applications, METU on the OPVs and OLEDs are discussed.

Polimeri vodiči privlače veliku pažnju u različitim oblastima istraživanja zbog osobina kao što su laka prerada, sposobnost provođenja elektriciteta, niski troškovi i jednostavne tehnike pripreme. Područje interesa naše grupe su polimeri vodiči u elektrohromnim uređajima, solarnim ćelijama, diodama koje emituju svjetlost i biosenzorima.

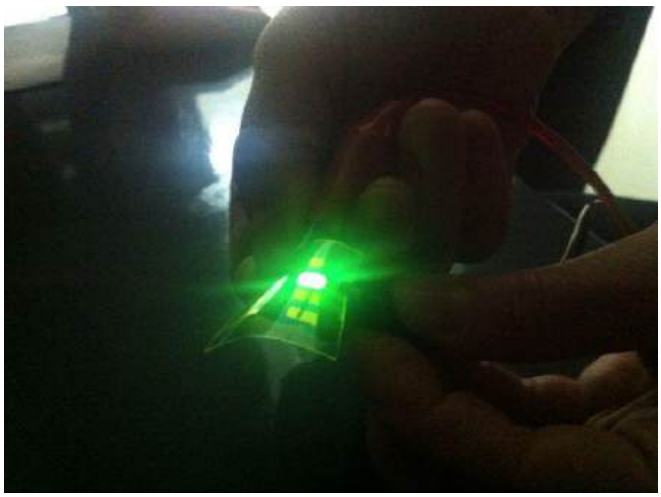
Polimeri koji posjeduju jednu od tri komplementarne boje (crvena, zelena i plava) u redukovanom stanju i visoku propusnost u oksidovanom stanju su osnovni materijali koji se koriste u elektrohromnim uređajima i displejima. Za primjenu elektrohromnih materijala u tehnologijama proizvodnje displeja, neophodno je omogućiti stvaranje cijelog spektra boja što se može postići sa materijalima koji sadrže primarne boje u neutralnom stanju. Da bi se dobila zelena boja, potrebno je da

postoje barem dvije simultane apsorpcione trake. Iako neutralno stanje boje ima veliku važnost, propuštanje boje u oksidiranom stanju je krucijalno također.

Biosenzori zasnovani na polimerima vodičima imaju prednosti nad konvencionalnim esejima. Konvencionalne metode vremenski dugo traju, skupe su, zahtjvaju dobro obučeno osoblje i ne mogu se koristiti u realnom vremenu mjerenja. Sa druge strane, biosenzori su jeftini, prenosivi uz minimalan dizajn, jednostavni za rukovanje, selektivni i osjetljivi. U našoj grupi su nastali različiti enzimski biosenzori zasnovani polimerima vodičima. Za tu svrhu je sintetizirano mnogo polimera vodiča sa specifičnim grupama.

Ovi polimeri su se koristili kao imobilizacione matrice za konstrukciju biosenzora. U toku imobilizacije, nekoliko modifikacionih struktura je korišteno u fabrikaciji biosenzora da bi se postigao najefikasniji površinski dizajn za određeni biosenzor.

Solarne ćelije prevode sunčevu svjetlost u elektricitet. Elektroni molekule donora se apsorpcijom svjetla pobuđuju od HOMO do LUMO stnja pri čemu nastaju ekscitoni. Ekscitoni disociraju na I elektrone. Elektroni se kreću kroz molekulu akceptora dok se šupljine kreću duž molekule donora. Nosači naboja dospijevaju do dogovarajućih elektroda gdje se sakupljaju. OLEDi sa druge strane rade na suprotnom principu sakupljajući svjetlo nakon određene, potencijalne aplikacije. Nova dostignuća u Centru za istraživanja solarne energije i njihova primjena , METU na OPV I OLED su predstavljena u ovom radu..



Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Plenary lectures

PL-05

Catalysis: «Awakening Affinities» for Organic Synthesis

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The synthesis of a complex molecule without the use of catalysis would, nowadays, be unthinkable. Catalytic reactions, from the mundane to the exotic, are ubiquitous in the field of organic synthesis. In particular, the use of transition metal catalysis has revolutionised the ways that we think about the formation of carbon-carbon bonds. We are currently employing a wide variety of metals to achieve mild and selective bond formation. This includes palladium, rhodium, osmium, iridium, platinum, silver and gold. In addition, we have developed methods using Lewis acidic main group metal catalysts. A selection of catalytic reactions and their applications will be presented

Sinteza složenih molekula bez upotrebe katalizatora bi, u današnje vrijeme, bila nezamisliva. Katalitička reakcije, od uobičajenih do neobičnih, su sveprisutne u području organske sinteze. Konkretno, korištenje prelaznih metala kao katalizatora je napravilo pravu revoluciju u načinu na koje razmišljamo o formiranju veze ugljik-ugljik. U trenutnim istraživanjima, koristimo različite metale za selektivno stvaranjem veze pod blagim uslovima. U ovu grupu metala se ubrajaju paladij, rodij, osmij, iridij, platina, srebro i zlato. Osim toga, razvili smo metode sinteze gdje se koriste katalizatori glavne grupe metala koji se ponašaju kao Lewisove kiseline. U ovom radu će biti predstavljene izabrane katalitičke reakcije i njihovih aplikacija.

Objavljeni radovi izvorno su autorski te nisu lektorisani.

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ORAL PRESENTATIONS

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 01

Application of Six Sigma in Control of Enzymes Determination in Human Serum

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Keywords:
enzymes,
Six sigma,
quality control.

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Abstract: Clinical Chemistry is backbone in the medical treatment, diagnostics or prevention.Test for several serum enzymes are used in the differential diagnosis of disease. Laboratory attempts to improve quality aim to reduce diagnostic errors and decrease turn around time with traceability of all laboratory procedures and to assure the safety of patients. Not all the of many approaches to quality control are equally effective. A critical limitation of the statistical quality control is that they are ineffective in detecting and contoling mistakes. Statistical quality contol can effectively contol process variation, but it cannot detect or prevent most mistakes. Six sigma belongs to statistical quality control and provides a new methodology for measuring process performance and refines earlier methodologies for making process improvements.The Sigma concept provides a universal methodology for measuring quality by counting the defects results. The performance of all processes can be characterized on the „Sigma scala“ ranga from 2 to 6. Sigma was calculated using Ricos quality requirements. In terms of Sigma, if a method has a value less than three is considered to be unreliable and should not be used in routine laboratory partice. Six Sigma provides benefits over prior approaches to quality menagement, it also creates newer challengens for laboratory practitioners.

Sažetak

Klinička kemija je okosnica medicinskog liječenja, dijagnostike ili prevencije. Određivanje aktivnosti nekoliko serumskih enzima koristi se u diferencijalnoj dijagnozi bolesti. Laboratoriji nastoje poboljšati kvalitetu s ciljem smanjenja učestalosti dijagnostičkih pogrešaka i skraćivanja vremena potrebnog za izdavanje cijelokupnog nalaza, s osiguranom sljedivosti svih laboratorijskih procesa, kako bi se osigurala sigurnost bolesnika. Nisu svi prilazi kontroli kvaliteta podjednako efikasni. Ključni nedostatak u primjeni metoda statističke kontrole kvaliteta leži u činjenici da su neefikasne u detekciji i kontoli grešaka. Statističkom kontrolom kvalitete mogu efikasno da se kontroliraju varijacije u procesu, ali ne mogu da se detektiraju ili spriječe greške. „Six sigma“ pripada statističkoj kontroli kvaliteta koja pruža novu metodologiju za mjerenje karakterisika procesa, a usavršava i predhodne metodologije čime dolazi do unapređenja procesa. Ona pruža univerzalnu metodologiju kojom se mjeri kvalitet time što se mjere defektni rezultati. Na taj način svi procesi mogu da se okarekteriziraju na „sigma skali“ vrijednosti od 2 do 6. Sigma se računa pomoću Ricos zahtjeva. Kad se dobiju vrijednosti manje od tri smatra se da su te metode nepouzdane za korištenje u rutinskoj laboratorijskoj praksi. Six Sigma pruža prednosti kod korištenja menađmenta kvalitete i također kreira nove mogućnosti razvoja laboratorijske prakse.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 02

Protective Effect of Cabbage Extract against Amiodarone Induced Oxidative Stress in Rat Brain

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Keywords:
Brain,
Amiodarone,
Cabbage,
Oxidative stress.

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Abstract: Amiodarone is the most commonly prescribed antiarrhythmics effectively treating atrial and ventricular fibrillation. It has many important side effects, including hepatotoxicity, thyroid and neuropathic problems. Cabbage (*Brassica oleracea* L. var. capitata) is one of the most important vegetable in worldwide. Due to its antioxidant and antiinflammatory activities, cabbage has a widespread use in traditional medicine. In this study, we aimed to investigate the effects of amiodarone and cabbage extract on rat brain. Female Sprague-Dawley rats were randomly divided into four groups as follows: control group receiving corn oil: cabbage extract (500 mg/kg/day) given group: amiodarone (100 mg/kg/day) given group: amiodarone + cabbage extract (in same dose) given group. Cabbage extract and amiodarone were given by gavage to the rats for 7 days. Amiodarone was given to the animals one hour after cabbage extract administration during the experimental period. All animals were sacrificed on the 8th day. Brain tissues were taken and homogenized in saline. Brain lipid peroxidation and protein carbonyl levels, catalase, superoxide dismutase, adenosine deaminase, xanthine oxidase and myeloperoxidase activities were increased while sodium potassium ATPase activity was decreased in amiodarone group. Administration of cabbage extract reversed these effects. These results demonstrated that administration of cabbage extracts is a potentially beneficial agent to reduce the brain damage induced by amiodarone.

Sažetak

Amiodaron je najčešće propisivani antiaritmik koji učinkovito liječi fibrilaciju srčanih komora. Ima mnogo značajnih popratnih efekata, uključujući hepatotoksičnost, tiroidne i neuropatične probleme. Kupus (*Brassica oleracea* L. var. capitata) je jedno od najznačajnijih vrsta povrća u svijetu. Zbog antioksidativnog i antiinflamatornog djelovanja, kupus se naširoko koristi u tradicionalnoj medicini. U ovom radu ciljali smo da ispitamo efekte amiodarona i ekstrakta kupusa na mozak pacova. Ženke Sprague-Dawley pacova su nasumično podjeljene u četiri grupe: kontrolna grupa kojoj je davano kukuruzno ulje; ekstrakt kupusa (500 mg/kg/dan); amiodaron (100 mg/kg/dan); amiodaron + ekstrakt kupusa (u istim dozama). Ekstrakt kupusa i amiodarona je davan kljukanjem pacova u periodu od 7 dana. Amiodaron je davan životinjama jedan sat nakon davanja ekstrakta kupusa u toku eksperimentalnog perioda. Sve životinje su uspavane osmog dana. Moždano tkivo je uzeto i homogenizirano u slanom rastvoru. Aktivnosti peroksidacije moždanih lipida i nivoi protein karbonila, katalaze, superoksid dizmutaze, adenozin deaminize, ksantin oksidaze i mijeloperoksidaze su povećane dok je aktivnost natrij kalij ATPaze smanjena u amiodaron grupi. Korištenjem ekstrakta kupusa ovi efekti su obrnuti. Ovi rezultati su pokazali da ekstrakt kupusa pretstavlja potencijalno koristan agens u smanjivanju oštećenja mozga izazvanog amiodaronom.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 03

Automated determination of active compounds in pharmaceutical formulations by flow injection analysis

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Keywords:
flow injection analysis,
thiol compounds,
pharmaceutical formulations.

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Abstract: Flow injection analysis (FIA) is an automated technique with numerous applications in quantitative chemical analysis. From the beginning in 1975 when Hansen and Ružička introduced FIA for the first time, till today, more than 17000 scientific papers and 20 monographs have been published. FIA is a kinetic method of analysis; signal is recorded in the moment when the chemical reaction did not proceed to thermodynamic equilibrium. In contrast to the conventional continuous flow procedures and batch methods, FIA do not rely on complete mixing of sample and reagent(s) (physical homogenization). In recent years, more strict regulation related to the quality control in pharmaceuticals led to increasing demands on automation of the analytical assays carried out in appropriate control laboratories. FIA became a versatile instrumental tool that contributed substantially to the development of automation in pharmaceutical analysis due to its simplicity, low cost and relatively short analysis time. In this work the developed flow injection methods with spectrophotometric detector for the determination of thiol compounds (active substances in pharmaceutical formulations) will be presented. The selectivity of the developed methods based on the reaction mechanism will be discussed.

Sažetak

Protočna analiza injektiranjem (Flow injection analysis, FIA) je automatizirana tehnika s brojnim primjenama u kvantitativnoj kemijskoj analizi. Od njenih samih početaka 1975. godine kada su je predstavili Hansen i Ružička do današnjeg dana, objavljeno je preko 17 000 znanstvenih radova i 20 monografija. Protočna analiza injektiranjem je kinetička metoda analize, te se signal bilježi u trenutku kada kemijska reakcija nije dosegla stanje termodinamičke ravnoteže. U usporedbi s klasičnim protočnim metodama i svim klasičnim metodama koje se odvijaju bez protoka (metode „u čaši“, batch methods) kod analize u protoku injektiranjem ne dolazi do potpunog miješanja analita i reagensa (fizičke homogenizacije). Posljednjih godina, sve strože kontrole kvalitete farmaceutskih formulacija zahtijevaju automatizaciju analitičkih metoda koji se koriste u laboratorijima za kontrolu kvalitete. Protočna analiza injektiranjem stoga je postala nezamjenjiva u razvoju automatiziranih metoda analize farmaceutskih pripravaka, zbog svoje jednostavnosti, niskih troškova i vrlo kratkom vremenu potrebnom za analizu. Cilj ovog izlaganja je pregled razvijenih i validiranih metoda određivanja farmaceutski aktivnih tvari korištenjem protočne analize injektiranjem sa spektrometrijskim detektorom za određivanje tiolnih spojeva (aktivnih tvari u farmaceutskim pripravcima). Biti će raspravljena postignuta selektivnost predstavljenih metoda, koja se temelji na reakcijskim mehanizmima.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 04

Anaerobic digestion of waste from leather industry: biogas production potential by bench and pilot scale experiments

Džajić – Valjevac M, Milanolo S., Haznadarević M., Kupusović T.

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Keywords:
Anaerobic digestion,
biological waste,
bioreactor,
biogas, methane,
leather, fleshing,
waste to energy.

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Abstract: Meat waste is the most common source of biological waste in the world, including Bosnia and Herzegovina. Leather industry contributes to the production of biological waste mainly through the processing of raw hides and the treatment of wastewater.

These residuals are difficult to be properly disposed and solutions such as thermal treatment, because of high water content, are less appealing. Anaerobic digestion could represent an attractive solution from the environmental and economic perspective.

Anaerobic digestion of leather industry wastes (raw hides fleshing and wastewater treatment surplus sludge) have been investigated using bench scale Biochemical Methane Potential tests (BMP) and a 1 m^3 inclined plug flow pilot reactor under mesophilic conditions (35 ±1 °C). The experiments revealed the possibility of stable biogas production. In detail, at maximum stable loading rate, the anaerobic treatment of 35-70 kgd^{-1} of waste generated up to 400 – 450 ld^{-1} of biogas, with a yield compared to maximum theoretically achievable of 70% (0,17-0,20 l_{CH4} g_{COD}^{-1}). Recorded concentrations of ammonia and sulfide did not reach values to produce evident inhibitory effects and to compromise the overall process.

Sažetak

Mesni otpad predstavlja najzastupljeniji izvor biološkog otpada kako u svijetu, tako i u Bosni i Hercegovini (BiH). Industrija prerade kože doprinosi produkciji biološkog otpada kroz proces obrade sirove kože i tretman otpadnih voda. Ovu vrstu otpada je izuzetno teško propisno zbrinuti, a rješenja poput termalne obrade su manje privlačna zbog velikog sadržaja vlage. Stoga se proces anaerobne digestije nudi kao atraktivno rješenje u okolišnom i ekonomski opravdanom smislu

Istraživanje anaerobne digestije otpada kožarske industrije (mesina i otpadni mulj postrojenja za tretman otpadnih voda) je vršeno uz primjenu laboratorijske postavke BMP testa (eng. Biochemical Methane Potential tests) i anaerobnog reaktora zapremine 1m^3, tipa horizontalno nagnutog reaktora (eng. plug flow reactor) u mezofilnim temperaturnim uslovima (35 ±1 °C). Eksperiment je dokazao mogućnost stabilne proizvodnje biogasa. Precizno govoreći, pri maksimalnom doziranju otpada, anaerobnom obradom 35 – 70 kgd^{-1} otpada nastaje oko 400-450 ld^{-1} biogasa, sa procenutalnim udjelom metana u odnosu na teoretski mogući u iznosu od 70% (0,17-0,20 l_{CH4} g_{COD}^{-1}). Zabilježene koncentracije amonijaka i sulfida nisu dostigle vrijednosti koje bi mogle ugroziti cjelokupan proces.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 05

Automated microfluidic synthesis of N-succinimidyl 4-[^{18}F] fluorobenzoate: a protein labelling agent

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Keywords:
Microfluidic,
[^{18}F] SFB,
protein labelling,
[^{18}F] FB-HAS.

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Abstract: Biomolecules labeled with radioactive fluorine ^{18}F are an invaluable tool for the molecular imaging of physiological processes with positron emission tomography (PET). N-succinimidyl 4-[^{18}F] fluorobenzoate ([^{18}F]SFB) is one of the most popular ^{18}F-synthons used for the labeling of free amine groups of biomolecules[2]. Manual synthesis of [^{18}F] SFB is, however, laborious work and leads to excess radioactivity exposure. The use of microfluidics for automated radiosynthesis has recently gained popularity in the research community. An automated procedure of [^{18}F]SFB synthesis has been developed starting from (4-ethoxycarbonyl)-N,N,N-trimethylbenzeneaminium triflate using a platform consisting of the microfluidic module Advion Nanotek (USA) and a conventional radiosynthetic module Nuclear Interface (Germany). To test the reactivity of the thus obtained [^{18}F] SFB, we used it to prepare [^{18}F] fluorobenzoylated human serum albumin ([^{18}F] FB-HSA), a blood pool imaging agent. [^{18}F]SFB was obtained within 90 min synthesis time (including purification) in 13±8% isolated yield and >95% radiochemical purity. Conversion of [^{18}F] SFB into [^{18}F] FB-HSA was 26.9 % within 30 min. Radiochemical purity of gel-filtration-purified [^{18}F] FB-HSA was >97%. An automated synthesis procedure suitable for the preparation of [^{18}F] SFB has been developed. This protocol can be used to label biomolecules for research purposes.

Sažetak

Biomolekule obilježene sa radioaktivnim fluorom, ^{18}F, predstavljaju neprocjenjivo sredstvo za molekularno oslikavanje fizioloških procesa sa pozitronskom emisionom tomografijom (PET). N-sukcinimidil 4-[^{18}F] fluorobenzoat ([^{18}F]SFB) je jedan od najpopularnijih ^{18}F-sintona koji se koristi za obilježavanje slobodnih amino grupa u biomolekulama[2]. Manuelna sinteza [^{18}F] SFB je komplikovana I praćena većem izlaganju radioaktivnom zračenju. Upotreba mikrofluida za automatiziranu radiosintezu sve više dobiva na značaju.

Automatizirana procedura za sintezu [^{18}F]SFB je razvijena u ovom radu počevši sa (4-etoksikarbonil)-N,N,N-trimetilbenzeneaminium triflatom, koristeći platform koja se sastoji od mikrofluidnog modula Advion Nanotek (USA) I konvencionalnog radiosintetskog modula Nuclear Interface (Germany). Za testiranje reaktivnosti dobivenog [^{18}F] SFB, pripremali smo[^{18}F] fluorobenzoilirani ljudski serum albumin ([^{18}F] FB-HSA), koji se koristi kao sredstvo za slikanje krvi.

[^{18}F]SFB je dobiven unutra 90 min trajanja sinteze (uključujući prečišćavanja) sa prinosom 13±8% i >95% radiohemijskom čistoćom. Konverzija [^{18}F] SFB u [^{18}F] FB-HSA je iznosila 26.9 % u toku 30 min. Radiohemijska čistoća gel-filtracijom prečišćenog [^{18}F] FB-HSA je iznosila >97%.

Automatiziran procedura za sintezu [^{18}F] SFB je razvijena u ovom radu. Ovaj protokol se može koristiti za obilježavanje biomolekula u cilju daljnih istraživanja.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 06

Electrochemical Synthesis and Study of Polyanilines with Covalently Attached Acidic Groups

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Keywords:
self-doped polyaniline, electrochemical polymerization

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Abstract: Abstract: Electrochemical copolymerization of aniline and its carboxylic acid and hydroxyl derivatives, postpolymerization electrochemical treatment of polyaniline films as well as electrochemical properties of obtained films are discussed. Synthesized copolymer films with carboxylic, hydroxyl and sulfonic groups were investigated by voltammetric and impedance techniques in electrolytes of different pH, in order to determine pH dependence of their electrical and redox properties. All co-monomers show inhibiting effect on electrochemical polymerization rate of aniline, thus making the ratio of aniline to co-monomer important variable. Copolymers with carboxylic and hydroxyl groups have well defined redox behavior in solutions of higher pH, while they remain fairly insoluble. Sulfonic acid derivatives also show redox activity in solutions of higher pH but cannot sustain as insoluble freestanding films.

Sažetak

Elektrohemijska kopolimerizacija anilina i njegovih derivata sa karboksilnom i hidroksilnom grupom, postpolimerizacijski tretman polianilinskih filmova kao i elektrohemijske osobine dobivenih filmova su diskutovani. Sintetisani kopolimerni filmovi sa karboksilnim, hidroksilnim i sulfonskim grupama su ispitani voltametrijskim i impedansnim tehnikama u elektrolitima različitih pH, sa ciljem određivanja pH zavisnosti njihovih električnih i redoks osobina. Svi komonomeri pokazuju inhibitorski efekat na brzinu elektrohemijske polimerizacije anilina, što čini odnos anilina i kopolimera bitnom promjenjivom. Kopolimeri sa karboksilnim i hidroksilnim grupama imaju dobro definisano ponašanje u rastvorima viših pH, pri čemu ostaju prilično nerastvorljivi. Derivati sa sulfonskom grupom takođe pokazuju redoks aktivnost u rastvorima viših pH ali ne mogu da se zadrže kao nerastvorni filmovi.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 07

Determination of water content with 774 KF Automated Oven Sample Processor in samples that are Maillard reaction producing

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Keywords:
Water,
Karl Fischer,
Maillard reaction,
Automated Oven Sample Processor

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Abstract: The water is obligatory quality indicator of all foodstuffs. However, its determination is not always easy because it could result in loosing of volatile compounds (heating) sample degradation or transformation. Results from heating methods will often show amount of all volatile compounds and not just water. The second problem caused by heating is Maillard reaction, during which water is produced in samples with high sugar and protein content. It is hard to distinguish water that is originally from sample and water produced by Maillard reaction. That asks for determination of two "kinds" of water: originally present in a sample and water produced in Maillard reaction. Karl Fischer titration is the most promising method for water determination which relies on chemical reaction of water. Our investigation used the method that combines the 774 Oven Sample processor (Metrohm) with coulometric Karl Fisher titration and as the control method classical volumetric Karl Fischer titration. The model systems were different combinations of whey protein and maltodextrin. Some 550 determinations, including parallels were made. The results have indicated, depending on proteins-maltodextrin ratio, a range of 0.34 % to 0.80 % of total sample water was produced in Maillard reaction.

Sažetak

Određivanje sadržaja vode je obavezan indikator kvaliteta hrane. Ipak, njeno određivanje nije uvijek jednostavno jer može doći do gubitka isparljivih komponenti (zagrijavanje) degradacije ili transformacije uzorka. Metode koje koriste zagrijavanje će često pokazati količinu svih isparljivh komponenti a ne samo vode. Drugi problem zagrijavanja je Majarova reakcija gdje se proizvodi voda u uzorcima sa visokim sadržajem šećera i proteina. Teško je razlučiti vodu koja je orginalno u uzorku i vodu koja je proizvedena Majarovom reakcijom. U tim slučajevima je neophodno odrediti dvije „vrste" vode: ona koja je normalno prisutna u uzorku i ona koja nastaje u Majarovoj reakciji. Titracija po Karl-Fischeru je metoda za određivanje vode koja najviše obećava i koja koristi kemijsku reakciju vode. Naše istraživanje kombinira 774 Automated Karl Fischer Oven Sample Processor sa kulometrijskom Karl-Ficher-ovom titracijom sa klasičnom Karl Fisher volumetrijskom titracijom kao kontrolnom metodom. Modelni sistemi su bile kombinacije proteina sirutke I maltodekstrina, u različitim odnosima. Uključujući paralelke, urađeno je oko 550 određivanja. Rezultati pokazuju da, ovisno o odnosu proteina sirutke i maltodekstrina, sadržaj vode porijeklom iz Majarove reakcije iznosi 0,34% do 0,80% od ukupnog sadržaja vode.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 08

Spectrometric Characterization of Iron Nanoparticles Preparation using Chelating Ligands

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Keywords:
iron nanoparticles,
ICP-OES,
SEM

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Abstract: Recent research has shown that nanoscale iron particles are effective material for the transformation of wide array of common environmental contamination in water systems. Zero valent iron nanoparticles (nZVI) are typically prepared by reducing Fe (II) of Fe (III) in an aqueous phase using sodium borohydride. In order to prepare nZVI of desired stability, a variety of stabilizing agents, surfactants or capping agents are employed in synthesis steps. The objective of this work is to provide comparison and quality control of iron nanoparticles produced under different experimental conditions. Therefore, the synthesis of nZVI from aqueous solution of iron salts after addition of different chelating ligands such as EDTA, dipicolinic and citric acid was studied. The resulting nanomaterials were characterized by scanning electron microscopy (SEM) which showed that the dendritic structure of nZVI in nano scale was favored in EDTA experiment. Preparation of nZVi was also tested by addition of selected heavy metals. Concentrations of metals in remaining aqueous solution were determined by inductively coupled plasma optical emission spectrometry (ICP-OES). The metal removal efficiency of nanoparticles was calculated from the observed changes in concentration.

Sažetak

Novija istraživanja pokazuju da su nanočestice željeza efikasan materijal za transformaciju različitih zagađivala u okolišu, a posebice u vodenim ekosustavima. Neutralne nanočestice željeza uobičajeno se pripravljaju redukcijom vodenih otopina soli željeza jakim redukcijskim sredstvom kao što je $NaBH_4$. U svrhu poboljšanja stabilnosti nastalih čestica, mogući su dodatci različitih stabilizirajućih agensa, surfaktanata ili maskirajućih sredstava. Cilj ovog rada je provesti usporedbu i kontrolu kvalitete nanočestica željeza sintetitziranih u različitim eksperimentalnim uvjetima. Stoga je sinteza provedena u vodenim otopinama uz dodatak EDTA, dipikolinske i limunske kiseline. Rezultirajući nanomaterijali karakterizirani su metodom SEM kojom je utvrđeno da je dendritička struktura čestica na nanoskali favorizirana u EDTA sustavu. Ispitana je priprava nanočestica uz dodatak odabranih teških metala. Koncentracije metala u otopinama analizirane su metodom ICP-OES. Efikasnost uklanjanja metala pomoću nanočestica željeza određena je iz razlike mjerenih koncentracija.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 09

Hydrothermal growth of ZnO nanorods on Zn substrates and their application in degradation of azo dyes under ambient conditions

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Keywords:
Degradation,
Azo dyes.

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Abstract: A new type of catalytic material, large-scaled ZnO nanorod arrays grown on self-source substrate, was directly synthesized by a facile hydrothermal approach. The catalytic activity of the ZnO nanocrystals with different exposed surfaces, including ZnO hexagonal nanorods with exposed reactive {0001} facets, hexagonal ZnO nanopyramids with the nonpolar $\{01\bar{1}0\}$ planes, and pencil-like morphology with exposed $\{10\bar{1}1\}$ polar planes, was tested towards the degradation of the azo dyes (Congo red (CR) and methyl orange (MO)). The aqueous azo dyes can be degraded efficiently under ambient conditions, requiring neither light illumination nor additional energy (agitation, ultrasonic, etc.). Systematic experiments suggested that the dye degradation proceeds through the electron transfers from the anionic dye molecules to the catalyst and then to electron acceptors such as dissolved oxygen. It strongly depends on the exposed polar surfaces of the ZnO nanocrystals, giving rise to the relative higher catalytic activity and stability of the ZnO hexagonal nanopencils. The present ZnO nanorods arrays grown on Zn substrate requires no additional reagents or external energy input, which hence provides a potentially low-cost alternative for the remediation of azo-dye effluents.

Sažetak

Nova vrsta katalitičkog materijala: nanoštapići ZnO deponirani na Zn podlogu izravno su sintetizirani hidrotermalnom metodom. Katalitička aktivnost ZnO nanokristala s različitim izloženim ravninama, (ZnO šesterokutni nanoštapići s izloženim reaktivnim {0001} plohama, šesterokutna ZnO nanopiramida s nepolarnim {01-10} plohama, i olovka morfologija s izloženim {10-11} polarnim ravninama) je testirana pri degradaciji azo bojila (Congo red (CR) i metil orange (MO)). Vodene azo boje mogu se ovim katalitičkim postupkom učinkovito razgraditi pod ambijentnim uvjetima bez dodane energije (svjetlo, zvuk, toplina). Sustavno provedeni eksperimenti ukazuju da se degradacija bojila odvija preko prijenosa elektrona iz anionske molekule bojila na katalizator, a zatim do akceptora elektrona poput otopljenog kisika. To uvelike ovisi o izloženim polarnim površinama ZnO nanokristala, doprinoseći relativno višoj katalitičke aktivnosti i stabilnosti ZnO šesterokutne olovka morfologije

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 10

Supercritical fluids as a tool of process intensification and sustainable technologies

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Keywords:
supercritical fluids,
process efficiency,
sustainable processes,
high pressure.

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Abstract: Using supercritical fluids (SCF) as solvents in chemical processes means an advantage in many points of view. It offers health, safety, environmental and also chemical benefits. Commonly SCFs are termed as green solvents. Using high pressure as a processing tool surpasses legal limitations for solvent residues and restrictions on use of conventional solvents in chemical processes. Additionally, particulate products can be also achieved by means of SCF processing. The contribution will give a limited overview of applications of sub- and supercritical fluids and will present energy savings compared to conventional production methods. Considering above mentioned facts, supercritical fluids could certainly be applied as a substitution of conventional solvents in extractive and non-extractive processes as a nontoxic, inexpensive, nonflammable, and nonpolluting solvents. Many applications such as high pressure sterilization, jet-cutting, thin film deposition for microelectronics, and the separation of value-added products from fermentation broths in the biotechnology field have been fully developed and commercialized. Particle formation processes using high pressures in presence of supercritical fluids may overcome several drawbacks of conventional particle size reduction processes.

Sažetak

Korištenje superkritičnih fluida (SCF) kao otapala u kemijskim procesima ima veliki broj prednosti u odnosu na ostale metode. Pored uloge u samim hemijskih procesima, SCF nisi toksični, sigurni su za korištenje i okoliš. Obično se SCF nazivaju zelena otapala. Korištenje konvencionalnih rastvarača u procesima je i zakonski limitirano za razliku od SCF. . Osim toga, ciljani proizvodi mogu biti formirani pomoću u zavisnosti od prerade SCF. Ovdje će biti prezentirani neki primjeri upotrebe superkritičnih fluida, a predstavit će se i primjeri ušteda energije u usporedbi s konvencionalnim metodama proizvodnje. S obzirom na gore navedene činjenice, superkritični fluidi mogu biti primijenjeni kao zamjena konvencionalnih otapala u procesima ekstrakcije i ostalim reakcijama jer su neotrovna , jeftina, nezapaljiva i nezagađujuća otapala . Mnoge aplikacije kao što su sterilizacija visokim tlakom, rezanje mlazom, depozicija tankog filma u mikroelektronici , i odvajanje proizvoda iz fermentacijskih smjesi u biotehnologiji su u potpunosti razvijen i komercijalizirani. Formiranje čestica pomoću visokog pritiska u prisutnosti superkritičnih fluida može imaj značajne prednosti u odnosu na konvencionalne postupake za usitnjavanje čestica.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 11

Preliminary chemical analysis of new discovered siderite meteorites from Croatia and Bosnia and Herzegovina

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Keywords:
iron meteorites,
qualitative and quantitative analysis,
structural and chemical classification,
ataxites,
siderophile elements

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Abstract: Ten samples of iron meteorites recently discovered on the territory of Croatia and one sample form Bosnia and Herzegovina were analyzed by three techniques: a) polishing and etching by ferric chloride, b) X – ray powder diffractometry (XRD) and c) inductively coupled plasma with atomic emission spectroscopy (ICP-AES). The goal of this work was to determine qualitative and quantitative composition of selected meteorite samples, and to attribute the samples structural and chemical group of iron meteorites if possible. The analyses have shown that all eleven samples contain iron and nickel as macroelements in one to one ratio, with the exception of a sample containing abundant manganese. All samples contain high amount of iridium. Most of the analyzed samples belong to the structural group of ataxites, containing almost pure taenite phase, while chemical groups could not be established with certainty due to lack of data on the quantity of siderophile elements like gallium, gold and germanium, which are main parameters for the chemical classification of iron meteorites.

Sažetak

Deset uzoraka željeznih meteorita koji su nedavno nađeni području Republike Hrvatske i jedan u Bosni i Hercegovini, analizirani su na tri načina; a) poliranjem i nagrizanjem otopinom feriklorida, b) rentgenskom difrakcijom na prahu (XRD), i c) tehnikom induktivno spregnute plazme s atomskom emisijskom spektroskopijom (ICP-AES). Cilj rada bio je utvrditi kvalitativan i kvantitativan sastav odabranih uzoraka, te pokušati odrediti strukturne i kemijske tipove željeznih meteorita kojima uzorci pripadaju. Analize su pokazale da su makroelementi u svim uzorcima željezo i nikal, u omjeru 1 : 1, s izuzetkom jednog uzorka koji uz navedene sadrži i puno mangana. Svi uzorci sadrže iridij, i to u poprilično velikoj koncentraciji. Većina analiziranih uzoraka pripada strukturnom tipu ataksita, izgrađenog gotovo od čistog taenita, dok se kemijski tip pojedinog uzorka nije mogao sa sigurnošću utvrditi zbog nemogućnosti mjerenja koncentracije siderofilnih elemenata galija, germanija i zlata, a koji su glavni parametri za kemijsku klasifikaciju siderita.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 12

Atomic Spectrometry as a Tool for Archaeological Material Description

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Keywords:
Atomic Spectrometry,
ICP-AES

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Abstract: Elemental composition of archaeological material is very useful when trying to answer the question of manufacture, provenance and/or purpose of the object of interest. Analytical atomic spectrometry methods have an extremely important role in the characterization of items of cultural heritage. Also, they are widespread and very useful for simultaneous determination of elements. They are mostly destructive which is a posing problem when analyzing cultural heritage objects. Inductively coupled plasma atomic emission spectrometry, ICP-AES and inductively coupled plasma-mass spectrometry, ICP-MS were used for determination of selected element content in fragments of iron artefacts such as slag and bloom which are dated to the Bronze Age, and La Tène culture, and were collected during extensive archaeological excavations under the supervision of the Zagreb City Museum. Instrumental working conditions were optimized after preliminary selection of the most appropriate emission lines for the selected elements. Microwave assisted digestion was used for the preparation of sample solutions and the analytical procedure was controlled with standard reference materials. Multivariate statistical analysis allowed classification of obtained results in groups which consisted of ceramic, ceramic-rich slag and bloom material. As an example, one sample (No3170) consists of Fe (35.5%), Al (4.4%), Mn (0.5%), Ti (0.3%), Cr (99.5 ppm), Zn (29.5 ppm), La (24.4 ppm), Ce (57.32 ppm), Pr(6.71 ppm), Eu (1.43 ppm).

Sažetak

Elementni sastav arheološkog materijala koristan je pri opisu proizvodnje, porijekla i/ili svrhe objekta od interesa. Metode atomske spektrometrije imaju iznimnu ulogu u opisu objekata kulturnog nasljeđa. Također, uobičajene su i vrlo korisne za simultanu elementnu analizu. Većinom su destruktivne što predstavlja veliku poteškoću kod analize arheoloških uzoraka. Atomska emisijska spektrometrija uz induktivno spregnutu plazmu, ICP-AES te spektrometrija masa uz induktivno spregnutu plazmu, ICP-MS, korištene su za određivanje elementnog sastava fragmenata željeznih izrađevina poput troske i »blooma« (»cvijeta«) iz brončanog doba i Latenske kulture, a pronađenih tijekom proširenih arheoloških iskapanja u nadležnosti Muzeja grada Zagreba. Radni uvjeti instrumenta su optimirani nakon odabira najpogodnijih emisijskih linija odabranih elemenata. Mikrovalno potpomognuta razgradnja je korištena za pripravu uzoraka dok je sama metoda priprave kontrolirana upotrebom certificiranih referentnih materijala. Multivarijatna statistička analiza korištena je za klasifikaciju uzoraka u grupe keramičkih materijala, keramikom bogate troske i blooma. Kao primjer, jedan od uzoraka (No3170), sadrži Fe (35,5%), Al (4,4%), Mn (0,5%), Ti (0,3%), Cr (99,5 ppm), Zn (29,5 ppm), La (24,4 ppm), Ce (57,32 ppm), Pr(6,71 ppm), Eu (1,43 ppm).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 13

Content of Fe, Cu and Pb in human teeth enamel and dentin in relation to the age

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Keywords:
Iron,
copper,
lead,
enamel,
dentin,
FAAS

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Abstract: The content of iron, copper and lead was determined in 25 human teeth samples from Sarajevo and Bihać by using flame atomic absorption spectrometry (FAAS). The aim of this study was to test whether the content of these metals increased with the age of the subjects. Samples were split on enamel and dentin by burning at 500°C and by using mechanical separation. For the dissolution, concentrated nitric acid and hydrogen peroxide was used. Concentration of Pb was below detection limit using the applied method in 7 dentin samples and even 18 enamel samples. It is for these reasons that we took as relevant results of Pb content those in dentin and not the ones in enamel. Results have shown cumulative effect for all three metals. This effect is more pronounced in enamel than dentin since in enamel the concentration of Cu and Fe was twice as high. The average concentration of Fe in enamel was 51.54, 73.87, 73.97 and 122.40 ppm; while the concentration of Cu was 0.19, 0.33, 0.72 and 1.53 ppm for persons aged 18-30, 31-59, 51-70 and over 70 years, respectively. A similar trend with less pronounced differences was detected in dentin for Fe and Cu while the concentration of Pb in dentin was 0.18, 1.39, 2.34 and 4.41 ppm for the specified age.

Sažetak

Određivan je sadržaj željeza, bakra i olova u 25 uzoraka zuba osoba iz Sarajeva i Bihaća metodom plamene atomske apsorpcione spektrometrije (FAAS). Cilj je bio provjeriti da li se sadržaj ovih metala povećava sa starošću osoba. Uzorci su spaljivanjem na 500 ^{0}C i mehaničkim odvajanjem razdvojeni na caklinu i dentin. Rastvaranje je vršeno u smjesi koncentrovane nitratne kiseline i vodik peroksida. Koncentracija Pb bila je ispod granice određivanja primijenjenom metodom u 7 uzoraka dentina i čak 18 uzoraka cakline. Iz navedenih razloga kao relevantni su uzeti rezultati za sadržaj Pb u dentinu, ali ne i caklini. Rezultati su pokazali kumulativni efekat za sva tri metala. Ovaj efekat je izraženiji za caklinu nego za dentin kod Fe i Cu gdje je njihova koncentracija u caklini bila i 2 puta veća nego u dentinu. Prosječna koncentracija željeza u caklini bila 51.54, 73.87, 73.97 i 22.40 ppm, a bakra 0.19, 0.33, 0.72 i 1.53 ppm za starosnu dob osoba 18-30, 31-50, 51-70 i iznad 70 godina redom. Sličan trend sa manje izraženim razlikama zabilježen je i za dentin kod Fe i Cu dok je koncentracija Pb u dentinu bila 0.18, 1.39, 2.34 i 4.41 ppm za navedene starosne dobi.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Oral presentation

OP- 14

A New Approach for The Synthesis of Ceramic Materials

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Keywords:
Ceramic pre-cursor, Polysilyne, silicon carbide, diamond

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Abstract: Polycarbynes and polysilynes have previously been shown to be polymeric precursors to diamond, diamond-like carbon (DLC) and silicon carbide production. The most important properties of these polymers are to form tough, hard-wearing ceramic materials with high thermal stabilities upon moderate heating. Poly(methyl silyne) (PMSi) and polyhydridocarbyne (PHC) are the most known pre-ceramic polymers. PHC forms diamond and DLC, while PMSi can be easily converted to SiC upon pyrolysis. Poly(silyne-co-carbyne) (PSC) simply forms silicon carbide without requiring the addition of more carbon species and a catalyst since it already contains silicon and organic carbon on its backbone. Here, we report a simple method for producing silicon carbide using PSC, which contains both silyne and carbine on its backbone. PSC is simply synthesized using trichloro(dichloro methyl) silane (TCS), electricity, a solvent and an electrolyte. Coating of PSC on any surface is very easy and cheap due to the solubility of it in common organic solvents. UV/Vis spectroscopy, ^{1}H-NMR and GPC analyses were shown the structure of PSC. Ceramic film was obtained by sintering of the polymer at 1000, 750 or 500 ^{o}C depending on sinter atmosphere whether being inert or air. This study was supported by TUBITAK with project number 211T108).

Sažetak

Polikarbini i polisilani su se prethodno pokazali kao polimerni prekursori dijamanta, karbona sa karakteristikama dijamanta (DCL) i silicij karbid produkata. Najvažnija svojstva tih polimera su da nakon umjerenog grijanja, formiraju tvrd , izdržljiv keramičkih materijala s visokom toplinskom stabilnošću . Poli (metil siline) (PMSI) i polihidridokarbine (PZZ) su najpoznatiji pocetni keramički polimeri. PHC formira dijamant i DLC , dok PMSI se može lako pretvoriti u SiC nakon pirolize . Poli (siline -CO - carbine) (PSC) jednostavno oblikuje silicijev karbid bez potrebe za dodavanjem novih atoma i katalizatora jer već sadrži silikon i organski ugljika u svom kosturu. Ovdje predstavljamo jednostavnu metodu za proizvodnju silicij karbida korištenjem PSC, koji sadrži i siline i karbin u svojoj strukturi. PSC se jednostavno sintetizira iz trihloro (dihloro metil) silana (TCS) u prisustvu otapala i elektrolita . Premazivanje PSC na bilo koju površinu je vrlo jednostavano i jeftino, zbog rastvorljivosti u uobičajenim organskim otapalima. UV / Vis spektroskopija, 1H - NMR i GPC-a analize su korištene u analizi strukture PSC. Keramički film je dobiven sinterovanjem polimera na 1000 , 750 ili 500 ° C , ovisno o atmosferi (inertna ili zrak).

Ova studija je podržana od strane TUBITAK s projektom broj 211T108.

POSTER PRESENTATIONS

Analytical and Environmental Chemistry

(AEC)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-01

Qualitative and quantitative analysis of free amino acids in plant extracts

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Keywords:
Plant extracts,
free amino acids,
spectrophotometric (UV/VIS) method,
thin layer chromatography (TLC) method.

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Abstract: Newly interests for free amino acids have been peaked at its positive effects on immune system responsiveness to infection, blood-pressure reduction, relaxation, neuroprotection and modulation of chemotherapy. The aim of this study was to determine the free amino acids in garlic, onion, purple onion, onion shallot, leek, bears garlic, fennel bulb, fennel leaf, rucola, corn salad, asparagus, black tea, green tea and artichoke commercially available from bosnian marketplaces by the simple, fast and economical methods. The qualitative analysis of free amino acids was performed by thin layer chromatography (TLC) method. The quantitative analysis of free amino acids was performed by spectrophotometric method (UV/VIS). 1.0 ml of each plant infusion was added to 0.5 ml of phosphate buffer solution (pH 8.04) and 0.5 ml of 2% ninhydrin solution containing 0.8 mg/ml of $SnCl_2x2H_2O$. The mixtures were placed on a boiling water bath until the color was changed and then samples were quickly cooled with cold water, and adjusted to 25 ml with distilled water. The absorbance of these blue-purple products was measured after 10 min. The results showed that the highest content of free amino acids was found in garlic (Allium sativum - bulb) 0.251 mg/g and the lowest content was found in fennel leaf (Foeniculum vulgare) 0.057 mg/g.

Sažetak

Amino kiseline su u posljednje vrijeme u centru pozornosti zbog njihovog pozitivnog uticaja na imuni sistem i njegovu reakciju na infekcije, redukciju krvnog pritiska, relaksaciju, neuroprotekciju i modulaciju hemoterapije. Cilj ovog istraživanja je bio odrediti slobodne amino kiseline i njihov sadržaj u bijelom luku, crvenom luku, ljubičastom luku, luku kozijaku, prasi, srijemošu, glavici i listu komorača, rukoli, matovilcu, šparogama, crnom i zelenom čaju i artičoki komercijalno dostupim na pijacama BiH, jednostavnim, brzim i ekonomičnim metodama, Kvalitativna analiza slobodnih aminokiselina je izvedena metodom tankoslojne hromatografije (TLC). Kvantitativna analiza slobodnih amino kiselina je izvedena spektrofotometrijskom metodom (UV/VIS). Na 1.0 ml supernatanta svake biljke je dodano 0.5 ml rastvora fosfatnog pufera (pH 8.04) i 0.5 ml 2 % rastvora ninhidrina koji sadrži 0.8 mg/ml $SnCl_2x2H_2O$.Smjesa se potom zagrijavala na vodenom kupatilu do promjene boje, a zatim brzo ohlađena i razblažena do 25 ml destilovanom vodom. Absorbansa plavo-ljubičastih rastvora je mjerena nakon 10 min. Rezultati su pokazali da je najveći sadržaj slobodnih amino kiselina nađen u bijelom luku 0.251 mg/g, a najmanji sadržaj je u listu komorača 0.057 mg/g.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-02

Total sulphur content in different plant samples determined by High Performance Ion Chromatography (HPIC) method

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Keywords:
Sulphur,
plant material,
high performance ion chromatography (HPIC)

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Abstract: Sulphur as an integral part of the protein is an element that is essential for life and human health. Some plants are particularly rich source of organo-sulphur compounds, and these compounds have beneficial effects against several diseases. The aim of this study was to determine the total sulphur content in 17 different plant species which are used as common food in Bosnia and Herzegovina. The total sulphur content in plant material was determined by high performance ion chromatography (HPIC). Plant samples were prepared by dissolving and oxidation with a mixture of nitric and perchloric acid. The HPIC method was performed with a Shimadzu Ion Chromatograph equipped with conductivity detector CDD-10A. Diluted samples were analyzed on Shodex IC SI-90G exchange column, using carbonate buffer solution as mobile phase ($NaHCO_3/Na_2CO_3$). The total sulphur content in the analyzed plant materials varies from 7.87 mg/g in dry black tea (*Camellia sinensis*) to 0.13 mg/g in bear's garlic (*Allium ursinum*). Black tea could serve as beneficial source of total sulphur content.

Sažetak

Sumpor kao sastavni dio proteina je element koji je neophodan za život i zdravlje ljudi. Neke biljke su posebno bogat izvor organo-sumpornih spojeva, a ovi spojevi imaju pozitivne efekte protiv nekih bolesti. Cilj ovog istraživanja bio je utvrditi ukupni sadržaj sumpora biljnih vrsta koje se koriste kao uobičajena hrana u Bosni i Hercegovini. Ukupni sadržaj sumpora u biljnom materijalu određen je jonskom hromatografijom visokih performansi (HPIC). Biljni uzorci su pripremljeni rastvaranjem i oksidacijom smjesom nitratne i perhlorne kiseline. HPIC metoda je izvedena na Shimadzu jonskom hromatografu opremljenim sa konduktometrijskim detektorom CDD-10A. Razblaženi uzorci analiziranisu na Shodex IC SI-90G izmjenjivačkoj koloni, koristeći karbonatni puffer kao mobilnu fazu ($NaHCO_3/Na_2CO_3$). Ukupni sadržaj sumpora u analiziranom biljnom materijalu varira od 7.87 mg/g, u suhom crnom čaju (*Camellia sinensis*) do 0.13 mg/g u srijemošu (*Allium ursinum*). Crni čaj može služiti kao koristan izvor ukupnog sadržaja sumpora.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-03

Determination of caffeine in green and black teas

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Keywords:
caffeine,
green tea,
black tea,
spectrophotometric (UV/VIS) method,
thin layer chromatography (TLC) method

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Abstract: Methyl derivatives of xanthine are a group of alkaloids commonly used for their effects as mild stimulants on various organ systems such as cardiovascular and central nervous system (CNS), respiratory system and skeletal muscles. The naturally occurring methylxanthines are caffeine, theophylline and theobromine. The aim of this study was to determine caffeine in the green and black teas commercially available from Bosnian, Croatian, Slovenian, Austrian, Turkish, Indian and Chinese markets by simple, fast and economical methods. The simultaneous quantitative and qualitative determination was based on spectrophotometric (UV/Vis) method and thin layer chromatography (TLC) method. Caffeine content in the green teas was in the range from 33.9 to 110.73 (mg/g dry sample), and in black teas was in the range from 10.32 to 63 (mg/g dry sample). The highest caffeine content was detected in the green tea from the Slovenian market, and in the black tea from Croatian market.

Sažetak

Derivati metil ksantina su grupa alkaloida koji se često koriste kao blagi stimulansi na različite sisteme organa, kao što su kardiovaskularni i centralni nervni sistem, respiratorni sistem i sistem skeletnih misića. Prirodni metil ksantini su kofein, teofilin i teobromin. Cilj ovog rada je određivanje kofeina u zelenim i crnim čajevima komercijalno dostupnim sa tržišta Bosne, Hrvatske, Slovenije, Austrije, Turske, Indije i Kine, jednostavnim, brzim i ekonomičnim metodama. Simultano kvantitativno i kvalitativno određivanje bazirano je na spektrofotometrijskoj metodi (UV/Vis) i hromatografiji na tankom sloju (TLC). Sadržaj kofeina u zelenim čajevima je bio u rasponu od 33.9 do 110.73, a u crnim čajevima od 10.32 do 63.00 (mg/g suhog uzorka). Najveći sadržaj kofeina određen je u zelenom čaju sa tržišta Slovenije i u crnom čaju sa tržišta Hrvatske.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-04

Antioxidant status of various mushrooms comercially available from Bosnian market

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Keywords:
Mushrooms,
total phenol content,
total anthocyanine content,
antioxidant activity.

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Abstract: Mushrooms are well balanced foodstuff that provides definite nutrition and health benefits for human. Mushrooms are known to produce many kind of bioactive compounds, generally linked with mycelial cell wall, that help in enhancing the immune capacity to fight against carcinogens. To consider the importance of polyphenolic compounds and its presence in many varieties of mushrooms, the total antioxidant activity of dry boletus mushrooms, white and brown champignons, oyster mushrooms and shiitake from Bosnian market was determined. Total phenolic content was estimated spectrophotometrically as gallic acid equivalents (GAE /g) according to the Folin-Ciocalteus method. Total anthocyanine content was analysed by pH differential spectrophotometric method at 525 and 700 nm. The radical scavenging activity (RSA) of mushroom extracts was determined by DPPH assay. The analysis revealed that the total phenolic contents ranged from 4.94 mg GAE/g in oyster mushrooms to 35.56 mg GAE/g in dry boletus mushrooms. The RSA was the highest in brown champignons 88.33 % and the lowest in oyster mushrooms 43.88 %. The mushrooms investigated in the present study could represent easily accessible sources of natural antioxidants.

Sažetak

Gljive su dobro izbalansirana hrana koja pruža određene prehrambene i zdravstvene pogodnosti za čovjeka.Gljive proizvode mnoge vrste bioaktivnih spojeva, uglavnom povezanih sa micelama ćelijskog zida, koji pomažu u jačanju sposobnosti imunološkog sistema da se bori protiv kancerogenih tvari. Da bi se razmotrile važnost polifenolnih supstanci i njihovo prisustvo u različitim vrstama gljiva, određena je ukupna antioksidativna aktivnost suhog vrganja, bijelih i smeđih šampinjona i shiitaka sa bosanskog tržišta. Sadržaj ukupnih fenola je određen spektrofotometrijski i izražen kao ekvivalent galne kiseline (GAE /g) metodom po Folin-Ciocalteu. Sadržaj ukupnih antocijanina je analiziran pH-diferencijalnom spektrofotometrijskom metodom na 525 i 700 nm. Antiradikalna aktivnost (RSA) ekstrakata gljiva je određena DPPH metodom. Analiza je pokazala da se sadržaj ukupnih fenola kreće u rasponu od 4.94 mg GAE/g u bukovačama do 35.56 mg GAE/g u uzorku suhog vrganja. RSA je bila najveća za smeđe šampinjone 88.33 %, a najmanja za bukovače 43.88 %. Gljive ispitane u ovoj studij predstavljaju lako pristupčan izvor antioksidanata.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-05

Determination of Free and Bound Monoterpenes Content in Aromatic Plants With Simple Distillation-spectrophotometric Method

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Keywords:
free volatile monoterpenes, glycosidically bound monoterpenes, aromatic plants, distillation-spectrophotometric method

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Abstract: In this paper the total content of free volatile monoterpenes (FVT) and glycosidically bound monoterpenes (GBT) present in six aromatic plants belonging to Lamiaceae family was determined by using simple and rapid distillation-spectrophotometric method. The investigated wild-growing plants, namely sage, lavender, rosemary, savory and oregano, were collected around Split during spring 2014., while commercial sample of basil was used. The method was originally developed for determination of free and glycosidically bound terpenes in grapes and adapted to analyze these compounds in aromatic plants. The plant materials were hydrodistilled under neutral and acidic conditions to collect two fractions, FVT and GBT. The colorimetric determination of monoterpenes in distillates was performed by adding vanillin-sulphuric acid reagent in order to obtain colour. The intensity of the colour was proportional to the content of monoterpenes. Absorbance was measured at 608 nm. The contents of monoterpenes in the distillates were calculated from the standard curve prepared with linalool standard solutions. According to the obtained results, all investigated plants contained very similar contents of FVT and GBT, except oregano with the lowest contents of these monoterpenes. Only slightly higher contents of FVT and GBT was recorded in basil.

Sažetak

U radu je brzom i jednostavnom spektrofotometrijskom metodom određen ukupni sadržaj slobodnih monoterpena (FVT) i glikozidno vezanih monoterpena (GBT) šest aromatičnih biljaka porodice Lamiaceae. Istražene su samonikle biljke, kadulja, lavanda, ružmarin, vrijesak i mravinac, sakupljene u okolici Splita tokom proljeća 2014., dok je bosiljak bio komercijalni. Metoda je izvorno razvijena za određivanje slobodnih i glikozidno vezanih terpena u grožđu i prilagođena za određivanje navedenih spojeva u aromatičnom bilju. Biljni materijal je podvrgnut hidrodestilaciji radi prikupljanja dviju frakcija, FVT i GBT. Kolorimetrijsko mjerenje monoterpena u destilatima provedeno je dodavanjem reagensa vanilin-sumporne kiseline, radi razvijanja boje čiji je intenzitet proporcionalan sadržaju monoterpena, a potom je izmjerena apsorbansa pri 608 nm. Sadržaj monoterpena u destilatima izračunat je iz kalibracionog pravca pripremljenog pomoću standardnih otopina linalola. Iz rezultata je vidljivo da sve istraživane biljke sadrže slične količine FVT i GBT, osim mravinca koji je imao najmanji sadržaj ovih spojeva, dok je sadržaj navedenih monoterpena bio neznatno veći u bosiljku.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-06

Green chemistry by using flow analysis: Determination of iron ions with green tea extracts as reagents

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Keywords:
sequential injection analysis (SIA),
green analytical chemistry,
green tea extract,
spectrophotometry,
Fe (II), Fe(III),
pharmaceuticals

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Abstract: The development of flow based technique such as sequential injection analysis (SIA) provides a new opportunity to development of green analytical chemistry methods.

The SIA system with spectrophotometric detector in combination with the extract of green tea as a natural chromogenic reagents were used for determination of Fe(III) and Fe(II). This green analytical method is based on formation of Fe-polyphenol complex that was monitored at 570 nm. In the process of optimization the selected experimental conditions allow determination of iron ions in concentration ranges from 4.0×10^{-5} to 4.0×10^{-4} mol/L with limit of detection of 5.3×10^{-6} mol/L and sampling rate of 122 injections h^{-1}. The method was successfully applied to the determination of iron ions in laboratory samples and pharmaceuticals.

Sažetak

Razvoj protočnih tehnika analize kao što je sekvencijska injekcijska analiza (SIA) daje nove mogućnosti razvoja zelanih analitičkih metoda. SIA sustav sa spektrofotometrisjkim detektorom uz primjenu ekstrakta zelenog čaja kao prirodnog reagensa upotrijebljen je za razvoj metode određivanja Fe (III) i Fe (II).

Ova zelena analitička metoda temelji se na nastajanju Fe-polifenol kompleksa čija se apsorbancija mjeri pri valnoj duljini 570 nm. U postupku optimizacije odabrani su eksperimentalni uvjeti koji omogućuju određivanje Fe iona u koncentracijskom području od $4,0\times10^{-5}$ do $4,0\times10^{-4}$ mol/Ls granicom dokazivanja od $5,3\times10^{-6}$ mol /L i dinamikom mjerenja od 122injektiranja h^{-1}. Metoda je uspješno primjenjena za određivanje iona Fe (II) i Fe (III) u laboratorisjkim uzorcima i farmaceutskim pripravcima.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-07

Study of homosalate stability in chlorinated water

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Keywords:
homosalate,
free chlorine, by-products.

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Abstract: The increasing use of sun-creams containing organic UV-filters has led to increased concentration of these compounds in aquatic environment. Chlorinated water can convert these chemicals into chlorinated products whose toxic effects are of primary concern.

In this paper, stability of the homosalate in chlorinated water was studied. UV/VIS spectroscopy was used to follow the reaction of homosalate in presence of free chlorine. Gas chromatography with mass spectrometry was used to identify the major transformation by-products. Under the experimental conditions used in this work, homosalate reacted with chlorine following zero order reaction. The chemical transformation of the homosalate in chlorinated water led to the formation of chlorinated by-products that was identified as mono and dichloro-products.

Sažetak

Povećana upotreba krema za zaštitu od sunca koje sadrže organske UV filtere, vode do povećane koncentracije ovih supstanci u vodenom okolišu. Hlorirana voda može prevesti ove supstance u hlorirane produkte koji imaju toksične efekte od primarnog interesa. U ovom radu ispitivana je stabilnost homosalata u hloriranoj vodi. Korištena je UV/VIS spektroskopija da bi se pratila reakcija homosalata u prisustvu slobodnog hlora. Gasna hromatografija sa masenom spektroskopijom je korištena da bi identificirali glavni produkti transformacije. Pod eksperimentalnim uslovima korištenim u radu, homosalat sa hlorom reaguje reakcijom nultog reda. Hemijska transformacija homosalata u hloriranoj vodi, vodi do formiranja hloriranih produkata, koji su identificirani kao mono i dihlor-produkti.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-08

Preconcentration of chromium species on Amberlite IR-120 and Amberlite CG-400 ionexchange resins

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Keywords:
specije hroma,
prekoncentriranje,
Amberilte IR-120,
Amberilte CG-400

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Abstract: The possibility of separation and preconcentration of chromium species Cr(III) and Cr(VI) from the solutions in which they mutually interfere was examined on ionexchange resins. The following conditions for preconcentration of Cr(VI) on Amberlite CG-400 resin were determined: mass of resin 1.0 g; sample pH 5.5; sample volume of 100 mL (with preconcentration factor of 10), sample flow rate 0.5 mL min^{-1}. Cr(VI) was determined by molecular UV/Vis spectrometry with the addition of diphenylcarbazide. The recovery value of Cr(VI) after preconcentration of prepared samples with known concentrations of Cr(III) and Cr(VI) was 63 %. The method for Cr(VI) determination does not give excellent results when it comes to preconcentration, but the results showed that the tested ionexchange resin can be successfully used for separation of chromium species. Cr(III) was quantitatively determined by flame atomic absorption spectrometry (FAAS) after preconcentration on Amberlite IR-120 resin using following conditions: mass of resin 1.5 g; using sample pH 4.5; sample flow rate 0.5 mL min^{-1}. The recovery values of Cr(III) after preconcentration of prepared samples with known concentrations for volumes of 250 and 1000 mL (with preconcentration factor of 25 and 100) were 102 % and 99 %, respectively. The method was applied for determination of Cr(III) content in several natural water of Bosnia and Herzegovina (Miljacka, Neretva, Vrbas, stream Faletići), and industrial waste water (metal, leather, industry of coal and cement).

Sažetak

Mogućnost separacije i prekoncentriranja specija Cr(III) i Cr(VI) iz rastvora u kojima međusobno interferiraju je ispitano na ionoizmjenjivačkim smolama. Određeni su sljedeći uslovi za prekoncentriranje Cr(VI) na Amberilte CG-400 smoli: masa smole 1.0 g, pH uzorka 5.5, volumen uzorka 100 mL (uz prekoncentracioni faktor 10), protok 0.5 mL min^{-1}. Cr(VI) je određen metodom molekulske UV/Vis spektrometrije uz dodatak difenilkarbazida. Vrijednost *recovery*-ja (analitičkog povrata) za Cr(VI) nakon prekoncentriranja pripremljenih uzoraka sa poznatom koncentracijom Cr(III) i Cr(VI) je bila 63 %. Metoda za određivanje Cr(VI) ne daje odlične rezultate *recovery*-ja kada je u pitanju samo pekoncencentriranje, ali su rezultati pokazali da se testirana ionoizmjenjivačka smola može uspješno koristiti za razdvajanje specija hroma. Cr(III) je kvantitativno određen atomskom apsorpcionom spektrometrijom-plamenom tehnikom (FAAS) nakon prekoncentriranja na Amberlite IR-120 smoli pri sljedećim uslovima: masa smole 1.5 g; pH uzorka 4.5; protok 1 mL min^{-1}. Vrijednosti *recovery*-ja za Cr(III) nakon prekoncentriranja pripremljenih uzoraka poznate koncentracije za volumene od 250 i 1000 mL (uz prekoncentracioni faktor 25 i 100) su bile 102 % i 99 %, redom. Metoda je primijenjena za određivanje sadržaja Cr(III) u nekoliko prirodnih voda Bosne i Hercegovine (Miljacka, Neretva, Vrbas, potok Faletići) i industrijskih otpadnih voda (metalna, kožarska, industrija uglja i industrije cementa).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-09

Validation ETA-AAS method for determination of Nickel in Calcium and Magnesium Stearate after Microwave Decomposition

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Keywords:
AAS (Atomic Absorption Spectrophotometry),
ETA (Electro thermal atomisation),
Nickel, microwave acid digestion.

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Abstract: Heavy metals , including nickel can be found at raw materials for manufacturing pharmaceutical products, but in very low quantity. Calcium Stearate and Magnesium Stearate is used as an excipients for drugs manufacturing. The purpose of this experiment is to develop and validation method which will eliminate very inefficient, long-term classic acid digestion. The samples of Calcium Stearate and Magnesium Stearate were decomposed by microwave acid digestion using nitric acid. Along this mode, it was developed and optimized a method for the determination of nickel traces ETA-AAS direct concentration method. With regard to classic method, in this case addition is not necessary, because the impact of matrix is very effectively compensated using modified (ammonium dihydrogen phosphate) and Zeman's background correction. The procedure is validated and the validation parameters show very good results: linearity for Calcium and Magnesium Stearate r^2> 0,999, accuracy 97,1% and 106,1%, reproducibility of system 1,1% and 1,2%, reproducibility of method 3,7% and 2,1%, detection limit 0,35 µg/g, and 0,34 µg/g, quantification limit 1,16 µg/g and 1,13 µg/g .

Sažetak

Teški metali se mogu naći u sirovinama za proizvodnju lijekova, ali samo u vrlo malim količinama. Kalcium stearat i magnesium stearat se koriste kao pomoćna sredstva u proizvodnji lijekova. Cilj ovog ispitivanja je da se razvije i validira metoda koja će isključiti klasičnu razgradnju uzoraka, koja je neefikasna i dugotrajna. Uzorci kalcium stearata i magnesium stearata su raščinjeni mikrovalnom kiselinskom digestiom sa nitratnom kiselinom. Razvijena je i optimizirana ETA-AAS metoda direktne koncentracije za određivanje tragova nikla u ovako pripremljenim uzorcima. U odnosu na klasičnu metodu u ovom slučaju adicija nije neophodna iz razloga što uticaj matriksa moguće efikasno kompenzovati uz korištenje modifikatora (amonij dihidrogen fosfata) i uz Zemanovu pozadinski korekciju. Cijeli postupak je validiran, a validacioni parametri su pokazali veoma dobre rezultate: za linearnost slučaju kalcij stearate i magnezij stearata r^2> 0,999, tačnost ide u intervalu 97,1% do 106,1%, preciznost sistema 1,1% odnosno 1,2%, preciznost metode, 3,7%, odnosno 2,1%, limit detekcije 0,35 µg/g, odnosno 0,34 µg/g, limit kvantizacije 1,16 µg/g, odnosno 1,13 µg/g .

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-10

The use of pulverized *Cucurbita pepo* peel for the preconcentration of Co and Ni ions from aqueous solutions

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Keywords:
SPE,
AAS,
heavy metals,
pulverized pumpkin peel,
optimal conditions,
recovery

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Abstract: In this study, the use of pulverized pumpkin peel (*Cucurbita pepo*) for the preconcentration of Co and Ni ions, from aqueous solutions in a column system, was described. After preconcentration, these metal ions were analysed by flame atomic absorption spectrometry. In the optimization procedure three important variables were investigated: sample pH, sample flow rate and preconcentration factor. Under optimized conditions the detection limits of the method ($3.3 \bullet S_{bl}$) were 87.50 and 96.65 μg L^{-1} for Co and Ni, respectively. The precision expressed as a relative standard deviation (RSD.s, %) of the method was 3.89 % (Co) and 4.37 % (Ni), calculated from ten measurements. The recoveries of analytes under the optimum conditions were 100.2 % (Co) and 99.1 % (Ni). The optimal pH for investigated metals was in the range of 5.0 to 10.0; optimal sample flow rate was 2 mL min^{-1} and optimal preconcentration factor was 10. Pulverized pumpkin peel as a biosorbent can be reused for a large number of cycles with insignificant loss of the initial sorption capacity. The results obtained show that *Cucurbita pepo* shell based biosorbent can be used as an effective and low-cost means for removal of toxic metals from natural water and wastewater.

Sažetak

U ovom radu opisano je korištenje sprašene kore bundeve (*Cucurbita pepo*) za prekoncentriranje iona Co i Ni iz vodenih rastvora primjenom kolona. Nakon prekoncentriranja, metali su određivani plamenom atomskom apsorpcionom spektrometrijom. U postupku optimizacije su istražene tri bitne varijable: pH rastvora, brzina protoka rastvora i faktor prekoncentriranja. Pod optimalnim uslovima limiti detekcije metode ($3.3 \bullet S_{bl}$) su bili 87.50 i 96.65 μg L^{-1} za Co i Ni, respektivno. Preciznost metode, izražena kao relativna standardna devijacija (R.S.D., %), za deset mjerenja bila je 3.89% (Co) i 4.37% (Ni). Recovery vrijednosti analita dobivene pri optimalnim uslovima analize su 100.2 % (Co) i 99.1 % (Ni). Optimalna vrijednost pH rastvora određivanih metala je u intervalu od 5.0-10.0; optimalni protok rastvora je 2 mL min^{-1} i optimalni faktor prekoncentriranja je 10. Sprašena kora bundeve, kao biosorbent, se može koristiti za veliki broj ponovljenih ciklusa prekoncentriranja sa zanemarljivim gubitkom početnog kapaciteta sorpcije. Dobiveni rezultati su pokazali da se biosorbent *Cucurbita pepo* može koristiti kao efikasno i jeftino sredstvo za uklanjanje toksičnih metala iz prirodnih i otpadnih voda.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-11

Optimization of Biological Surface Adsorption Index Approach for Applications in Surface Characterization of the Nanomaterials

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Keywords:
nanoparticles, characterization, interactions, biomolecules.

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Abstract: A complete characterization of the different physiochemical properties of nanomaterials is necessary for the evaluation of their impact on health and the environment. Surface characterization of the nanomaterial is the least developed among the surface properties of nanomaterials.

The biological surface adsorption index approach (BSAI) for characterization of surface adsorption properties of nanomaterials has been recently introduced. This approach offers in principle the possibility to characterize the different interaction forces exerted between a nanomaterials surface and biomolecules.

In this work we further developed the BSAI approach which, as an outcome, gives a better defined quantification of the adsorption properties on nanomaterials.

Sažetak

Detaljna karakterizacija fizičkih I hemijskih osobina nanomaterijala je neophodna za evaluaciju njihovog uticaja na zdravlje čovjeka I na okoliš. Među različitim osobinama nanomaterijala, površinska karakterizacija je najslabije razvijena.

Biološki površinski indeks (biological surface adsorption index – BSAI) je metoda nedavno razvijena za karakterizaciju površinskih osobina nanomaterijala. Metoda je bazirana na karakterizaciji različitih interakcija koje se javljaju između nanomaterijala I biomolekula. U ovom radu smo detaljno razradili I optimizirali BSAI metodu, koja će kao takva, dati bolju I detaljnu kvantifikaciju površinskih osobina nanomaterijala.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-12

SPE extraction and TLC Identification of Tetracycline and Fluoroquinolone in Surface Water

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Keywords:
antibiotics,
TLC,
identification,
surface water.

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Abstract: Simultaneous identification of the antibiotics tetracycline, oxytetracycline, chlortetracycline, ciprofloxacin and enrofloxacin in surface water is reported. The method is based solid-phase extraction (SPE), separation and identification by thin -layer chromatography (TLC). TLC separation was performed on TLC silica gel 60 F254 plate using a mobile phase system water/methanol/dichlormetan (6/35/59) (v/v). The plates are previously impregnated with 10% solution EDTA pH 9,0. The method was optimized with spiked surface water. Antibiotics were extracted on a OASIS HLB 6cc/500 mg cartridges. 10 µl aliquots of the water sample and reference solutions were applied to the plate. After development, the chromatograms were visualized under UV light at λ = 254 nm and λ = 366 nm.

The analysis of surface water samples taken from three different locations not confirmed the presence of the tested antibiotics. The described method is simple and suitable for the rapid identification of investigated residues of tetracycline and fluoroquinolone antibiotics in surface water with LOD of 0.5 ppm.

Sažetak

Provedena je simultana identifikacija antibiotika tetraciklina, oksitetraciklina, hlortetraciklina, ciprofloksacina i enrofloksacina u površinskoj vodi. Postupak se zasnivao na ekstrakcii na čvrstim fazama (SPE), razdvajanju i identifikaciji primjenom hromatografije na tankom sloju (TLC). Razdvajanje je provedeno na TLC silikagel 60 F254 pločama uz mobilnu fazu voda / metanol / dihlormetan (6/35/59) (v/v). Ploče su prethodno impregnirane sa 10%-tnom otopinom EDTA pH 9,0. Metoda je optimizirana primjenom površinske vode u koju je dodana poznata koncentracija antibiotika. Antibiotici su ekstrahirani primjenom OASIS HLB 6cc/500 mg ketridža. 10 µl uzoraka vode i standardnih otopina aplicirano je na ploču. Nakon razdvajanja, hromatogrami su vizualizirani pod UV lampom na λ = 254 nm i λ = 366 nm. Analizom uzoraka površinskih voda uzetih sa tri različita lokaliteta nije potvrđeno prisustvo ispitivanih antibiotika. Opisana metoda je jednostavna i prikladna za brzu identifikaciju rezidua ispitivanih antibiotika iz grupe tetraciklina i fluorokinolona u površinskoj vodi sa limitom detekcije 0.5 ppm.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-13

Synthesis of biobased antioxydant and antiusure additives for diesel fuel

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Keywords:
biodiesel,
fatty acids,
transesterification,
antioxydant,
antiusure additives

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Abstract: Biodiesel as a biodegradable, sustainable and clean energy has worldwide attracted renewed and growing interest in topical years, chiefly due to development in biodiesel fuel and ecological pressures which include climatic changes. In general, fatty esters are used as bio additive, cosmetic ingredients, polymers, and, more recently, biofuel or bio lubrifiant. This review describes important features related to be the synthesis, stability to, and activity acid or basic catalysts in bioadditifs production reactions. The maximum bioadditif l yield obtained were about 94%, 83%, in acid and basic middle respectively. Overall, the acid catalyst (H_2SO_4) in isoamylic alcohol showed high performance at operating conditions (95°C, 3h, H_2SO_4 at 1% wt, ratio of oil/isoamylic= 3/1).

Oxidation test was carried out in dispositive (ASTM D 2274). The oxidative degradation of diesel with or without antioxidants was investigated by UV-visible spectroscopy was used to monitor the changes using peroxide value at optimal concentration about 1% of bioadditif.

Sažetak

Širom svijetu raste interes za bio-dizelom kao bio-razgradivoj, održivoj i čistoj energiji, uglavnom zbog razvoja bio-dizela kao goriva i ekoloških zahtjeva izazvanih klimatskim promjenama. Najčešće se masni esteri koriste kao bio-aditivi, kozmetički sastojci, polimeri i u novije vrijeme kao bio-gorivo ili bio-mazivo. Ovdje će biti istaknut značaj same sinteze , stabilnosti, aktivnosti kiseline ili osnova katalize u reakcijama proizvodnje bio-aditiva. Maksimalno dobiveni prinos bio-aditiva l su oko 94% i 83% u kiseloj i baznoj sredini, redom. Općenito, kiseli katalizator (H_2SO_4) u *izo*amilnom alkoholu pokazuje visoki učinak pri radnim uslovima (95 ° C, 3h, 1% wt H_2SO_4 i odnosu ulje/*izo*amilalk. = 3/1). Oksidacijski test je proveden po uredbi (ASTM D 2274). Ispitivana je oksidacijska degradacija dizela sa ili bez antioksidansa UV-VIS spektroskopijom, koristeći vrijednost peroksida pri optimalnoj koncentraciji bio-aditiva oko 1%, za praćenje promjena.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-14

Isolation and Antioxidant activity of betulinic acid and oleanolic acid obtained from *Betula pendula* L., *Betulaceae*

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Keywords:
betulinic acid, oleanolic acid, isolation, dry column chromatography, antioxidant activity

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Abstract: *Betulae cortex, Betula pendula Roth., Betulaceae*, comprise triterpene substances which are confirmed to possess very important pharmacological activities such as anti-inflammatory, anticancer and antiviral. In this study, extraction and isolation of triterpenes, betulinic acid and oleanolic acid from external birch bark, was carried out using method of dry column chromatography. To those substances infrared (IR) spectra were recorded and compared with IR spectra of adequate standards. Further, we tested the antioxidant capacity of betulinic acid and oleanolic acid isolated from investigated plant material using 1-diphenyl-2-picrylhydrazyl radical scavenging method (DPPH).

Working solutions of the tested substances, betulinic acid (0,006 g), oleanolic acid (0,025 g), were dissolved in ethanol (10 ml). For every analyzed substance is calculated calibration relationship diagram between inhibition and concentration of dilution. Following IC50 values were obtained: betulinic acid 302,49±9,45, oleanolic acid 302,29±15,543. Since the *Betula pendula* is very widespread plant species a positive results of the antioxidant activity could be the basis for its use as dietary supplement and production of special recipe preparation in the prevention of cardiovascular disease, thrombosis, strengthen the immune system, particularly in terms of the stress of everyday life.

Sažetak

Betulae cortex, Betula pendula Roth., *Betulaceae*, sadrži triterpenske supstance za koje je potvrđeno da ispoljavaju vrlo važna farmakološka djelovanja kao što su protuupalno, antivirusno i antikancerogeno. U ovoj studiji, ekstrakcija i izolacija triterpena, betulinske kiseline i oleinske kiseline iz vanjske kore breze, je provedena metodom suhe kolonske hromatografije. Snimljeni su Infracrveni (IC) spektri i upoređeni s IC spektrom odgovarajućih standarda. Nadalje, testirali smo antioksidativni kapacitet betulinske kiseline i oleinske kiseline izolirane iz ispitivanog biljnog materijala pomoću 1-difenil-2-picrylhydrazyl radikal metode vezivanja (DPPH). Radne otopine ispitivanih supstanci, betulinske kiseline (0,006 g), oleinske kiseline (0,025 g), otopljene su u etanolu (10 ml). Za svaki analizirani uzorak napravljen je kalibracioni dijagram, odnosa između inhibicije i koncentracije supstance. Dobivene su sljedeće IC50 vrijednosti: betulinska kiselina 302,49 ± 9,45, oleinska kiselina 302,29 ± 15.543. Budući da je *Betula pendula* vrlo rasprostranjena biljna vrsta, kao i na osnovu pozitivnog rezultata antioksidativne aktivnosti, otvara se mogućnsot njene upotrebe kao dodataka prehrani i proizvodnji specijaliziranih pripravaka za prevenciju kardiovaskularnih bolesti, tromboze, jačanju imunološkog sistema.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-15

Photochemical investigation of arbutin content in herbal drugs from family *Ericace*ae and *Vacciniaceae*

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Keywords:
arbutin, uva, cranberry, blueberriy, phytocemistry

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Abstract: The phytochemical analysis of arbutin content ware performed on the plant species of the family *Ericaceae* and *Vacciniaceae* as follow: Uvae leaf and fruit (*Uvae ursi folium et fructus, Arctostaphylos uva ursi, Ericaceae*), domestic cranberry leaf and fruit (*Vitis idaea folium et fructus, Vaccinium vitis idaea L. Vacciniaceae*) and blueberries leaf and fruit (*Myrtilli folium et fructus, Vaccinium myrtillus L., Vacciniaceae*). Plant material was tested using method of thin layer chromatography (TLC) in the presence of arbutin. TLC conditions: mobile phase was ethylacetate-methanol-water (100:13,5:10), visualization was performed under UV lamp at 254nm and splash spray reagent in Berlin blue. Identification of the components was performed by comparison with standard substances (arbutin, rutin). By colorimetric method was examined the content of arbutin in plant material. Content of arbutin amounted as follow: uvae leaf (6.38%), cranberry leaf (4.32%), leaf blueberry (1.23%) and uvae fruit (1.02%).

Sažetak

Fitohemijski su ispitivane biljne vrsta iz porodica *Ericaceae* i *Vacciniaceae* na sadržaj arbutina. Fitohemijskom ispitivanju podvrgnutii su: list i plod uve (*Uvae ursi folium et fructu, Arctostaphylos uva ursi , Ericaceae)*, list i plod domaće brusnice (*Vitis idaea folium* et fructus, *Vaccinium vitis idaea L., Vacciniaceae* i list i plod borovnice *(Myrtilli folium et fructus, Vaccinium myrtillus L., Vacciniaceae*). Biljni material je ispitivan metodom hromatografije na tankom sloju na prisustvo arbutina. Korištena je mobilna faza etilacetat-metanol-voda (100:13,5:10), vizuelizacija vršena pod UV lampom na 254nm i prskanjem sprej reagensom berlinsko plav o. Identifikacija komponenti vršena poređenjem sa standardnim supstancama (arbutin, rutin). Kolorimetrijskom metodom je ispitan je sadržaj arbutina u biljnom materijalu i iznosio je: list uve (6,38%), list brusnice (4,32%), list borovnice (1,23%) i plod uve (1,02%).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-16

Determination of Fe and Mn from Aqueous Solutions after Preconcentration on Yttrium (III) Oxide

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Keywords:
yttrium oxide,
preconcentration,
recovery,
optimum conditions,
foreign ions,
water samples.

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Abstract: In this study, we described the use of a column packed with unmodified yttrium (III) oxide as sorbent for preconcentration of Fe and Mn prior to their analysis by flame atomic absorption spectrometry (FAAS). We determined factors affecting the preconcentration of known low concentration of Fe and Mn such as pH of the sample, sorbent mass, sample flow rate and volume (preconcentration factor) from pure aqueous solutions. The recovery values of prepared samples of known concentration of analytes were: 103.9 % (Fe) and 95.8 % (Mn), under optimum conditions (pH 10, sorbent mass 400 mg, sample flow rate 4 mL/min, preconcentration factor 10). Detection limits of the method were 37.1 μg/L for Fe and 10.3 μg/L for Mn. Influence of foreign ions (Mg, Ca), which are in water present in high concentrations, on recovery values was examined. Mg concentration in range from 25 to 1000 mg/L showed no influence on recovery values. Ca concentrations 25, 50 and 100 mg/L had no significant influence on recovery values, while Ca concentration of 250 mg/L and higher caused decrease in recovery values for approximately 15 %. Proposed method for metals preconcentration was also tested on spring and river water samples.

Sažetak

U ovom radu su korištene kolone punjene sa nemodificiranim itrij (III) oksidom kao sorbentom za prekoncentriranje Fe i Mn neposredno pred njihovo određivanje plamenom atomskom apsorpcionom spektrometrijom (FAAS). Određeni su faktori koji utiču na prekoncentriranje poznate, niske koncentracije Fe i Mn iz čistih vodenih rastvora i to pH uzorka, masa sorbenta, brzina protoka uzorka i volumen korištenog uzorka, odnosno prekoncentracioni faktor. Vrijednosti *recovery*-ja pripremljenih uzoraka metala poznate koncentracije su bile: 103.9 % (Fe) i 95.8 % (Mn), pod optimalnim uvjetima (pH 10, masa sorbenta 400 mg, brzina protoka uzorka 4 mL/min i prekoncentracioni faktor 10). Detekcioni limiti metode su bili 37.1 μg/L za Fe i 10.3 μg/L za Mn. Ispitivan je utica j stranih jona koji su u visokoj koncentraciji prisutni u vodi (Mg, Ca) na vrijednosti *recovery*-ja. Koncentracija Mg od 25 mg/L do 1000 mg/L nema uticaja na vrijednost *recovery*-ja. Koncentracije Ca, 25, 50 i 100 mg/L nemaju značajan uticaj na vrijednost *recovery*-ja, dok koncentracije Ca od 250 mg/L i više dovode do smanjenja vrijednosti *recovery*-ja približno 15 % za oba metala. Predložena metoda za prekoncentriranje metala je testirana i na uzorcima izvorske i riječne vode.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-17

Determination of copper, chromium and cadmium in food-packaging materials by atomic absorption spectrometry – flame technique

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Keywords:
Heavy metals
Atomic absorption spectrometry,
Packaging materials.

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Abstract: The issue of assessment of health risks of food packaging materials represents an ongoing challenge of producing safe and wholesome packaging materials. Selected heavy metals, Cu, Cr and Cd in five different food-packaging materials were analysed by flame atomic absorption spectrometry. The chosen packaging materials were: paper, carton, cellophane, plastic coated paper and tetra pak. Considering the fact that analysed samples were of different materials and percentage of coloration, significant differences were found in concentrations, especially in the case of copper and cadmium. Results show that the Cu, Cr and Cd concentrations were found in the range of 1.06 - 55.62 μg/g, 4.13 - 7.73 μg/g and 1.54 - 5.57 μg/g, respectively. Heavy metals in packaging material mainly originate from the colors that are used to obtain the final product, rather than the base material. The contents of all analysed metals mainly decrease with decreasing the percentage of coloration surface of the packaging material.

Sažetak

Procjena zdravstvenih rizika zbog upotrebe ambalažnih materijala za prehrambene proizvode predstavlja stalni izazov u smislu proizvodnje sigurnih i sa aspekta ljudskog zdravlja prihvatljivih ambalažnih materijala. U ovom radu su analizirani teški metali, Cu, Cr i Cd u pet različitih tipova ambalaže, metodom atomske apsorpcione spektrometrije - plamena tehnika. Korišteni su uzorci: papira, kartona, celofana, plastificiranog papira i tetra paka. S obzirom da su analizirani uzorci različitog sastava i obojenosti, uočena je značajna razlika u koncentracijama prije svega bakra i kadmija između različitih uzoraka. Koncentracije Cu, Cr i Cd kretale su se u ra sponu 1.06 - 55.62 μg/g , 4.13 - 7.73 μg/g i 1.54 - 5.57 μg/g, respektivno. Teški metali u ambalažnom materijalu uglavnom potiču od boja koje se koriste za dobivanje finalnog proizvoda, a ne od baznog materijala. **S**adržaj svih analiziranih metala se uglavnom smanjivao sa smanjenjem postotka obojenosti površine ambalažnog materijala.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-18

New kinetic method for determination of N-acetyl-L-cysteine in pharmaceutical formulations

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Keywords:
N-acetyl-L-cysteine,
Kinetic spectrophotometry,
Initial rate method,
Fixed time method,
Pharmaceutical analysis

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Abstract: N-acetyl-L-cysteine (NAC) is a synthetic aminothiol antioxidant that has been in clinical use for more than 40 years, primarily as a mucolytic agent and in the management of paracetamol (acetaminophen) poisoning. There is need for a new, robust, inexpensive, and rapid method of determination of NAC in pharmaceutical formulations, in order to assure proper quality control (QC).

Novel flow-injection spectrophotometric method for the determination of NAC has been developed and validated. The proposed method is based on the reduction of Cu(II)-neocuproine reagent to Cu(I)-neocuproine with the analyte, in a Britton-Robinson buffer solution (pH = 3.0). The non-steady state absorbance of the formed yellow Cu(I)-neocuproine complex is measured at 458 nm. A linear calibration curve is established in a concentration range of 6×10^{-7} to 4×10^{-5} mol L^{-1} NAC with regression equation $y = 3.89\times10^{3}x - 0{,}0015$ ($R^2 = 0.9996$) (n = 9) and detection limit of 9.4×10^{-8} mol L^{-1}. The proposed method is simple, rapid, sensitive and reproducible (RSD 0.9%, n = 100). In addition, proposed method is sensitive enough to enable determination of near nanomole amounts of NAC without expensive instruments with the analytical frequency of 120 h^{-1}.

Sažetak

N-acetil-L-cistein (NAC) je sintetski aminotiolni antioksidans koji je u kliničkoj upotrebi već više od 40 godina, prvenstveno kao mukolitički agens te pri liječenju trovanja paracetamolom. Kako bi se osigurala odgovarajuća kontrola kvalitete, postoji potreba za novim, robustnim, jeftinim i brzim metodama određivanja NAC-a u farmaceutskim pripravcima.

Razvijena je te vrednovana nova protočna injekcijska spektrofotometrijska metoda određivanja *N*-acetil-L-cisteina. Predložena metoda zasniva se na redukciji Cu(II)-neokuproin reagensa do Cu(I)-neokuproin kompleksa, djelovanjem analita, u acetatno-boratno-fosfatnom puferu (pH = 3.0). Promjenjiva apsorbancija stvaranog Cu(I)-neokuproin kompleksa mjerena je pri 458 nm. Krivulje umjeravanja su linearne u području koncentracija 6×10^{-7} do 4×10^{-5} mol L^{-1} s regresijskom jednadžbom $y = 3.89\times10^{3}x - 0{,}0015$ ($R^2 = 0.9996$) (n = 9) i granicom dokazivanja od 9.4×10^{-8} mol L^{-1}. Razvijena metoda je jednostavna, brza, osjetljiva i ponovljiva (RSD 0.9%, n = 100) te je dovoljno osjetljiva za određivanje nanomolarnih količina NAC-a izbjegavajući skupe instrumenate uz analitičku učestalost od 120 h^{-1}.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-19

Content of As, Cd, Pb and Sn in parsley (*Petroselium crispum*) from different districts in Serbia

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Keywords:
Parsley,
content of metals,
ICP OES

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Abstract: Parsley (*Petroselinum crispum*) is one of the most popular vegetables in Serbia and during the past decades its consumption has been increasing. Parsley belongs of the *Apiaceae* family, which also includes celery, coriander and carrot. Accumulation of metals in plants is very important, due to their effects on human health. The aim of this study was to determine the content of arsenic, cadmium, lead and tin in the parsley from different geographic origin. Vegetable samples were collected from nine locations in three districts in Serbia: Toplica, Bor and Rasina district. The concentrations of As, Cd, Pb, and Sn were determined using the ICP OES technique and results show different level of contamination in various district. The highest amount of arsenic, cadmium, lead and tin was found in parsley from Bor district, (3.734 μg g^{-1}), (0.052 μg g^{-1}), (0.804 μg g^{-1}) and (1.951 μg g^{-1}), respectively, as it was expected, because the considered locations are representatives of potentially most polluted. The lowest concentrations of As, Cd, Pb and Sn were registered in Rasina district, (0.321 μg g^{-1}), (0.038 μg g^{-1}), (0.399 μg g^{-1}) and (0.595 μg g^{-1}), respectively. Amount of selected metals is reflection of the environmental pollution and soil type.

Sažetak

Peršun je dvogodišnja biljka koja se često koristi u kulinarstvu u Srbiji. Pripada porodici *Apiaceae*, gde spadaju celer, korijander i šargarepa. Od velike važnosti za ljudsko zdravlje je akumulacija metala u biljkama, pa je shodno tome cilj ovog rada bio određivanje sadržaja arsena, kadmijuma, olova i kalaja u peršunu različitog geografskog porekla. Biljni material je sakupljan na devet lokaliteta Topličkog, Borskog i Rasinskog okruga. Koncentracija As, Cd, Pb i Sn je određivana ICP OES tehnikom i rezultati pokazuju različit nivo zagađenja u različitim okruzima. Najveća količina arsena, kadmijuma, olova i kalaja detektovana je u Borskom (3.734 μg g^{-1}), (0.052 μg g^{-1}), (0.804 μg g^{-1}) i (1.951 μg g^{-1}), respektivno, a najniža u Rasinskom okrugu, (0.321 μg g^{-1}), (0.038 μg g^{-1}), (0.399 μg g^{-1}) i (0.595 μg g^{-1}), respektivno. Različit sadržaj analiziranih metala ukazuje na različit tip zemljišta i zagađenja životne sredine.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-20

Simultaneous Determination of Caffeic and Chlorogenic Acid in Green Coffee Extracts by Gas Chromatography and Mass Spectrometry (GC-MS)

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Keywords:
caffeic acid,
chlorogenic acid,
gas chromatography
Mass spectrometry

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Abstract: Rapid and reliable method for simultaneous separation, identification and quantitative determination of selected phenolic acids in commercially available green coffee (*Coffea canephora*) extracts has been developed. Caffeic and chlorogenic acid were determined as trimethylsilyl (TMS) derivatives by GC-MS. GC-MS has the advantage because it allows simultaneous separation and identification of geometric *cis*- and *trans*-isomers of the investigated compounds. The results confirmed that *cis*-chlorogenic acid and *cis*-caffeic acid are not naturally occurring compounds but were produced after sample preparation procedure as a result of isomerization from their *trans*-forms. Stability studies were performed and it was found that »*trans*-*cis*« isomerization is solvent, temperature, and time-dependent. Anyhow, final silylated derivatives were stable at least 2 days as in this time the peak-area ratios for *cis*- and *trans*- isomers were constant throughout the whole concentration range. Linearity of the method was confirmed in the concentration range from 20 to 200 mg L^{-1} with r^2 greater than 0.9942. It was proven that this method is repeatable (precise) (RSD<10%), and accurate. It was established that the commercially-available dry weighed green coffee extract contains in average 16.1±1.1 mg g^{-1} of caffeic acid and 197.7±13.6 mg g^{-1} of chlorogenic acid.

Sažetak

Razvijena je brza i pouzdana metoda za simultano odvajanje, identifikaciju i kvantitativno određivanje odabranih fenolnih kiselina u ekstraktima komercijalno dostupne zelene kafe (Coffea canephora). Kofeinske i hlorogenske kiseline određivane su kao derivati trimetilsilil-a (TMS) pomoću GC-MS-a. GC-MS ima prednost jer omogućava istovremeno razdvajanje i identifikaciju geometrijskih *cis*- i *trans*-izomera ispitivanih spojeva. Rezultati su potvrdili da *cis*-hlorogenska kiselina i *cis*-kofeinska kiselina nisu prirodni spojevi, već su nastali kao rezultat izomerizacije iz njihovog *trans*-oblika u postupku pripreme uzorka. Izvedene su studije stabilnosti i utvrđeno je da je »*trans*-*cis*« izomerizacija zavisi od otapala, temperature i vremena. U svakom slučaju, konačni sililirani derivati bili su stabilni najmanje dva dana, jer su tokom ovog vremenskog perioda površina pika za *cis*- i *trans*- izomere bila je konstantna kroz čitav koncentracijski opseg. Linearnost metode potvrđena je u rasponu koncentracija 20-200 mg L^{-1} sa r^2 većim od 0,9942. Dokazano je da je ova metoda ponovljiva (precizna) (RSD <10%), i tačna. Utvrđeno je da odvagani suhi ekstrakt, komercijalno dostupne zelene kafe, sadrži u prosjeku 16,1±1,1 mg g^{-1} kofeinske kiseline i 197,7±13,6 mg g^{-1} hlorogenske kiseline.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-21

Measurement Uncertainty for the Determination of Monosaccharide Content in Different Olive Leaves Extracts Using Gas Chromatography and Mass Spectrometry

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Keywords:
olive biomass,
olive leaves,
glucose,
mannitol,
gas chromatography,
mass spectrometry.

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Abstract: Analytical method for the simultaneous determination of D-glucose and D-mannitol in olive biomass, was developed, optimized and validated. The measurement uncertainty for the determination of glucose and mannitol concentrations was evaluated and all possible sources of measurement uncertainty arising from the analytical procedure implementation were determined. Olive leaves were extracted by subcritical water extraction at different temperatures (80° C, 120° C and 180°C), different pressure levels (30 bar, 80 bar, 100 bar and 150 bar) and different extraction time (5 min, 10 min, 30 min, 60 min, 90 min). Samples were analyzed by gas chromatography and mass spectrometry (GC-MS) and sugars were quantified as oxime- trimethylsilyl derivatives from corresponding calibration curves using phenyl-β-D-glucopyranoside as an internal standard (ISTD). The results confirmed that the highest contents of glucose (2,576 g/L) and mannitol (4,031 g/L) were present in the sample extracted with subcritical water at 80°C for 90 min and the minimum contents of glucose (0,489 g/L) and mannitol (1,321 g/L) were determined in the sample extracted with subcritical water, at 180°C for 90 min.

Sažetak

Analitička metoda za simultano određivanje D-glukoze i D-manitola u biomasi od maslina je razvijena, optimizirana i validirana. Mjerna nesigurnost za određivanje koncentracije glukoze i manitola je evaluirana, određeni su svi mogući izvori mjerne nesigurnosti proizašli iz primjenjenog analitičkog postupka. Ekstrakcija maslinovog lišća je izvedana subkritičnom vodenom ekstrakcijom na različitim temperaturama (80°C, 120°C i 180°C), različitim pritiscima (30 bara, 80 bara, 100 bar i 150 bara) i različitim vremenima ekstrakcije (5 min, 10 min, 30 min, 60 min, 90 min). Uzorci su analizirani gasnom hromatografijojim i masenom spektrometrijom (GC-MS) a šećeri su kvantificirani kao derivati oksimtrimetilsilila iz odgovarajućih kalibracionih krivulja pomoću fenil-β-D-glukopiranozida kao internog standard. Rezultati su potvrdili da je najveći sadržaj glukoze (2,576 g/L) i manitola (4.031 g/L) bio prisutan u uzorku ekshiranom subkritičnom vodom na 80°C u toku 90 min a minimalni sadržaj glukoze (0489 g/L) i manitola (1,321 g/L) nađen je u uzorku ekshiranom subkritičnom vodom na 180°C za 90 min.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-22

Chemically modified Silica gel with Zirconium (IV) Oxychloride Octahydrate for Solid Phase Extraction and Preconcentration of Cr (III) and Pb (II)

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Keywords:
Silica gel,
zirconium (IV) oxychloride octahydrate,
chromium,
lead,
SPE,
FAAS.

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Abstract: Silica gel modified with zirconium (IV) oxychloride octahydrate was used for the preconcentration of chromium and lead prior to their determination by flame atomic absorption spectrometry (FAAS). Surface characterization of the silica gel (activated silica gel) before and after chemical modification was determined by Fourier Transform Infrared Spectrometer (FT-IR) in order to ensure the immobilization of zirconium (IV) oxychloride octahydrate onto the silica gel surface. The retention and recovery of the analytes were studied by applying the column technique. The experimental parameters, such as effect of pH of the sample, mass of silica and preconcentration factor (sample volume) were determined. At optimum conditions (pH 9, mass of silica gel 250 mg, preconcentration factor 10), the recoveries of Cr (III) and Pb (II) were 101 % and 98 %, respectively, with relative standard deviations (RSDs) of approximately ± 2 %. Detection limits of the method ($3.3s_b$) were 41.8 μg L^{-1} and 69.7 μg L^{-1} for Cr (III) and Pb (II), respectively. Good results of recovery show that the used method can be applied to preconcentration of chromium and lead from aqueous solutions that contain low concentrations of these metals.

Sažetak

Silika gel modificiran sa cirkonijum (IV) oksihlorid oktahidratom korišten je za prekoncentriranje hroma i olova prije njihovog određivanja pomoću plamene atomske apsorpcione spektrometrije. Karakteriziranje površine silika gela (aktivirani silika gel) prije i nakon modificiranja određeno je sa Fourier infracrvenom spektroskopijom (FTIR) kako bi se potvrdila imobilizacija cirkonijum (IV) oksihlorid oktahidrata na površini silika gela. Stepen zadržavanja, odnosno *recovery* vrijednost analita je određen primjenjujući tehniku kolona. Određeni su eksperimentalni parametri: utjecaj pH vrijednosti uzorka, mase silika gela i prekoncentracioni faktor (volumen uzorka). Pri optimalnim uslovima (pH 9, masa silika gela 250 mg, prekoncentracioni faktor 10) vrijednosti *recovery*-ja su bile 101 % za Cr i 98 % za Pb uz relativnu standardnu devijaciju (RSD) od oko ± 2 %. Detekcioni limit metode ($3.3s_b$) za hrom iznosi 41.8 μg L^{-1} dok za olovo 69.7 μg L^{-1}. Dobri rezultati *recovery*-ja pokazuju da korištena metoda može biti primjenjena na prekoncentriranje hroma i olova iz vodenih rastvora koji sadrže niske koncentracije ovih metala.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-23

Sediment quality assesment in the Bosna River Basin

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Keywords:
Sediment,
priority substances,
heavy metals,
PCB,
limit criteria,
heavy metals

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Abstract: Sediment quality assessment is one of the possibilities for elaboration of real picture of risks for water ecosystems. Complex screening of sediment structure and quality in Bosna River Basin was realized in the period of August/November, 2012. Scope of the sediment quality assessment was substances proposed by Directive 2008/105/EC that have tendency to accumulate in sediments plus heavy metals relevant for Danube River Basin (As, Cr, Cu, Zn) and PCB. Only the fraction of sediment with grain size less than 0,063 mm was analyzed because of the bioavailability. Measured data were standardized at 10% content of organic matter and 25 % ratio of lutit fraction. Results of this survey show that the most problematic compounds in Bosna River sediments are heavy metals and polycyclic aromatic hydrocarbons. The most significant contributor of heavy metals is agglomeration Zenica with its industrial surroundings. Agglomeration Sarajevo contributes to this kind of pollution with Hg and Cr. PAH substances mainly fenantrene, antracene, fluorantene and pyrene pose risk to ecosystem along the whole Bosna River. The highest concentrations of PAH was identified in the last monitoring site before the confluence of Bosna River with Sava River.

Sažetak

Procjena kvaliteta sedimenta je jedna od mogućnosti za dobijanje stvarne slike rizika za riječne ekosisteme. Kompleksno snimanje strukture i kvaliteta sedimenta riječnog bazena rijeke Bosne realizovano je u periodu avgust/novembar, 2012. Ispitivanje kvaliteta sedimenta se baziralo na analizi supstanci koje su predložene Direktivom 2008/105/EC i koje imaju tendenciju akumulacije u sedimentu, zatim teški metali relevantni za riječni bazen Dunava (As, Cr, Cu, Zn) i PCB. Analizirana je samo frakcija sedimenta granulacije manje od 0,063 mm, zbog biodostupnosti. Dobivene vrijednosti su normalizirane u odnosu su na sadržaj organske materije od 10 % i sadržaj frakcije gline od 25 %. Rezultati ovog istraživanja ukazali su na teške metale i policiklični aromatski ugljikovodike kao najproblematičnije supstance u sedimentu rijeke Bosne. Zenica zajedno sa svojim industrijskim okruženjem najviše doprinosi koncentraciji teških metala u sedimentu, dok Sarajevo sa svojim industrijskim okruženjem doprinosi ovoj vrsti zagađenja sa Hg i Cr. PAH-ovi, uglavnom, fenantren, antracen, fluoranten i piren uzrokuju rizik po ekosistem duž cijele rijeke Bosne. Najviša koncentracija PAH-ova je identificirana na zadnjoj monitoring tački, neposredno prije ušće rijeke Bosne u rijeku Savu.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-24

Analysis of trend, seasonality and the relationship between nutrients, oxygen and organic eco-chemical parameters of the Danube in Serbia

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Keywords:
Danube,
the spatial and temporal trend,
linear regression,
PCA,
inear regression

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Abstract: This work was performed trend analysis and seasonality of the following eco-chemical parameters: ammonium ion, BOD, phosphates, COD, chlorides, nitrates, dissolved oxygen, sulfate, total phosphorus, UV extinction, oxygen saturation on the river Danube. Some of these parameters is visible clearly pronounced linear time trend, with some seasonality can be seen throughout the course, with some parameters there are a large number of outliers, which makes it difficult to register a trend and seasonality types, as well as discontinuities in the time series, which also negatively affect the registration trend and seasonality. PCA (Principal Component Analysis) analysis, we found four factors that are present at the measuring points in the upper reaches of the Danube.

The analysis of the impact can be concluded that the interference can significantly affect the performance of statistical tests and therefore with great attention must choose statistical tests that will be used to select the test that has the best balance of resistance and statistical power. This will get the results on the basis of which they can bring the most authoritative conclusions about the nature and relationships of the tested eco-chemical parameters.

Sažetak

U radu je vršena analiza trenda i sezonalnosti na sledećim eko-hemijskim parametrima: amonijum-jon, BPK, fosfati, HPK, hloridi, nitrati, rastvoreni kiseonik, sulfati, ukupni fosfor, UV-ekstinkcija, zasićenje kiseonikom na vodotoku Dunava. Kod nekih od navedenih parametara uočljiv je jasno izražen linearni vremenski trend, kod nekih se može uočiti sezonalnost na čitavom toku, kod pojedinih parametara postoji veliki broj ekstremnih vrednosti koji otežava registrovanje trenda i vrste sezonalnosti, kao i diskontinuiteti u vremenskoj seriji koji takođe negativno utiču na registrovanje trenda i sezonalnosti. PCA analizom pronašli smo četiri faktora koja su prisutna na mernim mestima u gornjem toku Dunava. Analizom uticaja može se zaključiti da smetnje mogu bitno da utiču na performanse statističkih testova i zbog toga se s velikom pažnjom moraju birati statistički testovi koji će se koristiti da bi se odabrao test koji ima najbolji odnos otpornosti i statističke moći. Na ovaj način će se dobiti rezultati na osnovu kojih se mogu doneti najmerodavniji zaključci o prirodi i odnosima ispitivanih eko-hemijskih parametara.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-25

Removal of natural organic matter from water – application of advanced oxidation processes

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Keywords:
natural organic matter,
groundwater,
NOM removal,
advanced oxidation processes

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Abstract: Natural organic matter (NOM) is a complex mixture of organic compounds, mostly fulvic and humic acids, hydrocarbons, proteins and amino acids derived from plant and/or microbial residues. The occurrence of elevated concentration of natural organic matter in water that has been used as source of drinking water, can negatively affect final organoleptic and chemical quality of treated water, especially when chlorine is used as disinfectant, since NOM serve as reactants in the formation of potentially harmful disinfection by-products (DBPs) such as trihalomethanes (THMs), haloacetic acids (HAAs), bromate, chlorate etc. Removal of NOM from water and thus the prevention of DBPs formation can be achieved using following water treatment processes: coagulation/filtration method, ion exchange, adsorption onto activated carbons and membrane filtration while an alternative and most environmentally accepted method for NOM removal represent the application of advanced oxidation processes (AOPs). AOPs imply formation of highly reactive hydroxyl radicals and its reactions caused by usage of ozone, hydrogen peroxide and/or UV light, as well as Fenton's reagent and TiO_2 catalysis. This study reports the latest achievements in NOM removal from water using the AOPs.

Sažetak

Prirodne organske tvari su kompleksna smjesa organskih spojeva, uglavnom fulvinske i huminske kiseline, ugljikovodika, proteina te aminokiselina biljnog i/ili mikrobiološkog porijekla. Pojava povećanih koncentracija prirodnih organskih tvari u vodama koje se koriste kao sirovina u proizvodnji vode za piće, negativno utječu na organoleptičke karakteristike i kemijsku ispravnost vode za piće, naročito kada se dezinfekcija vode provodi primjenom elementarnog klora pri čemu prirodne organske tvari sudjeluju u reakciji nastanka štetnih dezinfekcijskih nusprodukata kao što su trihalometani, halooctena kiselina, bromati, klorati itd.

Uklanjanje prirodnih organskih tvari iz vode te sprječavanje nastanka dezinfekcijskih nusprodukata moguće je postići slijedećim procesima obrade voda: koagulacijom s filtracijom, ionskom izmjenom, adsorpcijom na aktivne ugljene te membranskom filtracijom, no ekološki najprihvatljiviji način uklanjanja prirodnih organskih tvari predstavlja primjena naprednih oksidacijskih procesa (eng. *advanced oxidation processes*, AOPs). Napredni oksidacijski procesi podrazumijevaju reakcije u kojima nastaju i reagiraju reaktivni hidroksilni radikali primjenom ozona, vodikova peroksida i/ili UV svijetla te Fentonova reagensa ili fotokatalitički aktivnog titanijeva dioksida. U ovom radu biti će prikazana najnovija dostignuća u području uklanjanja prirodnih organskih tvari iz vode primjenom naprednih oksidacijskih procesa.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-26

The Application of Microfluidics for Anionic Surfactant Determination

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Keywords:
anionic surfactant,
dimethyldioctadecylammonium-tetraphenylborate,
FIA/SIA,
microfludic,
potentiometric.

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Abstract: Anionic surfactants (AS) are represented with 58% of the total global production of surfactants. Standard methods for determination of AS in wastewater and commercial products are MBAS (Methylene Blue Active Substances), and two-phase titration. Because of the shortcomings that both standard methods have, there is a need for replacing them. Potentiometric measurements with the ion-selective electrode (ISE) solved most of the problems of standard methods. Microfluidics methods offer new possibilities in determining AS exploiting the ability to control molecules in space and time. Flow injection analysis (FIA) and Sequential injection analysis (SIA) using the screen-printed microsensor with incorporated new ionic associate (dimethyldioctadecylammonium-tetraphenylborate, DDA-TPB) as a detector, were used for determination of the AS. The measured electromotive force (EMF) is a function of the AS concentration in the sample. Sodium dodecyl sulfate (NaDDS) and sodium dodecyl benzene sulfonate (NaDBS) were used for calibration. The real samples are commercial products and industrial wastewater with different contents of AS. The sensor showed a sub-Nernstian slope for both anionic surfactants. Measurements were performed with adjusted ionic strength and pH.. The results showed good agreement with those obtained using the standard methods.

Sažetak

Anionski tenzidi (AS) su s 58% zastupljeni u ukupnoj svjetskoj proizvodnji tenzida. Standardna metoda za određivanje AS u otpadnim vodama je spektrofotometrijska MBAS (*Methylene blue active substances*) metoda dok se za određivanje AS u komercijalnim proizvodima koristi titracija u dvije faze. Zbog nedostataka koje imaju obje standardne metode, postoji potreba za iznalaženjem novih metoda koje bi ih mogle zamijeniti. Potenciometrijska mjerenja ionsko-selektivnom elektrodom s tekućom membranom (ISE) rješavaju većinu problema standardnih metoda. Mikrofluidičke metode nude nove mogućnosti u određivanju AS iskorištavajući mogućnost kontrole molekula u vremenu i prostoru. Metoda injektiranjem u protok (FIA) i sekvencijska injekcijska analiza (SIA) uz korištenje *screen-printed* mikrosenzora s novim ionskim asocijatom (dimetildioktadecilamonijevim-tetrafenilboratom, DDA-TPB) kao detektorom, korištena je za određivanje AS. FIA/SIA sustav je kućne izrade kao i program kojim je sustav vođen. Izmjerena elektromotorna sila (EMS) u funkciji je koncentracije AS u uzorku. Natrijev dodecil sulfat (NaDDS) i natrijev dodecil benzensulfonat (NaDBS) upotrebljeni su za kalibraciju, a realni uzorci su uzorci komercijalnih proizvoda i industrijske otpadne vode s različitim sadržajem AS. Senzor je pokazao sub-Nerstovski nagib za oba anionska tenzida. Mjerenja su izvođena uz podešenu ionsku jakost i pH vrijednost. Dobiveni rezultati pokazali su dobro slaganje s rezultatima dobivenim standardnim metodama.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-27

Simultaneous preconcentration of Cu, Fe and Mn on solid sulphur from river water samples prior to determination by FAAS

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Keywords:
solid sulphur,
preconcentration,
metals,
FAAS.

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Abstract: In the present study a simple and fairly rapid solid phase extraction (SPE) procedure has been applied. A mini-column loaded with sulphur powder as a nontoxic and low cost adsorbent for simultaneous preconcentration of copper, iron and manganese prior to determination by flame atomic absorption spectrometry, was used. The recoveries for the analytes under the optimum analytical conditions (pH 8; preconcentration factors of 10; flow rate 1 mL min^{-1}; amount of adsorbent 2.5 g) from solutions of known low metal concentrations were 104%, 109% and 90% for Cu, Fe and Mn, respectively. Furthermore, the adsorbed metal ions were eluted from the column by 1 mol L^{-1} of HNO_3 in methanol. The described procedure was tested on real water samples of Vogošća river. The used method has been successfully applied to the preconcentration and determination of trace Cu, Fe and Mn from river water samples. After preconcentration, the concentrations of Cu and Mn less than 0.05 µg mL^{-1}, and Fe less than 0.5 µg mL^{-1} were determined in river water samples.

Sažetak

U ovom radu primijenjen je jednostavan i relativno brz postupak ekstrakcije na čvrstom adsorbentu. Korištena je mini kolona punjena sumporom u prahu kao netoksičnim i lako dostupnim adsorbentom za simultano prekoncentriranje Cu, Fe i Mn prije njihovog određivanja atomskom apsorpcionom spektrometrijom - plamenom tehnikom. Dobivene vrijednosti *recovery*-ja analita pri optimalnim analitičkim uslovima (pH 8; prekoncentracioni faktor 10; brzina protoka uzorka 1 mL min^{-1}; količina adsorbenta 2.5 g), iz rastvora poznate niske koncentracije metala, bile su 104%, 109% i 90% za Cu, Fe i Mn, respektivno. Adsorbovani metalni joni su eluirani iz kolone sa 1 mol L^{-1} HNO_3 u metanolu. Prethodno opisana procedura testirana je na realnim uzorcima vode Vogošćanske rijeke. Korištena metoda uspješno je primijenjena za prekoncentriranje i određivanje tragova Cu, Fe i Mn iz uzoraka riječne vode. Nakon prekoncentriranja određena je koncentracija Cu i Mn niža od 0.05 µg mL^{-1}, odnosno Fe niža od 0.5 µg mL^{-1} u uzorcima riječne vode.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-28

Determination of Total Iron Content in Black Tea

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Keywords:
iron,
black tea,
spectrophotometry,
mineral digestion

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Abstract: The aim of this work was the assessment of total iron (Fe) content in some black tea brands by using a mineral digestion and Spectrophotometric method. In 4 samples of black tea from different manufactures and with 3 parallel were prepared by digestion and oxidation with a mixture of sulphuric and nitric acid. The total Fe content in analyzed black tea varies from 21 mg Fe/kg to 37,6 mg Fe/kg. The used spectrophotometric method is simple and sensitive method that can be applied for the determination of total Fe content in plant material. Results of this analysis suggest regular consumption of black tea as a significant natural source of organic-trace elements Fe for metabolic needs and their benefits on human health.

Sažetak

Cilj ovog rada je procjena ukupnog sadržaja željeza (Fe) u nekim brendiranim crnim čajevima primjenom mineralne digestije i spektrofotometrijske metode. 4 uzorka crnog čaja različitih proizvođača i u 3 paralelke pripremljeni su digestijom i oksidacijom s smjesom sumporne i nitratne kisleine. Sadržaj ukupnog željeza u uzorcima crnog čaja varirao je od 21 mg Fe/kg do 37,6 mg Fe/kg. Primjenjena metoda spektrofotometrije je jednostavna i osjetljiva i može biti primjenjena za određivanje ukupnog sadržaja željeza u biljnom materijalu. Rezultati ove analize sugerišu na redovnu konzumaciju crnog čaja kao značajnog prirodnog izvora organskog željeza u tragovima za metaboličke potrebe i njegove benefite na ljudsko zdravlje.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-29

Analysis of the soil in the vicinity of the mine "Bužim" - northwestern part of Bosnia and Herzegovina

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Keywords:
Soil,
X-ray analysis of soil,
Minerals,
Identification of minerals,
Manganese mine "Bužim"

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Abstract: In order to determine the individual Mn species, the investigations of soil were performed in the area of Bužim in the northwestern part of Bosnia and Herzegovina. Samples were taken at seven locations, at the manganese mine and its surrounding area. It was determined that the chemical properties of soil considerably affect the distribution of the individual species of Mn in the soil. The acidity of soil may cause Mn oxide-minerals to dissolve and release a significant amount of Mn ions in soil, therefore increasing the toxicity of soil for many plants. The method of X-ray analysis was used in our investigation to determine the mineral content of the studied soils. Based on these studies and chemical analysis, we were able to determine the presence of certain species of Mn.

All samples were scanned in an automatic X-ray goniometer with CuKα radiation and monochromatic graphite, whereat there was recorded the area of 2-64 ° in 2 Θ.

By using X-ray analysis, it was established a form of manganese presence in the soil or mineral content consisting of Mn, and the presence of other minerals such as quartz, albite, mica-muscovite, microcline, chlorite and kaolin minerals.

Sažetak

U cilju određivanja pojedinih specija Mn vršena su istraživanja tla na području Bužima u sjeverozapadnom dijelu Bosne i Hercegovine. Uzorci su uzeti na sedam lokaliteta, i to unutar rudnika mangana i u njegovoj okolici. Utvrđeno je da hemijska svojstva tla utječu na raspodjelu pojednih specija Mn u tlu. Kiselost tla može uzrokovati da se mineralni oksidi Mn otope i otpuštaju dovoljno iona mangana u tla i na taj način čini tla toksičnijim za mnoge biljke. Za naša istraživanja smo koristili metodu rentgenske analize da bi odredili mineralni sadržaj istraživanog tla. Na osnovu tih istraživanja i hemijskih analiza mogli smo utvrditi prisustvo pojedinih specija Mn. Svi uzorci su snimani na automatskom rentgenskom goniometru uz CuKα zračenje i grafitni monohromator, pri čemu je snimano područj e od 2-64° u 2 Θ. Rentgenskom analizom ustanovljen je oblik mangana prisutan u tlu odnosno mineralni sadržaj u čijem sastavu je Mn te prisustvo drugih minerala kao što je kvarc, albit, liskun-muskovit, mikroklin, klorit i kaolinski minerali.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-30

Validation of method for the determination of mercury in the auxiliary substances Azorubine 21% and Azorubine 85% using Cold-vapor Atomic Absorption Spectrometry

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Keywords:
Azorubine,
Hg determination,
Cold-vapor Atomic Absorption Spectrometry,
microwave acid digestion

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Abstract: Heavy metals, such as Mercury (Hg), are sometimes found in pharmaceuticals. Although the concentration of those elements is very low, their control is very important because of its toxicity. Permissible concentration of Mercury (Hg) in Azorubine 21% and Azorubine 85% is prescribed by the Directive of the European Commission concerning the specific purity criteria on food coloring. As the Pharmaceutical company "Bosnalijek" uses auxiliary substances such Azorubine 21% and Azorubine 85% in its production process, the quality of these substances is monitored prior to usage .The focuse of this paper is on validating precise and accurate methods of Hg determination in auxiliary substances mentioned above, by Cold-vapor Atomic Absorption Spectrometry after microwave acid digestion of solid samples. The best results at measuring concentration of mercury were achieved using the acid digestion of mixing of test samples with 1 mL MQ water + 1 mL 65% HNO_3 + 1 mL 70% $HClO_4$ + 5 mL 96% H_2SO_4 and digesting it for 30 min. on 1000 W. The concentration of Hg in the sample is determinated by Cold-vapor Atomic Absorption Spectrometry with sodium borohydride as a reducing agent. The method was successfully validated and can be applied for the determination of Hg in solid samples of Azorubine 21% and Azorubine 85%, with value of recovery factor of 95% - 104% and 96-105%, respectively.

Sažetak

Teški metali, kao što je živa (Hg), ponekad se mogu naći u farmaceutskim proizvodima. Iako je njihova koncentracija veoma niska, praćenje istih je veoma važno zbog njene toksičnosti. Dozvoljena koncentracija žive (Hg) u Azorubine 21% i Azorubine 85% je propisana Direktivom Europske komisije u vezi s posebnim kriterijima čistoće boja za hranu. Kako farmaceutska kompanija "Bosnalijek" koristi pomoćne supstance Azorubin 21% i Azorubin 85% u svom proizvodnom procesu prati se njihov kvalitet prije upotrebe. Fokus ovog rada je na validaciji precizne i tačne metode određivanja Hg u Azorubinu 21% i Azorubinu 85%, koristeći tehniku hladnih para atomske apsorpcione spektrometrije nakon mikrotalasne kiselinske digestije čvrstih uzoraka.. Najbolji rezultati pri mjerenju sadržaja žive su postignuti nakon mikrotalasne digestije ispitnih uzoraka smjesom koja sadrži 1 mL MQ vode + 1 mL 65% HNO_3 + 1 mL 70% $HClO_4$ + 5 mL 96% H_2SO_4 u periodu od 30 min. na 1000 W. Koncentracija Hg u uzorku je nakon toga određena tehnikom hladnih para atomske apsorpcione spektrometrije uz natrij borohidrid kao rededucens. Metoda je uspješno validirana i može se primjenjivati za određivanje Hg u čvrstom uzorku Azorubina 21% i Azorubina 85%, uz vrijednost *recovery*-ja faktora od 95% -104% i 96-105%, redom.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-31

Content of selected toxic and essential metals in muscle tissue and gills of *Oncorhynchus mykiss (Walbaum, 1792)* from stream and fishpond from Bugojno (Bosnia and Herzegovina)

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Keywords:
toxic metals,
essential metals,
fish, gills,
muscle tissue,
fishpond,
stream.

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Abstract: In this study toxic and essential metal concentrations were determined in muscle tissue and gills of trout (*Oncorhynchus mykiss, Walbaum, 1792*) from stream and fishpond from Bugojno. The concentrations of metals Cd, Co, Cr, Fe, Mn, Pb, Ni, Zn, Ca, Mg and Na were determined by flame atomic absorption spectrometry (FAAS). The obtained results showed that concentrations of toxic metals in muscle tissue did not exceed maximum allowable concentrations (MACs) prescribed by EU legislation while the MACs values of metals in gills are not defined by this legislation. Concentrations of metals in gills were higher than the concentrations in fish muscle tissue for most analyzed metals. Thus, the concentration of Fe in gills of the trout from the stream is 15, and Zn in gills of the trout from the fishpond is 21 times higher than the content of Fe and Zn in muscle tissue. The analysis confirmed that the concentration of metals in fish is in positive correlation to the concentration of metals in water. The concentrations of toxic metals were higher in trout from the fishpond, while the concentrations of essential metals (except Zn) were lower in relation to the trout from the stream, which could be related to their nutrition.

Sažetak

U ovom istraživanju određena je koncentracija toksičnih i esencijalnih metala u mesu i škrgama Kalifornijske pastrmke (*Oncorhynchus mykiss*) iz ribnjaka i potoka sa lokaliteta Bugojna. Za određivanje koncentracije metala Cd, Co, Cr, Fe, Mn, Pb, Ni, Zn, Ca, Mg i Na korištena je atomska apsorpciona spektrometrija-plamena tehnika (FAAS). Dobivene koncentracije toksičnih metala u mesu ribe ne prelaze maksimalno dozvoljene koncentracije prema legislativi EU (Evropske Unije), dok iste u škrgama nisu propisane ovom legislativom. Koncentracije metala u škrgama su veće u odnosu na koncetracije u mesu ribe za većinu analiziranih metala. Tako je koncentracija Fe u škrgama pastrmke iz potoka 15, a Zn u škrgama pastrmke iz ribnjaka 21 puta veća u odnosu na sadržaj Fe odnosno Zn u mesu. Analizom je potvrđeno da je koncentracija metala u ribama u pozitivnoj korelaciji sa koncentracijom metala u vodi. Koncentracije toksičnih metala su više kod pastrmke iz ribnjaka dok je koncentracija esencijalnih metala (sa izuzetkom Zn) niža u odnosu na ribe iz potoka što se može povezati sa načinom ishrane.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-32

Validation of an AAS-VGA method for determination of arsenic in titanium dioxide

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Keywords:
Validation,
Atomic Absorption Spectrophotometry Vapor Generation Accessory (AAS-VGA),
arsenic,
titanium dioxide.

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Abstract: In analytical laboratories atomic absorption spectrophotometry measurements are frequently used for determination of metal content in some raw materials for drug production. Atomic absorption spectrophotometry with vapour generation assembly (AAS-VGA) is well known technique for the trace analysis of arsenic. The aim of this study was to provide better and more accurate qualitative and quantitative analysis of arsenic in the raw material like Titanium dioxide, and validation of this method was performed thorough the following tests: selectivity, linearity, LOD, LOQ, accuracy, precision, intermediate precision and robustness. Measurements of the absorbance were done by using AAS Varian 240 FS – VGA instrument. Futhermore, standard solutions of arsenic in different concentration - target concentration of arsenic was 5 ppm, spiked solutions, test solutions and blank were prepared for the analysis. For validation of this method the literature of vendor and Ph.Eur. was used. The results are satisfactory and are included into the set limits: selectivity-complies; linearity–r:0,9986; LOD:0,7ppm; LOQ:2,0ppm; accuracy:104,7%-111,5%; precision–CV:0,68%; intermediate precision–CV:0,69%; robustness–solution stability D:3,8%, method parameters CV: 0,87%. Validated method is reliable and suitable for analysis of arsenic in titanium dioxide.

Sažetak

U analitickim laboratorijama atomska apsorpciona spektrofotometrija cesto se koristi za odredjivanje prisustva metala u materijalima za farmaceutsku upotrebu. Atomska apsorpciona spektrofotometrija sa dodatkom VGA jedinice (AAS-VGA) dobro je poznata tehnika za analizu tragova arsena. Cilj ovog istrazivanja bio je pruziti bolju i tacniju kvalitativnu i kvantitativnu analizu arsena u materijalima poput titan dioksida, i validacija ove metode je provedena ispitivanjem sljedecih parametara: selektivnost, linearnost, LOD, LOQ, tacnost, preciznost, intermedijarna preciznost i robusnost. Mjerenja apsorbance su izvedena pomocu AAS Varian 240 FS - VGA instrumenta. Nadalje, za analizu su pripremljene standardne otopine arsena razlicitih koncentracija - ciljana koncentracija arsena je 5 ppm, otopine standardnog dodatka, otopine probe i slijepe probe. Za validaciju ove metode koristena je literatura proizvidjaca Varian, i vazece Ph.Eur. Rezultati su zadovoljavajuci, i ulaze u zadane granice: selektivnost – odgovara; linearnost – r:0,9986; LOD:0,7ppm; LOQ:2,0ppm; tacnost:104,7%-111,5%; preciznost – CV:0,68%; intermedijarna preciznost – CV:0,69%; robustnost – stabilnost otopine D:3,8%, parametri metode CV: 0,87% Provjerena metoda je pouzdana i pogodna za analizu arsena u titan dioksidu.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-33

Kinetic and Flow Injection Spectrophotometric Determination of N-Acetylcysteine ethyl ester Based on the Reduction of Copper(II)-neocuproine

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Keywords:

N-Acetylcysteine ethyl ester,
Kinetic spectrophotometry,
Fixed time method,
Flow injection.

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Abstract: Kinetic spectrophotometric and flow injection methods of analysis were developed for the determination of a novel lipophilic cell-permeable cysteine derivative N-Acetylcysteine ethyl ester (NACET). The proposed methods are based on a reduction reaction of Cu(II)-neocuproine reagent to Cu(I)-neocuproine by NACET in a Britton-Robinson buffer solution. The absorbance of the generated Cu(I)-neocuproine complex is measured at 458 nm. In the kinetic procedure a fixed time method was utilized for the construction of calibration graphs, and the recorded peak height was used as a quantitative variable in the flow injection procedure. A linear calibration graph was obtained from 1.0×10^{-6} to 1.0×10^{-4} mol L^{-1} of NACET by the use of the kinetic spectrophotometric method where the detection limit was 4.7×10^{-8} mol L^{-1}. The linearity of the proposed flow injection method was obtained over the range 2.0×10^{-6} mol L^{-1} – 6.0×10^{-5} mol L^{-1} NACET, where the limit of detection was 2.7×10^{-7} mol L^{-1}.

Sažetak

Razvijene su kinetičke i FIA spektrofotometrijske metode analize određivanja novog lipofilnog spoja N-acetilcistein etil estera (NACET). Predložene metode se temelje na reakciji redukcije Cu(II)-neokuproina pomoću NACET-a u otopini Britton-Robinsonovog pufera pri čemu nastaje Cu(I)-neokuproin. Apsorbancija nastalog Cu(I)-neokuproin kompleksa je mjerena pri 458 nm. Kod kinetičkog postupka metoda određenog vremena se koristi za konstrukciju pravca umjeravanja, dok je zabilježena visina pika korištena kao kvantitativna varijabla kod protočne analize injektiranjem. Pravac umjeravanja je zabilježen kinetičkom spektrofotometrijskom metodom u području koncentracija NACET-a od 1,0 10^{-6} do 1,0 × 10^{-4} mol L^{-1} gdje je granica dokazivanja 4,7 × 10^{-8} mol L^{-1}. Predloženom FIA metodom zabilježena je linearnost u rasponu koncentracija od 2,0 × 10^{-6} mol L^{-1} do 6,0 × 10^{-5} mol L^{-1}, s granicom dokazivanja $2,7\times10^{-7}$ mol L^{-1}.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-AEC-34

A Study for the Method Transfer of Lisinopril dyhidrate and Hydrochlorotiazide from HPLC to RRLC

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Keywords:
HPLC (High performance liquid chromatography),
RRLC (Rapid resolution liquid chromatography)

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Abstract: Increasing demands for faster and more economical analysis initiated method development and validation on RRLC, an advanced form of conventional HPLC. A time and solvent consuming HPLC method for lisinopril dihydrate and hydrochlorothiazide assay (and determination of the related substances) was transferred and validated as a new RRLC method by using the new technique, i.e., the RRLC system with the short column (100 mm in length) and the low particle size of the packing (2.7 µm in diameter).

Validation of methods consisted of an analysis of the following parameters: selectivity, linearity, limit of detection, limit of quantization, accuracy, precision and robustness of the method using the device RRLC Agilent 1200. The results are good in relation to its borders, so that it can be considered that the method is reliable, and its use in practice has led to significant savings in time and consumables.

The long-term investment benefit for the company are a small number of the instruments (savings in the initial investment), the small space needed for the instruments, the lowered costs of annual maintenance and calibration of the instrument, the lowered energy consumption, etc.

Sažetak

Sve veći zahtjevi za bržu i ekonomičniju analizu inicirali su razvoj i validaciju metoda na RRLC. HPLC metoda za određivanje sadržaja izinopril dihidrata i hidrohlortiazida i srodnih supstanci, transferirana je i validirana kao nova RRLC metoda, uz korištenje nove tehnike, odnosno RRLC sistema sa kraćom kolonom (dužina 100 mm) i dijametrom kolone od 2,7µm. Validacija metode sastojala se od analize sljedećih parametara: selektivnost, linearnost, limit detekcije, limit kvantizacije, tačnost, preciznost i robustnost metode, uz korištenje uređaja RRLC Agilent 1200. Dobiveni su dobri rezultati u odnosu na postavljene granice, tako da se može smatrati da je metoda pouzdana, a njena upotreba u praksi dovela je do znatne uštede u vremenu i potrošnom materijalu u laboratoriji. Dugoročno, benefit je i u uštedi na broju potrebnih instrumenata i troškovima za njihovo održavanje i kalibraciju instrumenata.

POSTER PRESENTATIONS

Biochemistry and Biotechnology

(BB)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-01

Covalent Immobilization of Lactase onto UV-Curable Polymeric Matrix

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Keywords:
Lactase,
β-Galactosidase,
E. coli,
UV-Curable polymer,
Immobilization

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Abstract: Lactase (β-Galactosidase; EC 3.2.1.23; from E. coli), was immobilized on to glycidyl methacrylate monomer containing epoxy functionality by covalent binding. The response surface methodology (RSM) was applied to optimize the immobilization conditions, enzyme concentration (25-100µg/mL), reaction time (2–8 h), and reaction pH (6.0-8.0). The results indicated that enzyme concentration, pH and immobilization time were the significant factors on the immobilization of lactase. The morphology of the polymeric support was characterized by scanning electron microscopy (SEM) and FT-IR. By immobilization, the temperature resistance of the enzyme was improved and showed maximum activity at 60 ºC. pH dependent activities of the free and immobilized enzymes were also investigated, and it was found that the pH of maximum activity for the free enzyme was 6.8, while for the optimal pH of the immobilized enzyme was 6.5. The immobilized enzyme retained 65% of its activity after 20 runs. Free enzyme lost its activity completely within 30 days, while immobilized enzyme lost only 18.7% of its activity in 30 days. V_{max} values for the free and immobilized enzymes were calculated as 1.0 and 0.077 mg/mL/min, respectively.

Sažetak: Laktaza (β-Galaktozidaza; EC 3.2.1.23; iz E. coli), je imobilizirana na glicidil metakrilatni monomer sa epoksi osobinama kada se kovalentno veže. Metodologija odgovora površine (RSM) je korištena za optimizaciju imobilizacionih uslovia: koncentracija enzima (25-100µg/mL), vrijeme reakcije (2–8 h) i pH reakcije (6.0-8.0). Rezultati upućuju da su koncentracija enzima, pH i vrijeme imobilizacije značajni faktori u imobilizaciji laktaze. Morfologija polimerne potpore je okarkaterizirana uz pomoć skenirajućeg elektronskog mikroskopa (SEM) i FT-IR. Imobilizacijom je poboljšana otpornost enzima na temperature, a maksimalna aktivnost je dostignuta na 60 ºC. pH ovisnost aktivnosti slobodnog i imobiliziranog enzima je također ispitana i nađeno je da je pH maksimalne aktivnosti slobodnog enzima 6.8, dok je optimalna pH za imobilizirani enzim 6.5. Imobilizirani enzim je zadržao 65 % svoje aktivnosti nakon 20 ispitivanja. Slobodni enzim je u potpunosti izgubio svoju aktivnost nakon 30 dana, dok je imobilizirani enzim izgubio tek 18.7 % svoje aktivnosti u periodu od 30 dana. V_{max} vrijednosti za slobodne i imobilizirane enzime su izračunati kao 1.0 i 0.077 mg/mL/min, respektivno.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-02

Covalent Immobilization of Lipase onto Sol-Gel Hybrid Coating Films

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Keywords:
Lipase,
Candida rugosa,
Epoxy-silica polymer,
Immobilization

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Abstract: In this study UV-curable hybrid epoxy-silica polymer films were prepared via sol–gel method. Lipase (E.C. 3.1.1.3) from *Candida rugosa* was covalently immobilized onto hybrid epoxy-silica polymer films. The response surface methodology (RSM) was applied to optimize the immobilization conditions: enzyme concentration (25-100μg/mL), reaction time (2–8 h), and reaction pH (6.0-8.0). Immobilization yield was found as 1.54 mg/g of polymer films. The morphology of the polymeric support was characterized by scanning electron microscopy (SEM) and FT-IR. Immobilized and free enzymes were used in two different reaction systems: hydrolysis of *p*-nitrophenyl palmitate (*p*NPP) in aqueous medium and synthesis of *p*NPP (from *p*-nitrophenol and palmitic acid) in hexane medium. The effects of pH on hydrolytic activities was found that the pH of maximum activity for the free enzyme was 6.5, while for the optimal pH of the immobilized enzyme was 6.0. The effects of pH on synthetic activities were found that for both free and immobilized enzyme was found to be 6.5. The characteristic properties of the immobilized and native enzyme, such as kinetic activity, reusability and storage stability were also studied at optimum pH and temperature. Immobilized enzyme exhibited better reusability and storage stability than the free one.

Sažetak: U ovom istraživanju UV-ljekoviti hibridni epoksi-silika polimerni filmovi su pripremljeni pomoću sol–gel metode. Lipaza (E.C. 3.1.1.3) iz *Candida rugosa* je kovalentno imobilizirana na hibridne epoksi-silika polimerne filmove. Metodologija odgovora površine (RSM) je korištena da se optimiziraju imobilizacioni uslovi: koncentracija enzima (25-100μg/mL), vrijeme reakcije (2–8 h), i pH reakcije (6.0-8.0). Imobilizacioni prinos polimernog filma je bio 1.54 mg/g. Morfologija polimerne potpore je okarkaterizirana uz pomoć skenirajućeg elektronskog mikroskopa (SEM) i FT-IR. Imobilizirani i slobodni enzimi su korišteni u dva različita reakciona sistema: hidroliza *p*-nitrofenil palmitata (*p*NPP) u vodenoj sredini i sinteza *p*NPP (iz *p*-nitrofenola i palmitinske kiseline) u heksanskoj sredini. Utvrđeni efekti pH na hidrolitičke aktivnosti su takvi da pH maksimalne aktivnosti za slobodan enzim iznosi 6.5, dok optimalna pH za imobilizirani enzim iznosi 6.0. Efekti pH na sintetske aktivnosti kod slobodnog i imobiliziranog enzima ustanovljeni su pri pH 6.5. Karakteristična svojstva imobilizianog i nativnog enzima kao što su kinetička aktivnost, mogućnost ponovnog korištenja i stabilnost pri skladištenju su također ispitana pri optimalnoj pH i temperaturi. Imobilizirani enzim je pokazao bolju stabilnost pri skladištenju kao i mogućnost ponovnog korištenja u odnosu na slobodni.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-03

Effects of Chard (*Beta vulgaris* L. var. cicla) on Pancreas Damage in Valproic Acid Induced Toxicity

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Keywords:
Chard,
Pancreas,
Valproic Acid

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Abstract: Valproic acid (VPA) is one of the most widely used anticonvulsants in adults and children. However, its usefulness may be compromised due to its potential adverse effects on the gastrointestinal, neurological, hematological and reproductive systems. It is possibly the most common cause of drug induced pancreatitis. Pancreatitis with VPA was first recognized in 1979. Chard (*Beta vulgaris* L. var. cicla) is a low cost plant and has a widespread use in many traditional dishes. It has been demonstrated that chard has antioxidant, antiacetylcholinesterase, antidiabetic, antitumor and hepatoprotective effects. The aim of this study is to evaluate whether VPA and/or chard might interfere with oxidative metabolism in pancreas. Female rats were divided into four groups as intact control animals, VPA (0.5 g/kg/day, i.p.), chard (100 mg/kg/day, oral) and VPA+chard (in same dose and time) given groups for seven days. Chard extract was given 1 h prior to the administration of VPA. On the 8th day the animals were sacrificed under anesthesia and pancreas samples were homogenized in saline. Oxidant-antioxidant biochemical parameters were determined in homogenized pancreas samples. Results were evaluated statistically and discussed.

Sažetak

Valproična kiselina ("Valproic acid"-VPA) je najčešće korišten antikonvulziv kod odraslih osoba I djece. Međutim, njenu korist umanjuju štetni uticaji na gastrointestinalni, neurološki, hematološki I reproduktivni system. Lijekovi sa valproičnom kiselinom su najčešći uzrok nastanka pankreatitisa. 1979 godine prvi put je nastanak pankreatitisa povezan sa valproičnom kiselinom. Blitva (*Beta vulgaris* L. var. cicla) je biljka niskih troškova uzgoja koja je jako zastupljena u različitim tradicionalnim kuhinjama. Dokazano je da ova biljka ima antioksidativna, antiacetilholinesterazna, antidijabetska, antitumorska I hepatoprotektivna svojstva. Cilj ove studije je dokazati da li VPA i/ili blitva mogu interferirati sa oksidativnim metabolizmom pankreasa. Ženke štakora su podijeljene u četiri grupe kao intakt kontrolne životinje, VPA (0.5 g/kg/dan, i.p.), blitva (100 mg/kg/dan, oralno) i VPA+blitva (u istoj dozi I vremenu) su date životinjama u periodu od sedam dana. Ekstrakt blitve je dat životinjama 1 sat prije VPA. Osmog dana uzorci pankreasa su uzeti od uspavanih životinja. Biohemijski parametric oksidans-antioksidans su određivani u homogeniziranim uzorcima. Rezultati su obrađeni statistički.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP- BB-04

An Oxovanadium (IV) Complex Based on Thiosemicarbazone Reduces Glycoprotein Components and Oxidative Lung Injury in Experimental Diabetes

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Keywords:
Lung,
vanadium complex,
glycoprotein,
Diabetes mellitus

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Abstract: Vanadium derivatives have been shown to possess insulin-mimetic and antidiabetic activities in the animal models and diabetic people. The aim of this study was to investigate the protective effect of an oxovanadium (IV) complex based on thiosemicarbazone (VOL) [L: (N(1)-2,4-dihydroxybenzylidene-N-(4)-2-hydroxybenzylidene-S-methyl-thiosemicarbazidato-oxovanadium (IV)] on glycoprotein components levels and oxidative lung injury of streptozotocin (STZ)-induced diabetic rats. The male animals were divided into four groups. Group I: control (intact) animals. Group II: control animals administered with VOL. Group III: STZ-induced diabetic rats. Group IV: STZ-induced diabetic animals administered VOL. VOL was given to some of the experimental animals by gavage at a dose of 0.2 mM/kg body weight every day for 12 days. Diabetes was induced by single intraperitoneal injection of STZ (65 mg/kg body weight).On the 12^{th} day, lung tissue samples were taken. Hydroxyproline, advanced oxidation protein products and protein carbonyl levels and arginase, prolidase activities and glycoprotein components significantly increased and carbonic anhydrase, Na^+/K^+-ATPase and arylesterase activities decreased in lung tissue of diabetic rats. Treatment with VOL reversed these effects showing a beneficial effect of vanadium. In conclusion, the present study shows that VOL has a protective effect against diabetes-induced lung damage and on abnormal glycoprotein component levels.

Sažetak

Dokazanao je da derivati vanadija posjeduju inzulin-mimetičke i antidijabetičke aktivnosti na životinjskim modelima i kod dijabetičara. Cilj ovog rada je bio ispitivanje zaštitnih osobina oksovanadij(IV) kompleksa baziranog na tiosemikarbazonu (VOL) [L: (N(1)-2,4-dihidroksibenziledin-N-(4)-2-hidroksibenziledin-S-metil-tiosemikarbazidato-oksovanadij (IV)] na nivoe glikoproteinskih komonenata I oksidativne povrede pluća dijabetičnih štakora kojima je dat streptozotocin (STZ). Mužjaci su podijeljeni u četiri grupe. Grupa I su bile kontrolne životinje. Grupa II su bile kontrolne životinje kojima je dat VOL. Grupa III su bili STZ-inducirani dijabetični štakori. Grupa IV su bili STZ inducirani dijabetični štakori kojima je dat VOL. VOL je dat eksperimentalnim životinjama u dozi od 0.2 mM/kg tjelesne težine svaki dan u periodu od 12 dana. Dijabetes je induciran jednom intraperitonealnom injekcijom STZa (65 mg/kg tjelesne težine). Uzorci tkiva pluća su uzeti dvanaestog dana. Proteinski proizvodi hidroksiprolinske oksidacije I karbonilni proteinski nivoi kao aktivnosti arginaze I prolidaze te glikoproteinske komponente su se značajno povisile dok su se aktivnosti karbonilne anhidraze, Na^+/K^+-ATPaze I arilesteraze snizile u plućnom tkivu dijabetičnih štakora. Tretman sa VOL je obrnuo procese pokazujući bitnu ulogu vanadija. Rad je pokazao da VOL ima zaštitnu ulogu kod oštećenja pluća uzrokovanih dijabetesom I na abnormalno visoke nivoe glikoproteina.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-05

Effects of Chard on Some Biochemical Parameters in the Testicular Tissue of Streptozotocin-Induced Diabetic Rats

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Keywords:
Diabetes mellitus,
testis,
rat,
chard.

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Abstract: Chard (*Beta vulgaris* L. var. cicla) is widely spread in Turkey. This plant is used as antidiabetic in traditional medicine in Turkey. The aim of this study was to investigate the protective effect of chard on enzyme activities and glycoprotein components of streptozotocin (STZ) - induced diabetic rat testis. Male Sprague Dawley rats were divided into three groups. Group I; Control animals fed with citrate buffer, Group II; STZ - diabetic animals, Group III; STZ - diabetic animals fed with chard extract. Diabetes was induced by intraperitoneal injection of STZ in a single dose of 60 mg/kg body weight. The chard extract was administrated by gavage technique to rats at a dose of 2 g/kg every day for 45 days, 15 days after animals were made diabetic. At the end of the experimental period, testis tissue was taken after decapitation. The testis tissues were homogenized. Myeloperoxidase activity and protein carbonyl, advanced oxidation protein products, hydroxyproline contents and glycoprotein components were increased, while paraoxonase activity was decreased in testis tissues of diabetic rats. After administration of chard to diabetic rats, these changes were reversed. These results suggest that chard is potentially beneficial agent to reduce testicular damage in diabetic rats.

Sažetak

Blitva (*Beta vulgaris* L. var. *cicla*) je široko rasprostranjena u Turskoj. Koristi kao antidijabetik u turskoj tradicionalnoj medicini. Cilj ovog istraživanja bio je ispitivanje uticaja blitve na aktivnosti enzima i glikoproteina streptozotocinom (STZ) koji izaziva dijabetični rat testisa. Mužjaci Sprague Dawley štakora korišteni u ovom eksperimentu su bili podijeljeni u tri grupe. Grupa I; Kontrolni uzorci hranjeni citratnim puferom, Grupa II; STZ – dijabetičarski uzorci životinja, Grupa III; STZ – dijabetičarski uzorci životinja hranjeni ekstraktom blitve. Dijabetes je izazvan intraperitonealno za STZ u dozi od 60 mg/kg tjelesne težine. Ekstrakt blitve je davan štakorima u dozi od 2 g/kg svaki dan u toku 45 dana, 15 dana nakon što su životinja dijagnosticirane kao dijabetičari. Tkivo testisa je odstranjeno i homogenizirano na kraju ekperimentalnog perioda. Aktivnost mijeloperoksidaze i proteina karbonila, napredne oksidacije proizvoda proteina, te sadržaj hidroksiprolina i komponenti glikoproteina su povećani, dok aktivnost paraoksonaze je smanjena u tkivima testisa štakora dijabetičara. Ove promjene su bile obrnute nakon administracije blitve u štakora dijabetičara. Ovi rezultati ukazuju da je blitva korisno sredstvo pri smanjenju oštećenja testisa u štakora dijabetičara.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-06

Antioxidant Activities of Various Plant Oils

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Keywords:
Plant oils,
Antioxidant

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Abstract: Fats and oils present in many foods may easily deteriorate due to oxidation, in a chain of reactions in which free radicals are formed, propagated, and finally converted into stable oxygenated compounds, which are responsible for off-flavors and other undesirable characteristics. Synthetic antioxidants such as butylated hydroxyanisole, butylated hydroxytoluene, and propyl gallate have been used in food industries, but there are some arguments about the safety and adverse effects of these substances when used as food additives. Thus, there is a need for identifying alternative natural and safe sources of food antioxidants. The objective of this study was to measure the antioxidant capacity of twenty five different plant oils such as rose, lavender, jasmine, garlic, corn, olive and clove oils. 2,2-Diphenyl-1-picryl-hydrazyl (DPPH) and 2,2′-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) radical scavenging activities were used to evaluate the antioxidant activities. The results were compared with natural and synthetic antioxidants. Antioxidant activity was increased with increasing oil concentration in all plant oils. All plant oils showed a potential antioxidant activity. We can conclude that these oils can be used in pharmacy and food industries due to their excellent antioxidant activity.

Sažetak

Masti i ulja, prisutni u različitoj hrani mogu vrlo lako da se razgrade usljed oksidacije, u seriji reakcija u kojima se formiraju slobodni radikali, propagiraju i na kraju pređu u stabilne oksigenizirane spojeve, koji su odgovorni za loš miris i druge neželjene karakteristike. Sintetski antioksidansi kao što su butilirani hidroksianisol, butilirani hidroksitoluen i propil galat se koriste u prehrambenoj industriji, ali postoje određeni dokazi o sigurnosnim i štetnim efektima ovih tvari kada se koriste kao aditivi u hrani. Stoga postoji potreba da se pronađu alternativni prirodni i sigurniji izvori antioksidanasa za hranu. Cilj ovog istraživanja je bio da se izmjeri antioksidativni kapacitet dvadeset pet različitih biljnih ulja kao što su ružino, lavandino, ulje jasmina, ulje bijelog luka, kukuruzno, maslinovo i ulje klinčića. 2,2-difenil-1-pikril-hidrazil (DPPH) i 2,2′-azino-bis (3-etilbenzotiazolin-6-sulfonska kiselina) (ABTS) metode aktivnosti radikalskog istiskivanja su korištene da bi se procijenila antioksidativna aktivnost. Rezultati su upoređivani sa prirodnim i sintetskim antioksidansima. Antioksidativna aktivnost se povećavala sa povećanjem koncentracije ulja u svim biljnim uljima. Sva biljna ulja su pokazala potencijalnu antioksidativnu aktivnost. Možemo zaključiti da se ova ulja mogu koristiti u farmaceutskoj i prehrambenoj industriji zbog svoje odlične antioksidativne aktivnosti.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-07

Antioxidant and Antiacetylcholinesterase Activities of *Sorbus torminalis* (L.) Crantz Fruits

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Keywords:
acetylcholinesterase,
antioxidant activity,
free radicals,
Sorbus torminalis (L.) Crantz,

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Abstract: In this study, the antioxidant and antiacetylcholinesterase activities of *Sorbus torminalis* (L.) Crantz (wild service tree) fruits were evaluated. Total phenolic and flavonoid compounds, 2,2'-azino-bis (3-ethylbenzothioazoline-6-sulphonic acid) (ABTS), 2,2-diphenyl-1-picrylhydrazyl (DPPH) and superoxide anion (O_2^-) radicals scavenging activities and ferric-reducing antioxidant power (FRAP) of water, ethyl acetate, acetone and methanol extracts were determined for the measurement of the antioxidant activity. Quercetin and α-tocopherol were used as standard antioxidants. The inhibitory effect of the water extract on acetylcholinesterase (AChE) was evaluated using Ellman method and galantamine was used as a standard. The results showed that water extract had the highest total phenolic content and the strongest antioxidant activity followed by ethyl acetate and acetone extracts whereas methanol extract had the lowest phenolic content and the weakest antioxidant activity. Moreover, water extract showed moderate ability to inhibit AChE. It was concluded that fruits of *S. torminalis* had antioxidant and antiacetylcholinesterase activities and that the plant might be a natural source of antioxidants and AChE inhibitors.

Sažetak

U ovom radu je ispitivana antioksidativna I antiacetilholinesterazna aktivnost voća *Sorbus torminalis* (L.) Crantz (brekinja, "wild service tree"). Sadržaj ukupnih fenola I flavonoidnih jedinjenja, 2,2'-azino-bis (3-etilbenzotioazolina-6-sulfonska kiseline) (ABTS), 2,2-difenil-1-pikrilhidrazil (DPPH) I superoksidnog anionskog (O_2^-) inhibitora aktivnosti slobodnih radikala, antikosidativna aktivnost ispitivana sa sa željezom (FRAP), vodenih, etil acetatnih, acetonskih I metanolnih ekstrakata je određivana mjerenjem antioksidativne aktivnosti. Kvercetin I α-tokoferol su korišteni kao standardi antiokisidansa. Inhibitorski uticaj vodenog ekstrakta na acetilholinesterazu (AChE) je određivan Ellmanovom metodom I galantaminom kao standardom. Rezultati su pokazali da je vodeni ekstrakt imao najviši sadržaj fenolnih jedinjenja I najjaču antioksidativnu aktivnost. Etil acetatni I acetonski ekstrakt su su imali niže vrijednosti fenolnih jedinjenja I antioksidativne aktivnosti dok je metanolni ekstrakt imao najniži sadržaj fenolnih jedinjenja I najslabiju antioksidativnu aktivnost. Također, vodeni ekstrakt je pokazao umjerenu sposobnost inhibicije AChE. Zaključeno je da voće roda *S. torminalis* posjeduje antioksidativnu I antiacetilholinesteraznu aktivnost I da ova biljka može predstavljati prirodni izvor antioksidanasa I AcHE inhibitora.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-08

Zinc Supplementation Ameliorates Oxidative Stress Changes in the Lung of Streptozotocin Induced Diabetic Rats

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Keywords:
Diabetes mellitus,
lung,
zinc,
rat.

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Abstract: Diabetes mellitus is an endocrine and metabolic disease that affects almost every organ of the body. The lung is a target organ for diabetic microangiopathy. Hyperglycemia causes physiologically important losses of Zn from body. Zn may improve glycemia and helping to prevent complications associated with diabetes. The present study was undertaken in order to evaluate the effect of Zn in lung tissues of streptozotocin-induced diabetic rats. Female Swiss albino rats were divided into 4 groups. Group I, control; Group II, control + zinc sulfate; Group III, STZ-diabetic; Group IV, diabetic + zinc sulfate. Diabetes was induced by intraperitoneal injection of STZ (65 mg/kg body weight). Zinc sulfate was given daily by gavage at a dose of 100 mg/kg body weight every day for 60 days to groups II and IV. At the last day of the experiment, rats were sacrificed and lung tissues were taken. Lung glutathione levels and glutathione peroxidase and aryl esterase activities were decreased, while lipid peroxidation levels, catalase, superoxide dismutase, myeloperoxidase and adenosine desaminase activities were increased in diabetic group. Treatment with Zn reversed these effects. In conclusion, the present study shows that zinc has a protective effect against diabetes-induced lung damage by downregulating oxidative stress.

Sažetak

Diabetes mellitus je endokrina I metabolitička bolest koja zahvata gotovo svaki organ ljudskog tijela. Pluća predstavljaju glavni organ zahvaćen diabetičkom microangiopatijom. Hiperglikemija uzrokuje fiziološki važne gubitke Zn iz tijela. Zn može poboljšati glikemiju I pomoći u prevenciji komplikacija povezanih sa dijabetesom. Cilj ovog rada je bio evaluacija efekata Zn u plućnom tkivu streptozotocin-induciranih dijabetičnih štakora. Ženke Švicarskih albino štakora su podijeljene u 4 grupe. Grupa I – kontrola; grupa II –kontrola+ cink sulfat; grupa III – STZ dijabetični štakori; grupa IV – dijabetični štakori+cink sulfat. Dijabetes je indiciran STZ intraperitonealnom injekcijom (65 mg/kg tjelesne težine). Cink sulfat je indiciran dnevno u dozi od 100 mg/kg tjelesne težine u period od 60 dana grupama II I IV. Zadnjeg dana eksperimenta, uzeti su uzorci pluća životinja. Nivoi aktivnosti glutationa u plućima, glutatoin peroksidaze I aril esterase su se smanjili dok su nivoi aktivnosti lipidne peroksidacije, katalze, superoksid dizmutase, mieloperoksidaze I adenozin desaminaze povećali u diajbetičnim grupama. Tretman sa Zn je obrnuo ove uticaje. Ova studija je pokazala da cink pokazuje protektivni uticaj kod oštećenja pluća nastalih dijabetesom regulacijom oksidativnog stresa.

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Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-09

Quantification of Proline in Honey Using HPLC–ED

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Keywords:
amino acid
imino acid
proline
honey
HPLC – ED
chromatography

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Abstract: : Proline is a cyclic aliphatic amino acid (AA), one of the major components of collagen, which is the predominant protein of bone, cartilage and connective tissue in the human body. Reduced levels of this AA have been observed in some athletes, especially in runners. It is known that honey is one of many natural nutrients, which has a big contribution to health. These contributions, are also due to free AAs, among which proline is the most common. The aim of this study was to quantify proline in different types of honey from Bosnia and Herzegovina using the high performance liquid chromatography with electrochemical detection (HPLC-ED). For the calculation of proline, the equation of calibration curve was used: integrated area peak = $f[\text{proline}]_{\text{standard solution}}$. The mobile phase was EDTA, methanol, acetic acid, sodium acetate and water. Experimental parameters of the instrument were: range 50 nA, working potential +0.75 V, filter 0.02 Hz, mobile phase flow rate 1 mL/min, column ODS Hypersil 5 μm, 250x4.6 mm, Phenomenex. 43 samples of honey were analysed. The highest content of proline was in meadow honey (6.02 mg/100 g) and the lowest was in honey from linden (0.70 mg/100 g).

Sažetak

Prolin je ciklična alifatska aminokiselina (AK), jedna od glavnih gradivnih komponenti kolagena, kao najzastupljenijeg proteina kostiju, hrskavice i vezivnog tkiva ljudskog organizma. Sniženi nivoi ove AK uočeni su kod nekih sportista, a posebno kod maratonaca. Poznato je da se pčelinji med ubraja u prirodni nutrijent sa brojnim doprinosima za zdravlje. Ti doprinosi su, pored ostalog, zahvaljujući sadržaju slobodnih AK, od kojih je prolin najzastupljenija. Ovo istraživanje imalo je za cilj da se primjenom metode tečne hromatografije visoke efikasnosti, uz elektrohemijsku detekciju (HPLC–ED), odredi sadržaj prolina u različitim vrstama meda sa prostora Bosne i Hercegovine. Za izračunavanje sadržaja prolina korištena je jednačina kalibracionog pravca: površina integrala pika = $f[\text{prolin}]_{\text{standarda otopina}}$. Mobilna faza je bila EDTA, acetatna kiselina, metanol, natrij-acetat i voda. Eksperimentalni uslovi metode bili su: range 50 nA, radni potencijal +0,75 V, filter 0,02 Hz, brzina protoka mobilne faze 1 mL/min, kolona ODS Hypersil 5 μm; 250x4,6 mm, Phenomenex. Analizirana su 43 uzorka meda. Najviše prolina zastupljeno je u livadskom medu (6,02 mg/100 g), a najmanje u medu od lipe (0,70 mg/100 g).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-10

Identification of Proline in Honey Using HPLC-ED Method

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Keywords:
Proline
Honey
HPLC-ED
Amino acid

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Abstract: Proline is a hydrophobic amino acid with an aliphatic cyclic structure in side chain. It is not an essential amino acid in the organism, but it is an important component of collagen. Proline is the most dominant amino acid in honey, used for the determination of its quality. The aim of this work was to identify proline in samples of different types of natural bee honey and from different locations using high-performance liquid chromatography with electrochemical detection (HPLC-ED). The investigation was performed with 43 honey samples. Three different mobile phases at working potential of 750 mV were used for optimization of the method. The working potential was optimized in the interval 350 – 850 mV. The mobile phase composed of EDTA (372 mg/L):sodium acetate (13.61 g/L):methanol (50%, 63.3 ml/L): concentrated acetic acid (7.9 ml/L) was chosen as the most appropriate for the assay. The other experimental conditions were: working potential of 750 mV, mobile phase flow rate 1.00 ml/min, range 50 nA, filter 0.02 Hz, column ODS Hypersil 5 μm; 250x4.6 mm, Phenomenex. Retention time for the detection of proline at these conditions in the samples was 5.80±0.17 min, and 5.89±0.10 min for the standard of proline.

Sažetak

Prolin je hidrofobna aminokiselina sa alifatskom cikličnom strukturom u bočnom lancu. Nije esencijalna aminokiselina, ali je važan sastojak kolagena. Prolin je najdominantnija aminokiselina u medu i koristi se za određivanje njegovog kvaliteta. Cilj ovog rada je identifikacija prolina u uzorcima prirodnog pčelinjeg meda različitih vrsta i sa različitih lokacija metodom tečne hromatografije visoke efikasnosti uz elektrohemijski detektor (HPLC-ED). Analiza je vršena na 43 uzorka meda. Za optimizaciju metode korištene su tri različite mobilne faze pri radnom potencijalu od 750 mV. Radni potencijal je optimiziran u intervalu 350-850 mV. Mobilna faza sastava EDTA (372 mg/L):natrijum-acetat (13,61 g/L):metanol (50%, 63,3 ml/L):koncentrirana acetatna kiselina (7,9 ml/L) pokazala se kao najprikladnija za ovu vrstu detekcije. Ostali radni uslovi bili su: radni potencijal 750 mV, brzina protoka mobilne faze 1,00 ml/min, range: 50 nA, filter: 0,02 Hz, kolona: ODS Hypersil 5 μm; 250x4,6 mm, Phenomenex. Pri navedenim uslovima dobijeno je da se prolin detektuje u uzorcima pri retencionom vremenu 5,80±0,17 min, te pri 5,89±0,10 min. kao standard.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-11

Fluorimetric Determination of Thiamine in Baby Cereal Food

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Keywords:
baby cereal-based food,
grains,
fortification, thiamin,
fluorimetric thiochrome method

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Abstract: Grains are used as processed products and therefore have a lower nutritional content. Fortification of the products is a useful procedure which increases the daily intake of vitamin B group. Thiamine is crucial in intercellular glucose metabolism and essential for normal growth and development, helps to maintain proper functioning of the heart, nervous and digestive systems. Thiamine content was determined in twelve, commercially available, baby cereal food using fluorimetric method. Combination of acid digestion and enzymatic degradation released vitamin bound to protein. Samples were hydrolyzed with 0.1 M sulfuric acid (H_2SO_4) at 105-110°C to break protein complexes and effectively liberate thiamin. Phosphorylated thiamin esters were converted to a free thiamin using enzyme clarase. The digest was incubated at 45°C for 60 min and filtrated. An aliquot of extract was oxidized with 1% potassium ferrycyanide in 15% sodium hydroxide to form highly fluorescent thiochrome. Thiochrome was extracted with isobutanol and the fluorescence was measured at excitation and emission wavelengths of 375 nm and 430 nm, respectively. Total thiamin content in 12 baby cereal food samples, analyzed with fluorimetric thiochrome method, varied from 0,59 mg/100 g to 1,87 mg/100 g. Free thiamine content varied from 0,32-1,73 mg/100 g. Content of thiamin diphosphate made up 4,84-51,26 % of total thiamin.

Sažetak

Upotreba prerađenih žitarica za posljedicu ima nižu nutritivnu vrijednost prehrambenih proizvoda. Fortifikacija takvih proizvoda je korisna procedura kojom se povećava dnevni unos vitamina B grupe. Tiamin je važan u interćelijskom metabolizmu glukoze i esencijalan za normalan rast i razvoj, a pomože održavanje pravilnog funkcionisanja srca, nervnog i probavnog sistema. Fluorimetrijskom metodom je određivan sadržaj tiamina u dvanaest komercijalno dostupnih uzoraka dječije hrane na bazi žitarica. Kombinacijom kiselinske i enzimske hidrolize oslobađa se za proteine vezani tiamin, kao i tiamin iz fosfatnih formi. Hidroliza sa 0,1 M H_2SO_4 kiselinom pri 105-110°C kida proteinske komplekse, čime se oslobađa tiamin. Enzim klaraza je korišten za prevođenje fosfatiranih tiaminskih formi u slobodan tiamin, inkubacijom na 45°C, u trajanju od 60 minuta. Nakon filtracije, ekstrakt uzorka se oksidira sa 1% kalijheksacijanoferatom u 15%-oj vodenoj otopini NaOH, čime se formira visoko fluorescirajući tiohrom. Tiohrom se ekstrahuje sa izobutanolom i potom se mjeri intenzitet fluorescencije pri talasnoj dužini ekscitacije od 375 nm i talasnoj dužini emisije od 430 nm. Sadržaj ukupnog tiamina u uzorcima dječije hrane na bazi žitarica, koji su analizirani tiohrom metodom, bio je u intervalu od 0,59 mg/100 g do 1,87 mg/100 g, dok je interval za slobodni tiamin iznosio 0,32-1,73 mg/100 g. Sadržaj tiamin difosfata čini od 4,84-51,26% ukupnog tiamina.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-12

Levels of Erythropoietin in Patients with Varying Degrees of Renal Insufficiency and Anemia

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Keywords:
erythropoietin,
renal insufficiency,
anemia,
creatinine clearance,
hemoglobin

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Abstract: Chronic renal insufficiency leads to hyporegenerative anemia due to the lack of erythropoietin (Epo). In order to determine the value of Epo in patients with various kidney diseases, research was conducted on 300 patients with varying degrees of renal impairment in the Nephrology Department and Nephrology counseling center. These subjects were divided into four groups according to the degree of renal impairment. For these studies, human urine, serum and whole blood samples were used. Creatinine clearance (CC) and hemoglobin (Hb) were also measured. To obtain the reference group, 109 healthy subjects were sampled as well. Epo was determined by the chemiluminescent enzyme immunometric method of solid phase by IMMULITE/IMMULITE 1000 from Siemens. The concentration of Hb was determined by a blood cell counter (Abbott Cell Dyn 3700 system), which uses a modified hemoglobin-cyanide or hemoglobin-hydroxylamine colorimetric method. CC was determined by the kinetic method based on the Jaffe reaction using auto-analyzer Dimension RxL from Siemens. The results show that the determinations of Epo, CC, and Hb are good laboratory indicators of renal insufficiency and anemia.

Sažetak

Hronična renalna insuficijencija dovodi do hiporegenerativne anemije zbog nedostatka eritropoetina (Epo). Da bi se utvrdile vrijednosti Epo kod oboljelih od različitih bubrežnih oboljenja sprovedeno je ispitivanje na 300 osoba sa različitim stepenom bubrežnog oštećenja sa nefrološkog odjeljenja i nefrološkog savjetovališta. Ovi ispitanici su podijeljeni u četiri grupe prema stepenu bubrežnog oštećenja. Za ova ispitivanja korišteni su humani uzorci i to: urin, serum i puna krv. Određivane su i vrijednosti klirensa kreatinina (KK) i hemoglobina (Hb). Za dobijanje referentne grupe uzeti su uzorci 109 zdravih ispitanika. Epo je određivan enzimatsko-kemiluminiscentnom imunometrijskom metodom na čvrstoj fazi na IMMULITE/IMMULITE 1000 kompanije Siemens. Za određivanje koncentracije Hb koristio se brojač krvnih elemenata (Abbott Cell Dyn 3700 system), koji koristi modificiranu hemiglobin-cijanidnu ili hemiglobin-hidroksilaminsku kolorimetrijsku metodu. KK je određivan kinetičkom metodom na bazi Jaffeove reakcije na autoanalizatoru Dimension RxL kompanije Siemens. Dobiveni rezultati pokazuju da su određivanja Epo, KK i Hb dobri laboratorijski pokazatelji renalne insuficijencije i anemije.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-13

Isolation, amplification and profiling DNA from blood stains treated with different reagents

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Keywords:
Profiling DNA,
blood stains,
reagents,
DNA degradation,
Identification.

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Abstract: In these modern times, forensic analysis and establishment identity of the person - used for various purposes, is unimaginable without DNA profiling. The aim of this paper was to examine the influence of different types of agents-which in realistic cases can be found on the place of biological trace discovery-in the aspects of isolation, amplification and DNA profiling. The biological trace used in this research was a blood smear applied on filter paper and treated with the following agents: : 0,1 M NaOH, 50 % CH_3COOH, olive oil, detergent and gasoline. The samples were situated in a laboratory for 10 days, on the temperature of 20°C. DNA isolation was performed by *Miller's salting out procedure*, quantification with gel electrophoresis, and the amplification with the *PowerPlex®16 System* commercial kit. Detection was made by *ABI PRISM® 310* genetic analyzer which is based on the capillary electrophoresis, combined with *310 Collecting Data Software.* The samples of the former treatment were compared to the undisputed buccal mucus sample. The sample treated with 0,1 M NaOH gave a complete DNA profile, expected because of the fact that pH=13 makes DNA resistant to hydrolysis. Remaining four treated samples gave partial DNK profiles, and the sample treated with detergent also gave a mixed profile which pointed to DNA degradation, contamination or some other interaction of the used agents with DNA. We can conclude that, based on the results, the sample treated with 0,1 M NaOH can be undeniably used for identification, while the other samples need to be combined with other evidence.

Sažetak

Forenzička analiza i utvrđivanje identiteta osobe, u različite svrhe, u današnje vrijeme je nezamislivo bez DNK profiliranja. Cilj ovog rada je bio ispitati utjecaj različitih vrsta agenasa, koji se u realnim slučajevima mogu naći na mjestu pronalaska biološkog traga, na izolaciju, amplifikaciju i profiliranje DNK. Kao biološki trag korištena je krvna mrlja nanešena na filter papir i tretirana sljedećim agensima : 0,1 M NaOH, 50 % CH_3COOH, maslinovim uljem, deterdžentom i benzinom. Uzorci su smješteni u laboratorij i čuvani 10 dana, na 20°C. Izolacija DNA je izvršena *Millerovim postupkom isoljavanja*, kvantifikacija postupkom gel elektroforeze, a amplifikacija pomoću PowerPlex®16 komercijalnog kita. Detekcija je vršena pomoću *ABI PRISM® 310* genetičkog analizatora koji se zasniva na principu kapilarne elektroforeze, u kombinaciji sa *310 Collecting Data Software.* Uzorci su uspoređivani sa nespornim uzorkom brisa bukalne sluznice. U ovisnosti od korištenog reagensa dobiveni su i različiti rezultati. Uzorak tretiran 0,1 M NaOH dao je potpun DNK profil, što se i očekivalo zbog činjenice da je pri datom pH DNK otporna na hidrolizu. Preostala četiri tretirana uzorka dala su parcijalne DNK profile, a kod uzorka tretiranog deterdžentom dobijen je i mješani profil što ukazuje na degradaciju DNK, kontaminaciju ili eventualno neku drugu interakciju korištenih agenasa sa DNK. Na osnovu dobivenih rezultata moglo bi se zaključiti da se uzorak tretiran sa 0,1 M NaOH nedvojbeno može iskoristiti za identifikaciju, dok se preostala četiri uzorka mogu upotrijebiti tek u kombinaciji sa drugim dokaznim materijalom.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-14

GC-MS analysis of sertraline in human urine

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Keywords:
Sertraline,
Gas Chromatography-Mass Spectrometry;
Liquid-Liquid Extraction;
Solid-Phase Extraction.

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Abstract: Sertraline (Zoloft) is a selective serotonin reuptake inhibitor that is a commonly prescribed drug for the treatment of depression, as well as obsessive-compulsive disorder, panic disorder, social anxiety disorder, premenstrual dysphoric disorder, and post-traumatic stress disorder. A gas chromatographic-mass spectrometric (GC-MS) method was developed for detection of sertraline in urine. Liquid-liquid and solid phase extraction were applied to urine samples using methadon as an internal standard (IS). The GC-MS analysis were carried out using HP-5MS capillary column. The linearity ranges of the method were 0,025-2,0 mg/L for both LLE and SPE. The detection limits were achieved under 0,097 mg/L. The range of recoveries were 75-110% by LLE and 71-116% by SPE for analyte. The GC-MS method developed for detection of sertraline in urine appears to be very precise, it shows good linearity and a wide range of detection. The developed method allowed clinical and toxicological analysis of sertraline in urine samples. With this method it is possible to determine the presence of antidepressants and other psychoactive substances at the same time.

Sažetak

Sertralin (Zoloft) je selektivni inhibitor povrata serotonina koji se često koristi za liječenje depresije, opsesivno kompulzivnih poremećaja, paničnih napada, kod poremećaja socijalne anksioznosti i PTSP-a. Za detekciju sertralina je razvijena GC-MS metoda. Tečno-tečno ekstrakcija (LLE) i ekstrakcija na čvrstoj fazi (SPE) su korištene u pripremanju uzoraka urina, koristeći metadon kao interni standard. Za GC-MS analize korištena je P-5MS kapilarna kolona. Linearnost metode je bila u području 0,025-2,0 mg/L za tečno-tečnu ekstrakciju kao i za ekstrakciju na čvrstom nosaču . Limit detekcije je bio ispod 0,097 mg/L. Efikasnost ekstrakcije za analit je bila 75-110% za LLE i 71-116% za SPE. GC-MS metoda razvijena za detekciju sertralina u urinu je veoma precizna, pokazuje dobru linearnost i širok raspon određivanja. Razvijena metoda je uspješno korištena za kliničke i toksikološke analize sertralina u uzorcima urina. Pokazalo se da je metoda primjenjiva za istovremeno određivanje antidepresiva i drugih psihoaktivnih supstanci.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-15

Antioxidant Activity of *Ornithogalum sigmoideum* Frey et Sint.

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Keywords:
Antioxidant activity,
Ornithogalum sigmoideum.

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Abstract: *Ornithogalum sigmoideum* Frey et Sint. is nature to Balkan Peninsula, Caucasus, Turkey and northern Iran. This plant is widely used in Black Sea region of Turkey for consumption in the daily diet. Moreover, it is used as an antiinflammatory and anticancer agent and might help improve liver and immune system functions in people with hepatitis. In the present study, different antioxidant tests were employed in order to evaluate the antioxidant activities of water, ethanol, and acetone extracts of *O. sigmoideum*, namely, reducing power, free radical scavenging (DPPH), hydroxyl radical scavenging, ABTS radical scavenging, metal chelating activities. The results were compared with natural and synthetic antioxidants, e.g. α-tocopherol, butylated hydroxyanisole, butylated hydroxytoluene. The level of total phenolics and total flavonoids of the extracts were also determined. It was found that antioxidant activity increased with increased concentrations of the extracts. It can be concluded that because of the highest antioxidant activity of acetone extract, which was rich in flavonoids, there could be a relation between flavonoids and antioxidant activity. This study showed that *O. sigmoideum* extracts exhibited antioxidant activity in all tests and that the extracts could be considered as a source of natural antioxidants.

Sažetak

Ornithogalum sigmoideum Frey et Sint. je rasprostranjen na Balkanskom poluotoku, Kavkazu, Turskoj i sjevernom Iranu. Ova biljka se naširoko koristi u crnomorskoj regiji Turske u svakodnevnoj prehrani. Nadalje, koristi se kao antiupalni i antikancerogni agens i može da potpomogne poboljšanju funkcije jetre i imunog sistema kod ljudi koji boluju od hepatitisa. U ovom radu, upotrijebljeni su različiti antioksidativni testovi s ciljem da se ocjeni antioksidativna aktivnost vodenog, etanolskog i acetonskog ekstrakta *O. sigmoideum,* tj. redukcijska moć, istiskivanje slobodnih radikala (DPPH), istiskivanje hidroksil radikala, istiskivanje ABTS radikala i metal helatne aktivnosti. Rezultati su upoređeni sa prirodnim i sintetskim antioksidansima, npr. α-tokoferol, butilirani hidroksianisol, butilirani hidroksitoluen. Također su utvrđeni ukupni fenoli i ukupni flavonoidi u ekstraktima. Nađeno je da se antioksidativna aktivnost povećava s povećanjem koncentracije u ekstrakatima. Može se zaključiti da zbog najveće antioksidativne aktivnosti acetonskog ekstrakta, koji je bogat flavonoidima, može postojati veza između flavonoida i antioksidativne aktivnosti. Ovo istraživanje je pokazalo da su *O. sigmoideum* ekstrakti pokazali antioksidativnu aktivnost u svim testovima i da se ekstrakti mogu uzeti u obzir kao izvori prirodnih antioksidansa.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-16

Antioxidant Activity of Phytoestrogens

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Keywords:
Antioxidant activity,
Phytoestrogens,
Phloretin,
Phloridzin.

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Abstract: Phytoestrogens are a group of compounds that display estrogen like properties. Phloretin is a type of flavonoid that has beneficial anticancer properties and primarily derived from various species of apple leaves. It is commonly used as a new type of whitening agent in cosmetics. Phloridzin belongs to the chemical dihydrophenylpropanoids with structures closely related to those of the immediate flavonoid precursors, the calcones. Phloridzin and its derivatives have been widely used in medicine and for physiological studies on biological membranes. Antioxidants are natural molecules important for life because they that help protect the body from harmful free radicals. Due to these facts, most of scientific research is based on antioxidants. In the present study, we have established the antioxidant activities of phloridzin and phloretin which are phytoestrogens used in menopausal symptoms, cardiovascular diseases, prostate cancers, diabetes and other various diseases. These tests used for antioxidant activity are; reducing power, DPPH radical scavenging, ABTS radical scavenging, DMPD radical scavenging activities and Cuprac test. The results were compared to natural and synthetic antioxidants. It was found that antioxidant activity increased with increased concentrations of phloretin and phloridzin. It was determined that both phloridzin and phloretin show antioxidant activity in all tests. For reason, these two products could also be used an antioxidants.

Sažetak

Fitoestrogeni su grupa jedinjenja koja pokazuju ponasanje slicno etrogenima. Floretin je vrsta falonoida koji ima antikancer osobine I koji se dobiva iz lišća različitih vrsta jabuka. Često se koristi I kao sredstvo za bijeljenje u kozmetici. Floridizn pripada dihidrofenilpropanoidima sa strukturom koja odgovara flavonoidnim prekursorima, kalconima. Floridzin I njegovi derivati se jako koriste u medicine I za fiziološke studije na biološkim membranama. Antioksidansi su prirodne molekule važne za život zbog toga što štite tijelo od štetnih slobodnih radikala. Zbog toga je veliki broj naučnih istraživanja baziran na antioksidansima. U ovom radu smo odredili antioksidativne aktivnosti floridizina I floretina, fitoestrogena, koji se koriste za prevenciju simptoma menopause, kardiovaskularnih oboljenja, tretmanu kancera prostate, dijabetesa I drugih oboljenja. Testovi korišteni za određivanje antiokditaivne aktivnosti su bili; stepen redukcije, DPPH inhibicija radikala, ABTS inhibicija radikala, DMPD rinhibicija radikal I Cuprac test. Rezultati su upoređeni sa prirodnim I sintetskim antioksidansima. Utvrđeno je da se antioksidativna aktivnost povećava sa povećanjem koncentracije floretina I floridzina. Utvrđeno je da floridzin I floretin pokazuju antioksidativnu aktivnost u svim testovima. Zbog toga se oba ova produkta mogu koristiti kao antioksidansi.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-17

Spectrophotometric determination of total phenolics and total flavonoids contents in extracts of different *Ephedra* species

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Keywords:
Ephedra,
phenolics,
flavonoids,
spectrophotometry

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Abstract: Abstract: Extracts of *Ephedra*, an evergreen shrub-like plant, have been used in traditional medicine to treat conditions such as colds, asthma and nasal congestion. Phenolic compounds and flavonoids as their subgroup represent aromatic secondary metabolites in plants and include a diverse group of molecules that are essential for their growth, reproduction and defense against pathogens. Considerable attention has been drawn to their potentially preventive role in human chronic diseases and antioxidant activity. The aim of this study was to determine the content of total phenolics and total flavonoids in herb extracts of different *Ephedra* species. The total phenolics content was determined spectrophotometrically using the Folin-Ciocalteu reagent. Gallic acid was used as a standard. Analyses were performed in cold water extracts and in water-organic solvent mixture (methanol-water-acetic acid) extracts. The total flavonoids content was also determined spectrophotometrically using the aluminium chloride method in water-organic solvent extracts only. Quercetin was used as standard. Results showed that the total phenolics content was higher in water-organic solvent extracts and there the values ranged between 6.8 mg GAE/$g_{dry\ weight\ (d.w.)}$ and 31.3 mg GAE/$g_{d.w.}$. The total flavonoids content in the species of interest varied between 0.5 mg QE/$g_{d.w.}$ and 2.1 mg QE/ $g_{d.w.}$.

Sažetak

Ekstrakti efedre, zimzelene biljke nalik na grm, koristili su se u tradicionalnoj medicini za stanja kao što su prehlade, astma i nazalne kongestije. Fenolni spojevi i flavonoidi kao njihova podgrupa predstavljaju sekundarne aromatske metabolite biljaka i obuhvataju raznovrsnu grupu molekula značajnih za njihov razvoj, reprodukciju i zaštitu od patogena. Značajna pažnja je poklonjena njihovoj potencijalno preventivnoj ulozi u hroničnim oboljenjima kod ljudi, te antioksidativnoj aktivnosti. Cilj ovog rada je bio odrediti sadržaj ukupnih fenola i ukupnih flavonoida u ekstraktima herbe različitih *Ephedra* vrsta. Sadržaj ukupnih fenola određen je spektrofotometrijskom metodom upotrebom Folin-Ciocalteau reagensa i galne kiseline kao standarda. Analize su izvedene u hladnim vodenim ekstraktima i ekstraktima iz smjese voda-organsko otapalo (metanol-voda-acetatna kiselina). Sadržaj ukupnih flavonoida (samo u ekstraktima iz smjese voda-organsko otapalo) također je određen spektrofotometrijski upotrebom metode sa aluminij hloridom i kvercetina kao standarda. Rezultati su pokazali da je sadržaj ukupnih fenola bio viši u ekstraktima iz smjese voda-organsko otapalo (6.8-31.3 mg GAE/$g_{suhe\ droge\ (s.d.)}$. Sadržaj ukupnih flavonoida u vrstama od interesa varirao je u intervalu 0.5-2.1 mg QE/$g_{s.d.}$.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-18

Production of phenylpropanoids and naphtodianthrones in callus cultures of *Hypericum perforatum* L. elicited with dextran

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Keywords:
callus cultures,
dextran,
Hypericum perforatum L.,
naphtodianthrones,
phenylpropanoids.

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Abstract: *Hypericum perforatum* L. callus cultures were evaluated for their growth, antioxidant potential and ability to produce phenylpropanoids (phenolics, flavonoids, flavanols and anthocyanins) and naphtodiantrones (hypericin and pseudohypericin) after elicitation with different dextran concentrations (50-200 mg/L). Non-enzymatic antioxidant properties (NEAOP) and specific activity of antioxidant enzymes such as peroxidase (POD) and catalase (CAT) were observed in callus culture extracts. The activities of two key enzymes of the phenylpropanoid/flavonoid pathways, phenylalanine ammonia lyase (PAL) and chalcone isomerase (CHI) were also monitored to estimate channeling in the different metabolic pathways. Treatment with dextran did not affect the growth of *H. perforatum* calli after 21 day of elicitation. Exogenously applied dextran induced NEAOP, POD and CAT activities in treated calli suggesting a strong perturbation of the cell redox system leading to the activation of defense responses. The elevated activities of PAL and CHI confirmed an efficient activation of the phenylpropanoid/flavonoid pathway. Furthermore, naphtodianthrone and phenylpropanoid productions were globally stimulated upon elicitation with all tested concentrations of dextran. Therefore, dextran application seems to be a promising approach for enhancement of secondary metabolite productions in callus cultures and can also be used to further extend other plant culture models.

Sažetak

Hypericum perforatum L. callus kulturama je ispitivan rast i razvoj, antioksidativni potencijal i sposobnost proizvodnje fenilpropanoida (fenola, flavonoida, flavanola i antocijanina) i naftodiantrona (hipericina i pseudohipericina) nakon elicitacije sa različitim koncentracijama dekstrana (50-200 mg/L). Ne-enzimatske antioksidativne osobine (NEAOP) I specifična aktivnost antioksidativnih enzima kao što su peroksidaze (POD) I katalaze (CAT) su praćene u ekstraktima callus kultura. Aktivnosti dva ključna enzima fenilpropanoidnog/flavonoidnog reakcionog puta, fenilalanine amonij liaze (PAL) I kalkon izomeraze (CHI) su također praćene u cilju procjene kanalisanja u različitim metabolitičkim procesima.

Tretman sa dekstranom nije uticao na rast *H. perforatum* calli nakon 21 dana od elicitacije. Egzogeno primjenjeni dekstran je inducirao NEAOP, POD I CAT aktivnosti u calli ukazujući na jaku perturbaciju ćelijskog redoks sistema koja dovodi do aktivacije mehaniyma ćelijske odbrane. Povišene aktivnosti PAL I CHI su potvrdile efikasnu aktivaciju fenilpropanoidnog/flavonoidnog reakciong puta. Također, proizvodnja naftodiantrona I fenilpropanoida su jako stimulirane nakon elicitacije sa svim testnim koncentracijama dekstrana. Zbog toga , primjena dekstrana predstavlja obećavajući pristup za poboljšanje proizvodnje sekundarnih metabolite u callus kulturama I može se koristiti za primjenu na druge kulture biljnih modela.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BB-19

Acetylcholinesterase and butyrylcholinesterase inhibitory activity of extracts from medicinal plants

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Keywords:
acetylcholinesterase inhibition,
butyrylcholinesterase inhibition,
medicinal plants

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Abstract: Inhibition of acetylcholinesterase (AChE) and butyrylcholinesterase (BChE), enzymes which breakdown acetylcholine and butyrylcholine, are considered as a promising strategy for the treatment of Alzheimer's disease (AD). Alzheimer's disease is chronic neurological disorder characterized by memory impairment, cognitive dysfunction and behavioral disturbances. A potential source of AChE and BChE inhibitors is provided by the abundance of plants in nature. In the present study, we selected five plants used in traditional medicine to treat different disorders of the central nervous system. Aqueous and methanolic extracts of sage (*Salvia officinalis* L.), arnica (*Arnica montana* L.), rue (*Ruta graveolens* L.), St John's wort (Hypericum perforatum L.) and aronia (Aronia melanocarpa (Michx.) Elliot.) were tested for the AChE and BChE inhibitory activity using Ellman's colorimetric method. Galanthamine hydrobromide was used as positive control. The results show that exstracts from the aeiral parts of St John's wort, sage, and rue and flowers of arnica could inhibit the activity of AChE or BChE or both. The best inhibition effect was observed using the methanolic extracts of St John's wort and arnica at concentration of 400 μg mL^{-1}.

Sažetak

Inhibicija enzima koji razgrađuju acetilkolin, acetilkolinesteraze (AChE) i butirilkolinesteraze (BChE), smatra se obećavajućom strategijom za liječenje Alzheimerove bolesti (AD). Alzheimerova bolest je kronični neurološki poremećaj koji se očituje u smanjenju pamćenja, kognitivne disfunkcije i poremećajem ponašanja. Obilje biljaka u prirodi pruža potencijalni izvor inhibitora za AChE i BChE. U ovom istraživanju odabrali smo pet biljaka koje se koriste u tradicionalnoj medicini za liječenje različitih poremećaja središnjeg živčanog sustava. Pomoću Ellmanove kolorimetrijske metode testiran je inhibicijski učinak vodenih i metanolnih ekstrakata kadulje (Salvia officinalis L.), arnike (Arnica montana L.), rute (Ruta graveolens L.), gospine trave (Hypericum perforatum L.) i aronije (Aronia melanocarpa (Michx.) Elliot.) na AChE i BChE. Kao pozitivna kontrola korišten je galntamin hidrobromid. Rezultati ukazuju da ekstrakti nadzemnih dijelova gospine trave, kadulje i rute i cvjetova arnike mogu inhibirati aktivnost AChE ili BChE, ili oboje. Najjači inhibicijski učinak uočen je kod metanolnih ekstrakata gospine trave i arnike pri koncentraciji od 400 μg mL^{-1}.

POSTER PRESENTATIONS

Inorganic Chemistry

(IC)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-01

Dioxomolybdenum(VI) complexes of 3,5-dichlorosalicylidene-S-butyl-thiosemicarbazone

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Keywords:
Thiosemicarbazone
cis-dioxomolybdenum(VI)
Structure analysis

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Abstract: Thiosemicarbazones have been of great importance because of their biological activity. In recent years, many papers were published about structural properties and biological activity of metal complexes of thiosemicarbazone derivatives. However, studies of the thiosemicarbazone complexes with molybdenum as oligo element are in a relatively little number, and solvated molybdenum(VI) complexes of thiosemicarbazones, which are a special class of molybdenum chelates, are very limited. Various molybdenum complexes are essential in enzymes such as nitrogenase, sulfite, and xanthine oxidases, and even some of the molybdenum compounds are included in excellent enzyme model systems. In addition, it is known that some molybdenum compounds catalyze the oxygen atom transfer mechanisms.

Here in, two new dioxomolybdenum(VI) complexes were prepared with the reaction of dioxomolybdenum (VI) acetyl acetonate and 3,5-dichlorosalicylaldehyde-4-ethyl-S-butyl thiosemicarbazone in ethanol or pyridine. The solid complexes were characterized by elemental analysis and spectroscopic methods.

Sažetak

Tiosemikarbazoni su od velikog značaja zbog svoje biološke aktivnosti. Poslednjih godina, objavljeni su mnogi radovi o strukturnim svojstvima i biološkoj aktivnosti metalnih kompleksa derivata tiosemikarbazona. Međutim, ograničen je broj studija koje se bave kompleksima tiosemicarbazona sa molibdenom kao oligo elemenatom i solvatiranim kompleksima molibden (VI) tiosemikarbazona, koji su posebna klasa helata molibdena, Različiti kompleksi molibdena su od suštinskog značaja u enzimima: nitrogenaza, sulfit i ksantin oksidaze, a neki su kompleksi molibdena uključeni u sisteme prvoklasnih enzimskih modela. Osim toga, poznato je da neki spojevi molibdena kataliziraju mehanizme prijenosa atoma oksigena. Pripremljena su dva nova dioksomolibden (VI) kompleksa reakcijom dioksomolibden (VI) acetilacetonata i 3,5-dihlorosalicilaldehyd-4-etil-S-butiltiosemickarbazona u etanolu ili piridinu. Čvrsti kompleksi su karakterizirani elementarnom analizom i spektroskopskim metodama.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-02

3-ethoxysalicylaldehyde-4-ethyl-S-methyl-thiosemicarbazone and its Dioxomolybdenum(VI) complexes

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Keywords:
Thiosemicarbazone
S-methyl ester
Dioxomolybdenum(VI)

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Abstract: The chemistry of thiosemicarbazones, mixed ligands, has attracted considerable interest primarily due to their biological activities. Those activities have been correlated with their metal-chelating abilities and reductive capacity. Also, such complexes are considered important because of their potential antibacterial, antiviral and antitumor activities. *cis*-dioxomolybdenum cation is present in the oxidized form of certain oxotransferase enzymes like xanthine oxidase/dehydrogenase, DMSO reductase, etc. This has created a tremendous impetus in synthesis of a number of model complexes mimicking the oxotransferase molybdoenzymes.
In this study, 2 new solvate dioxomolybdenum(VI) complexes were obtained with the reaction of dioxomolybdenum(VI) acetyl acetonate and 3-ethoxysalicylaldehyde-4-ethyl-S-methyl thiosemicarbazone with the use of as second ligand methanol or ethanol by known methods. Characterization of the compounds was explained by elemental analysis, IR, ^{1}H-NMR and UV-VIS spectroscopy methods.

Sažetak

Hemija tiosemikarbazona s mješovitim ligandima, privukla je značajan interes, prije svega zbog njihove biološke aktivnosti. Ove aktivnosti su u korelaciji sa njihovim sposobnostima za metal-helaciju i reduktivni kapacitet. Također, kao kompleksi smatraju se važnim zbog njihove potencijalne antibakterijske, antivirusne i antitumorske aktivnosti. Kation cis-dioksomolibdena prisutan je u oksidiranoj formi izvjesnih enzima oksotransferaze kao što su ksantin oksidaza/dehidrogenaza, DMSO reduktaza, itd. Ovo je potaklo sintezu brojnih modela kompleksa koje oponašaju moliboenzime oksotransferaze. Poznatom metodom dobijena su dva nova solvatirana kompleksa dioksomolibdena (VI) reakcijom dioksomolibden (VI) acetilacetonata i 3-etoksisalicilaldehid-4-etil-S-metiltiosemikarbazona uz upotrebu metanola ili etanola kao drugog liganda. Karakterizacija spojeva je objašnjena elementarnom analizom, IR, 1H-NMR i UV-VIS spektroskopskim metodama.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-03

Development of a New Amperometric Sensor for Dopamine Based on the Carbon Electrode Modified with Ru(III) Complex

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Keywords:
Ru(III) complexes,
Schiff Bases,
Dopamine,
Modified electrode,
Carbon ink,
Amperometry

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Abstract: Dopamine is one of the most important neurotransmitters controlling the motor activity, autonomic and endocrine functions as well as the mental and emotional health of the human being. On the one side, the reduced dopaminergic activity leads to Parkinson's disease, while on the other side, the increased dopaminergic activity is associated with the emergence of psychosis and schizophrenia. Considering the wide range of physiological and pathophysiological effects, the development of a new sensor for specific and selective measurement of dopamine at low levels of concentration can make a major contribution to the disease diagnosis. With the aim of developing a new dopamine amperometric sensor, a glassy-carbon electrode was modified. The electrode was modified with water-insoluble redox mediator Sodium bis [N-2-oxyphenyl-5-bromo-salicylideneiminato-*ONO*] ruthenate(III) complex using carbon ink. The electrode is scanned by Differential Pulse Voltammetry (DPV) and Cyclic Voltammetry (CV) in the range of -0.3 V to + 0.4 V *vs.* Ag/AgCl electrode in the phosphate buffer, pH 7.42. The modified electrode shows a fast electric current response, i.e. an excellent electro-catalytic activity for the oxidation of dopamine. Hydrodynamic (HA) and Flow injection (FIA) amperograms were also recorded. Amperometric measurements were performed at an applied potential of 0.0; 0.1 and 0.15 V. An impact from numerous interferences being present in real samples will be reduced by low working potential of this sensor.

Sažetak

Dopamin je jedan od najvažnijih neurotransmitera koji nadzire motoričke aktivnosti, autonomne i endokrine funkcije te mentalno i emocionalno zdravlje čovjeka. Snižena dopaminergična aktivnost, s jedne strane, dovodi do Parkinsonove bolesti, a s druge strane, povećana dopaminergična aktivnost povezuje se s pojavom psihoza i šizofrenije. S obzirom na širok raspon fizioloških i patofizioloških učinaka, razvoj novog senzora za specifično i selektivno mjerenje dopamina na niskim razinama koncentracije može dati veliki doprinos za dijagnozu bolesti. S ciljem razvoja novog amperometrijskog senzora za dopamin modificirana je elektroda od staklastog karbona. Elektroda je modificirana s ne topivim u vodi redoks medijatorom Natrij bis[N-2-oksifenil-5-bromosalicilideniminato-*ONO*] rutenat(III) kompleksom primjenom karbon tinte. Elektroda je skenirana diferencijalno pulsnom voltametrijom (DPV) i cikličnom voltametrijom (CV) u rasponu potencijala od -0.3 do 0.4 V prema Ag/AgCl elektrodi u fosfatnom puferu, pH 7.42. Modificirana elektroda pokazuje brz strujni odziv odnosno odličnu elektrokatalitičku aktivnost za oksidaciju dopamina. Također su snimljeni hidrodinamički i protočno-injekcioni amperogrami. Amperometrijska mjerenja su rađena na primijenjenom potencijalu 0.0; 0.1 i 0.15 V. Nizak radni potencijal senzora će smanjiti utjecaj brojnih interferenci prisutnih u realnim uzorcima.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-04

Synthesis of dioxouranium(VI) complexes of S-propylthiosemicarbazones

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Keywords:
Thiosemicarbazones,
dioxouranium(VI),
Crystal structure,

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Abstract: The condensation of an aldehyde or a ketone compounds with the hydrazine nitrogen atom of thiosemicarbazide has been known since 1900s. However, the amidic nitrogen of thiosemicarbazone does not react with these carbonyl compounds and coordinates to metal center. However, the amide nitrogen can be condensed with an aldehyde by transition metal ions having template effect in which metal center has the significant orientation effect. By this method, the structures obtained are metal complexes.

The alkylated thiosemicarbazones substituted on sulfur were synthesized using 5-bromosalicylaldehyde as starting material. The template reactions of the S-propyl-thiosemicarbazones in the presence of dioxouranium(VI) were investigated. Two dioxouranium(VI) complexes were synthesized. Propyl or allyl alcohol used as second ligand completed the seventh coordination site of UO_2(VI). The synthesized thiosemicarbazones and template complexes were characterized by elemental analysis, UV –visible, FTIR, and 1H NMR. The structure of the dioxouranium(VI) complex, [UO_2L(allylalcohol)], was studied by single-crystal diffraction. The uranium is seven-coordinate in a pentagonal-bipyramidal arrangement with two oxo groups occupying the apical positions..

Sažetak

Kondenzacija aldehidnih ili ketonskih spojeva sa atomom hidrazinskog nitrogena iz tiosemikarbazida je poznata još od 1900-ih. Ipak, amidni nitrogen iz tiosemikarbazona ne reaguje sa ovim karbonilnim jedinjenjima i koordinira se na metalni centar. Međutim, amidni nitrogen može se kondenzirati sa nekim aldehidom uz pomoć jona prelaznog metala koji djeluje kao model u kojem metalni centar ima značajan orijentacioni efekt. Ovom metodom se dobijaju strukture metalnih kompleksa. Alkilirani tiosemikarbazoni supstituirani na sumporu, su sintetizirani iz 5-bromsalicilaldehida kao početnog reagensa . Ispitivane su templatne reakcije S-propiltiosemikarbazona u prisustvu dioksouraniuma (VI). Sintetizirana su dva kompleksa dioxouraniuma (VI). Propilni ili alilni alcohol koji je korišten kao drugi ligand zauzeo je sedmo koordinacijsko mjesto u UO_2 (VI). Sintetizirani tiosemikarbazoni i templatni kompleksi su potvrđeni elementarnom analizom, UV–VIS, FTIR, i 1H NMR. Monokristalnom difrakcijom određena je struktura kompleksa dioksouraniuma(VI), [UO_2L (alilalkohol)]. Koordinacioni broj urana je sedam u strukturi pentagonalne bipiramide, sa dvije okso grupe na apikalnim pozicijama.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-05

Synthesis and antioxidant activities of oxovanadium(IV) complexes of 3-hydroxy-S-methylthiosemicarbazones

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Keywords:
Thiosemicarbazones,
Antioxidant Capacity/activity,
oxovanadium(IV),
CUPRAC

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Abstract: Thiosemicarbazones has a very broad range of biological properties as antiviral, antifungal, antibacterial, antitumor, anticancergenic and insulin mimetic properties. Biological properties of this class compounds depend on the substituent position, the metal centre and the oxidation number of the metal ion.

Antioxidants which are believed to reduce the risk of cancer have a great importance in these days. In addition, the uncontrolled production of free radical reactive oxygen species such as superoxide anion, hydroxyl radical, and hydrogen peroxide can induce DNA damage in humans.

Herein, we present two oxovanadium(IV) complexes with hydroxy substituted salicylaldeyde thiosemicarbazones in the ONNO coordination mode. All compounds were characterized using analytical and spectroscopic data. The free ligand and its metal complexes have been tested for *in vitro* antioxidant capacity by reduction of copper(II) neocuproine (Cu(II)-Nc) using the CUPRAC method. Furthermore, the antioxidant activity of the free ligand and its complexes were determined by *in vitro* methods measuring the scavenging activity of reactive oxygen species (ROS) including hydroxyl radical (·OH) , superoxide anion radical ($O_2^{\cdot -}$), and hydrogen peroxide (H_2O_2).

Sažetak

Tiosemikarbazoni imaju vrlo širok spektar bioloških svojstava kao što su: antivirusna, antifungalna, antibakterijska, antitumorska, antikancerogena i inzulin mimička svojstva. Biološka svojstva ove klase spojeva zavise od položaja supstituenta, metalnog centra i oksidacijskog broja metala. Antioksidansi za koje se vjeruje da smanjuju rizik od raka su sve od veće važnosti. Nekontrolirano stvaranja slobodnih radikala reaktivnih oksigenovih vrsta, kao što su: superoksidni anion, hidroksilni radikal, i hidrogenperoksid mogu dovesti do oštećenja DNA kod ljudi. U ovom radu predstavljena su dva oksovanadium (IV) kompleksa s hidroksi supstituiranim salicilaldehid tiosemikarbazonima, ONNO koordinacijskim modelom. Svi spojevi su karakterizirani analitičkim i spektroskopskim podactima. Antioksidativni kapacitet slobodnog ligand i njegovog metalnog kompleksa su testirani *in vitro* redukcijom bakar (II) neokuproina (Cu (II)-NC) po CUPRAC metodi. Nadalje, antioksidativno djelovanje slobodnog liganda i njegovih kompleksa su određene *in vitro* metodom za mjerenje aktivnosti reaktivnih oksigenovih vrsta (ROS), uključujući hidroksilni radikal (•OH), radikal superoksidnog aniona ($O_2^{\bullet -}$) i hidrogenperoksid (H_2O_2).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-06

Spectroscopic evidence on interaction of ruthenates (III) derived from *N*-low alkyl-5-substituted salicylideneimine with calf thymus DNA

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Keywords:
ruthenium(III)
Schiff base
CT DNA
intercalation
spectroscopic titration

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Abstract: Interaction of Ru(III) complexes containing monobasic bidentate ON-donor Schiff base ligands derived from simple aliphatic amines with 5-substituted salicylaldehyde with calf thymus DNA has been studied using spectroscopic titration. Complexes of general formula $Na[RuCl_2(N\text{-}R\text{-}5\text{-}X\text{-}salim)_2]$, where R = Pr, Et and X = H, Cl, Br, NO_2, were prepared as previously reported by our group and purity was checked by infrared spectroscopy confirming expected composition. The intrinsic binding constants for CT DNA with eight complexes were determined by spectroscopic titration experiments giving surprising evidence of quite strong interaction with K_b values in range $(0.58–2.27) \times 10^4$ M^{-1}, which could be result of moderate intercalation or strong groove binding. Results also showed that K_b values are more affected with change of substituent in position 5- on salicylaldehyde component of ligand then with change of amine suggesting that aldehyde component might have significant influence on binding of complex with CT DNA. Regardless to ammine component, K_b values decrease in order $H>NO_2>Br\approx Cl$. Also, K_b values decrease with increasing alkyl chain of amine for the same substituent in position 5- of salicylideneimines.

Sažetak

Interakcija Ru(III) kompleksa sa monobaznim bidentatnim ON-donorskim Schiff-ovim bazama izvedenim iz jednostavnih alifatskih amina i 5-supstituiranih salicilaldehida, sa calf thymus DNA ispitana je spektrofotometrijskom titracijom. Kompleksi opšte formule $Na[RuCl_2(N\text{-}R\text{-}5\text{-}X\text{-}salim)_2]$, gdje je R = Pr, Et i X = H, Cl, Br, NO_2 su pripremljeni po objavljenim procedurama, što je ranije izvjestila naša grupa, a čistoća je provjerena infracrvenom spektroskopijom potvrđujući očekivani sastav. Konstanta vezivanja CT DNA sa osam kompleksa je određena spektrofotometrijskom titracijom dajući iznenađujući rezultat umjereno jake interakcije sa K_b vrijednostima u području $(0.58 – 2.27) \times 10^4$ M^{-1}, što je vjerovatno rezultat umjerene sposobnosti interkalacije ili jakog vezivanja u velikom žlijebu. Rezultati su također pokazali da je vrijednost K_b više afektirana sa promjenom supstituenta u poziciji 5- na salicilaldehidnoj komponenti liganda, nego sa promjenom amina sugerirajući da aldehidna komponenta može imati značajan uticaj na vezivanja kompleksa sa CT DNA. Bez obzira na aminsku komponentu K_b vrijednost pada u nizu $H>NO_2>Br\approx Cl$. Također K_b vrijednost pada sa porastom alkilnog lanca amina za isti supstituent u poziciji 5 salicilidenimina.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-07

Synthesis and characterization of novel cationic complexes Ru(III) with *N*-heterocycles and Schiff base derived from salicylaldehyde

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Keywords:
Ruthenium, complex, Schiff base, salicylideneimine, *N*-heterocycle.

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Abstract: Ruthenium complexes are the subject of huge interest and imposing development in the last decades due to their many significant properties, especially anticancer and catalytic properties. Novel cationic complex compounds of Ru(III) with selected *N*-heterocycles and Schiff base derived from salicylaldehide and aniline have been synthesized. The compounds with the general formula $[RuB_2(N\text{-Ph-salim})_2]Cl$ (where B = imidazole, pyrazole, indazole, pyrimidine and pyridine) were prepared from the reaction of Sodium dichloro-bis-[*N*-phenyl-salicylideneiminato-*N,O*]ruthenate(III) and selected *N*-heterocycles. The synthesis of the complexes was carried out in relative mild conditions by replacement of two easily outgoing chloride ions in starting compound with the heterocycle. Formulation and characterization of the new complexes were performed using MALDI-TOF/TOF mass spectrometry, FT-IR spectroscopy and UV/Vis spectrophotometry. In the octahedral environment of Ru(III), coordination of bidentate Schiff bases occurs through azomethine nitrogen and deprotonated phenolic oxygen while in heterocycles via nitrogen atoms. MALDI-TOF/TOF mass spectrometry confirmed existance of cations with general formula $[RuB_2(N\text{-Ph-salim})_2]^+$. Redox property of complexes has been determed by using cyclic voltammetry.

Sažetak

Zadnjih decenija kompleksi rutenija su predmet velikog interesa i impozantnog razvoja zbog njihovih mnogih značajnih osobina, među kojima se posebno ističu antikancerne i katalitičke osobine. Sintetizirani su novi kationski kompleksni spojevi Ru(III) sa odabranim *N*-Heterociklusima i Schiff-ovom bazom izvedenom iz saliciladehida i anilina. Spojevi opšte formule $[RuB_2(N\text{-Ph-salim})_2]Cl$ (gdje je B = imidazol, pirazol, indazol, pirimidin i piridin) pripremljeni su u reakciji između natrij dihloro-bis-[N-fenil-salicilideniminato-N,O]rutenata(III) i odabranog *N* - heterociklusa. Sinteza kompleksa provedena je u relativno umjerenim uslovima zamjenom dva lahko odlazeća hloridna jona iz polaznog spoja sa heterociklusom. Formulacija i karakterizacija novih kompleksa napravljena je na bazi MALDI-TOF/TOF masene spektrometrije, FT-IR spektroskopije i UV/Vis spektrofotometrije. U oktaedarskom okruženju Ru(III), koordinacija bidentatne Schiffove baze se ostvaruje preko azometinskog azota i deprotoniranog fenolnog kisika, dok se kod heterociklusa ostavaruje preko atoma azota. MALDI-TOF/TOF masena spektrometrija potvrdila je postojanje kationa opšte formule $[RuB_2(N\text{-Ph-salim})_2]^+$. Redoks osobine kompleksa određene su cikličnom voltametrijom.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-08

Spectrophotometric determination of binding constants of Ru(III) salicylideneimine complexes with CT DNA

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Keywords:
ruthenium(III)
Schiff bases
CT DNA
intercalation
spectroscopic titration
salicylideneimine

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Abstract: Ruthenium as a coordination center in different complexes is interesting due to many reasons, especially because its complexes act as catalysts, electron-transfer mediators or anticancer agents depending on a coordination environment. Schiff's bases are organic ligands that have many good properties that qualify them in development and design of novel metal complexes. That is due to their antibacterial, antiviral and anticancer activity, significant stereochemical flexibility, and possibility to tune the electrode potential of metal complex. Here, we are giving report about interaction of eleven Ru(III) salicylideneimine complexes with general formula Na[Ru(N-R-5-X-salim)$_2$] (R = C_6H_4O, X = H, Cl, Br, NO_2), Na[$RuCl_2$(N-R-5-X-salim)$_2$] (R = C_4H_9, X = H, Cl, Br, NO_2) and [Ru(N-R-5-X-salim)$_3$] (R = $C_{10}H_7$, X = H, Cl, Br) with CT DNA. Spectrophotometric titrations were used for quantification of complex interaction with DNA. Experimental data show that Ru(III) complexes with salicylideneimine act as moderate intercalators of CT DNA with binding constant of 10^4 M^{-1} magnitude. There is an evident influence of substituent in position 5 in salicylaldehyde on binding constants values.

Sažetak

Rutenij kao centar koordinacije u raznim kompleksima je interesantan iz više razloga, a posebno zbog sposobnosti rutenijskih kompleksa da u najrazličitijim koordinacionim okruženjima djeluju kao katalizatori, elektron-transfer medijatori ili antikanceri. Schiff-ove baze su organski ligandi koji imaju niz osobina koje ih kvalificiraju u razvoju i dizajnu novih metalnih kompleksa, od kojih su posebno značajne njihovo antibakterijsko, antiviralno i antitumorno djelovanje, te velika stereohemijska fleksibilnost i mogućnost podešavanja elektrodnog potencijala metalnog kompleksa. U ovom radu se izvještava o interakciji 11 salicilideniminskih kompleksa Ru(III) sa calf thymus DNA, opštih formula Na[Ru(N-R-5-X-salim)$_2$] (R = C_6H_4O, X = H, Cl, Br, NO_2), Na[$RuCl_2$(N-R-5-X-salim)$_2$] (R = C_4H_9, X = H, Cl, Br, NO_2) i [Ru(N-R-5-X-salim)$_3$] (R = $C_{10}H_7$, X = H, Cl, Br). Za kvantifikaciju interakcije kompleksa sa CT DNA korištena je spektrofotometrijska titracija. Eksperimentalni podaci pokazuju da ispitivani salicilideniminski kompleksi Ru(III) nastupaju kao umjereni interkalatori CT DNA sa konstantama vezivanja reda veličine 10^4 M^{-1}. Evidentan je uticaj supstituenta u poziciji 5 na salicilaldehidnoj komponenti na vrijednost konstante vezivanja.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-09

Mixed ligand complex of dioxomolybdenum(VI) 3-methoxy-salicylaldehyde-S-propyl-thiosemicarbazone and 3-methyl-2-butene-1-ol

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Keywords:
Thiosemicarbazone
ONN donor set
Dioxomolybdenum complex
Crystal syructure

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Abstract: Molybdenum is an oligo-element and one of cofactors for several enzymes catalysing redox reactions and some molybdenum compounds are included in plausible enzyme model systems. The known molybdenum (VI) complexes of thiosemicarbazones of general formula $[MoO_2L(L')]$ are potential catalysts as the coordinated L' molecule may be replaced by the activated enzyme molecule.

New dioxomolybdenum(VI) complex was prepared by reaction of 3-methoxysalicylaldehyde S-propyl-thiosemicarbazone (L) with $[MoO_2(acac)_2]$ in 3-methyl-2-butene-1-ol (L'). In the complex, the doubly deprotonated ligand is coordinated to molybdenum through tridentate ONN-donor set consisting of phenolic oxygen, azomethine nitrogen and thioamide nitrogen. The solid complex of general formula $[MoO_2L(L')]$ which contain 3-methyl-2-butene-1-ol (L') as second ligand was characterized by elemental analysis and spectroscopic methods. The structure of the complex was determined by the single crystal X-ray diffraction method. X-ray crystal studies indicated a distorted octahedral geometry for complex. The MoO_2 unit has a *cis*-dioxomolybdenum structure with angles ca. 105 Å.

Sažetak

Molibden je oligo-element, on je kofaktor u nekim enzimski kataliziranim redoks reakcijama neki od spojevia molibdena su uključeni u enzimski sistem. Poznati kompleksi molibden (VI) tiosemicarbazona opće formule $[MoO_2L(L')]$ su potencijalni katalizatori jer koordinirana L' molekula može biti zamijenjena aktiviranom molekulom enzima. Novi kompleks dioksomolibdena (VI) je pripremljen reakcijom 3-metoksisalicilaldehid S-propil-tiosemikarbazona (L) sa $[MoO_2(acac)_2]$ u 3-metil-2-buten-1-ol (L '). U kompleksu, dvostruko deprotonirani ligand je koordiniran na molibden preko tridentatnog ONN-donorskog seta koji se sastoji od fenolnog oksigena, azometinskog nitrogena i tioamidnog nitrogena. Čvrsti kompleks opće formule $[MoO_2L(L')]$ koji sadrži 3-metil-2-buten-1-ol (L') kao drugi ligand, karakteriziran je elementarnom analizom i spektroskopskim metodama. Struktura kompleksa je određena metodom difrakcije monokristala X-zracima. Rezultati su pokazali narušenu oktaedarsku geomertiju kompleksa. MoO_2 ima strukturu cis-dioksomolibdena s uglovima oko. 105 Å.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-10

cis-Dioxomolybdenum(VI) complexes with N-pentyl-thiosemicarbazone of 2-hydroxy-3-methoxy-benzaldehyde

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Keywords:
Thiosemicarbazone
ONS ligand
Dioxomolybdenum complex
Structural analysis

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Abstract: Some molybdenum compounds have biological effects including cofactors for several enzymes such as nitrogenase, sulfite and xanthine oxidases catalyzing redox reactions. Catalytic capacity of the molybdenum compounds has been thought to be related with structural features of coordinated *cis*-MoO_2 unit, chelate ring structure and also substituents of ligands. Besides, some *cis*-dioxomolybdenum(VI) complexes may be catalyst for oxygen atom transfer mechanisms. Thiosemicarbazones have a wide range of pharmacological activity due to their ability to chelate with trace metals, and therefore dioxomolybdenum(VI)-thiosemicarbazone complexes have raised considerable interest. In this study, two *cis*-MoO_2^{2+} complexes having the general formula $[MoO_2(L)(L')]$ were synthesized. In the complexes, L is dianionic form of 2-hydroxy-3-methoxy-benzaldehyde -N^4-pentylthiosemicarbazone (H_2L) and L' are methanol or ethanol. Characterizations of the compounds were carried out by elemental analysis, electronic, infrared and ^{1}H-NMR spectroscopies. The ligand is coordinated to the *cis*-MoO_2^{2+} unit through O, N and S atoms which are phenolic oxygen, azomethine nitrogen and thiolate sulphure, respectively. The sixth coordination site of *cis*-MoO_2^{2+} is occupied by oxygen of alcohol.

Sažetak

Neki spojevi molibdena imaju biološke efekte, oni su kofaktori za neke enzime kao što su: nitrogenaze, sulfit i ksantin oksidaze koji kataliziraju redoks reakcije. Smatra se da je katalitički kapacitet spojeva molibdena u vezi sa strukturnim karakteristikama koordiniranog *cis*-MoO_2, strukturom helatanog prstena kao i supstituentima na ligandima. Osim toga, neki kompleksi *cis*-dioksomolibdena (VI) mogu katalizirati mehanizme prenosa oksigena. Kompleksi tiosemikarbazona su sve interesantniji jer imaju širok spektar farmakološke aktivnosti zbog svoje sposobnosti da se heliraju sa metalima u tragovima.

Ovdje su sintetizirana dva nova kompleksa cis-MoO_2^{2+} opće formule $[MoO_2(L)(L')]$. U kompleksima, L je dianionski oblik 2-hidroksi-3-metoksi-benzaldehid-N^4-pentiltiosemikarbazona (H_2L) a L' je metanol ili etanol. Spojevi su karakterizirani elementarnom analizom, elektronskom, infracrvenom i 1H-NMR spektroskopijom. Ligand je koordiniran na cis-MoO_2^{2+} preko atoma O, N i S koji redom pripadaju fenolu, azometinu i tiolatu. Šesto koordinacijsko mjesto na *cis*-MoO_2^{2+} zauzima oksigen iz alkohola.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-11

Nickel(II)-Triphenylphosphine complex of S-methyl, N^4-methyl substituted thiosemicarbazone

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Keywords:
Schiff base
Nickel complex
Triphenylphosphine
X-ray crystal structure

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Abstract: Thiosemicarbazones are an important class of Schiff base ligands known for their selectivity and sensitivity towards various metal ions. In addition to antitumor effect of transition metal complexes of thiosemicarbazones, it is well known that they are also antiviral, even anti-HIV chemicals.

The study presents new nickel(II) complex obtained by reaction of $[Ni(PPh_3)_2Cl_2]$ with 5-Bromo-2-hydroxy-*S*-methyl- *N*-methyl benzaldehyde thiosemicarbazone (H_2**L**). Elemental analysis, IR, UV-vis and ^{1}H-NMR spectrum have been used to characterization of the thiosemicarbazone ligand and nickel phosphine complex. The structure of [Ni**L**(PPh_3)] the complex was also determined by single crystal X-ray diffraction. Crystal study of the nickel complex with S-methyl-N^4- methyl substitued thiosemicarbazidato ligand was reported for the first time.

Sažetak

Tiosemikarbazoni su važna klasa liganda Schiffovih baza, poznatih po selektivnosti i osjetljivosti ka različitim metalnim jonima. Kao dodatak antitumornom efektu kompleksa prelaznih metala sa tiosemikarbazonima, dobro je poznato da imaju antivirusne, čak i anti-HIV osobine.

U ovom radu prikazani su novi nikl (II) kompleksi dobiveni u reakciji $[Ni(PPh_3)_2Cl_2]$ sa 5-brom-2-hidroksi-*S*-metil- *N*-metil benzaldehid tiosemikarbazonom (H_2**L**). Elementarna analiza, IR, UV-vis i ^{1}H-NMR spektri su snimljeni za karakterizaciju tiosemikarbazonskih liganada i nikl fosfinskih kompleksa. Struktura [Ni**L**(PPh_3)] kompleksa je također potvrđena metodom difrakcije monokristala X-zrakama. Po prvi put je objavljeno istraživanje nikl kompleksa sa S-metil-N^4- metil supstituisanim tiosemikarbazidat ligandima.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-12

3-Bromo-5-chloro-acetophenone-N-hexyl-thiosemicarbazidato triphenylphosphine nickel(II) complex

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Keywords:
Thiosemicarbazone
Nickel complex
Triphenylphosphine
Structural analysis

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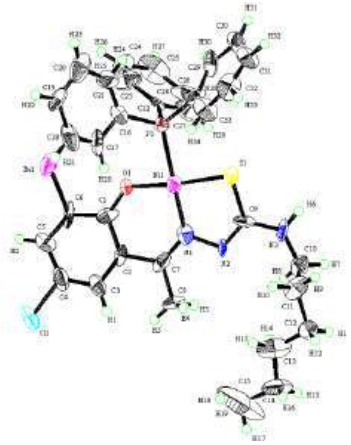
Abstract: For many years, thiosemicarbazones and their metal complexes have been the subject of most structural and medicinal studies because of biological significance and phosphine ligands are reactive and versatile homogeneous catalysts in reactions, also. By study, [Ni**L**(PPh_3)] complex was synthesized by reaction of [Ni(PPh_3)$_2$$Cl_2$] with 3-bromo-5-chloro2-hydroxyacetophenone-N-hexyl-thiosemicarbazone (H_2**L**). Thiosemicarbazone ligand and nickel phosphine complex was characterized by elemental analysis, IR and ^{1}H-NMR spectrum and the complex was also determined by single crystal X-ray diffraction.

Sažetak

Dugi niz godina, tiosemikarbazoni i njihovi metalni kompleksi su bili predmet većine strukturnih i medicinskih istraživanja zbog njihovog biološkog značaja, a fosfin ligandi su reaktivni i raznovrsni homogeni katalizatori u reakcijama.

U ovom radu, [Ni**L**(PPh_3)] kompleks je sintetizovan u reakciji [Ni(PPh_3)$_2$$Cl_2$] sa 3-brom-5-hlor-2-hidroksiacetofenon-N-heksil-tiosemikarbazonom (H_2**L**). Tiosemikarbazonski ligand i nikl fosfinski kompleks su okarakterizirani elementarnom analizom, IR i ^{1}H-NMR spektrima, a kompleks je potvrđen metodom difrakcije monokristala X-zrakama.



Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-IC-13

Synthesis and Characterization of a New Thiocarbohydrazone and its Dioxomolybdenum (Vi) Complex

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Keywords:
Schiff base
Thiocarbohydrazide
Thiocarbohydrazone
Dioxomolybdenum(VI) complex

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Abstract: Chemistry of the mixed hard-soft nitrogen-sulfur chelating ligands bound to Mo at higher oxidation state is a field of current interest. Such studies did assume greater importance after the revealation that several oxido-reductases like DMSO reductase, xanthine oxidase and other oxo-transferases contain Mo(IV), Mo(V) and Mo(VI) as their prosthetic groups coordinated to nitrogen-sulpur donor points of a macromolecular ligand system. Thiocarbohydrazones and their transition metal complexes are generally screened for antibacterial and antifungal activity using the bacteria *Azotobacter* and *Rhizobium* and the fungus *Fusarium oxysporium*. Thiocarbohydrazone ligand (H_3L) was obtained by the condensation of thiocarbohydrazide with 3,5-dibromo salicylaldehyde. Also, solvate dioxomolybdenum(VI) complex of general formula $[MoO_2(HL)(Metanol)(DMF)]$ were prepared in methanol + DMF. The structure of thiocarbohydrazone ligand and its oxomolybdenum(VI) complex have been characterized by elemental analysis, IR, ^{1}H-NMR, UV-VIS spectroscopic techniques and thermogravimetric analysis.

Sažetak

Hemija mješanih tvrdo-mekih nitrogen-sumpor helatirajućih liganada, koji se vežu za Mo u višim oksidacionim stanjima je područje trenutnog interesa istraživanja. Takva istraživanja su pokazala značajnu važnost, nakon otkrivanja nekoliko oksido-reduktaza kao DMSO reduktaza, ksantin oksidaza i druge okso-transferaze koje sadrže Mo (IV), Mo (V) and Mo (VI), pošto su njihove prostetičke grupe koordinirane na nitrogen-sumpor donorska mjesta u makromolekularnom ligandnom sistemu.

Tiokarbohidrazoni i njihovi kompleksi sa prelaznim metalima se općenito proučavaju zbog antibakterijskih i antigljivičnih svojstava bakterija *Azotobacter* i *Rhizobium*, te gljivica *Fusarium oxysporium*.

Tiokarbohidrazon ligand (H_3L) je dobiven u reakciji kondenzacije tiokarbohidrazida sa 3,5-dibrom salicilaldehidom. Također, solvati dioksoomolibden (VI) kompleksa opće formule $[MoO_2(HL)(Metanol)(DMF)]$ su pripremljeni u metanol + DMF smjesi. Struktura tiokarbohidrazon liganada i njihovih oksomolibden (VI) kompleksa je okarakterizirana elementarnom analizom, IR, ^{1}H-NMR, UV-VIS spektroskopskim tehnikama i termogravimetrijskom analizom.

POSTER PRESENTATIONS

Biological Chemistry

(BC)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BC-01

Kinetine Induced Changes in Quercetin, Naringenin, Hesperitin and Rutin content in *Knautia sarajevensis* (G. Beck) Szabó Shoot Cultures

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Keywords:
Knautia sarajevensis,
quercetin,
naringenin,
hesperitin,
rutin,
shoot cultures

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Abstract: *Knautia sarajevensis*, Dipsacaceae, is an endemic species found at wood margins and meadows only on mountains of Dinaric Alps. Members of this family are widely used in traditional medicine as rich sources of pharmacologically important substances. Since it is well known that flavonoid compounds are carriers of biological activities of plant extracts, the aim of this study was to investigate cytokinin effects in concentration changes of flavonoid constituents. Four different flavonoid constituents were analysed: quercetin, naringenin, hesperitin and rutin in extracts of *K. sarajevenis* shoots cultivated on three *in vitro* treatments (control, 1.0 mg L^{-1} kinetine and 10.0 mg L^{-1} kinetine). All extracts were prepared using dried material and 80% methanol HPLC grade. Analysis of four flavonoid constituents indicated that high cytokinin concentrations did induce improvement of quercetin, naringenin and rutin content, but these concentrations are still lower than those recorded for control treatment. Heseperitin showed cytokinin depended decrease in concentration, and control treatment had the highest hesperitin concentration compared to cytokinin treatments. Further analysis using different types and concentrations of cytokinins are necessary to establish a pattern of cytokinin induced concentration changes in content of these four investigated flavonoids in *Knautia sarajevensis*.

Sažetak

Knautia sarajevensis, Dipsacaceae, je endemična vrsta koja raste na rubovima šuma i livadama dinaridskih Alpa. Pripadnici ove porodice koriste se u narodnoj medicini kao izvor farmakološki značajnih supstanci. S obzirom da su flavonoidi nosioci bioloških aktivnosti biljnih ekstrakata cilj ove studije bio je istražiti djelovanje citokinina na promjene koncentracije flavonoidnih konstituenata. Četiri različita flavonoida su analizirana: kvercetin, naringenin, hesperitin i rutin, u ekstraktima izdanaka *K. sarajevenis* kultiviranim na tri različita *in vitro* tretmana (kontrola, 1.0 mg L^{-1} kinetina i 10.0 mg L^{-1} kinetina). Svi ekstrakti su pripremljeni od sušenog biljnog materijala uz korištenje 80% metanola, HPLC čistoće. Analiza četiri flavonoidna konstituenta pokazala je da visoke koncentracije citokinina induciraju povećnaje koncentracije kvercetina, naringenina i rutina, ali su te koncentrtacije i dalje niže od kontrole. Sniženje koncentracije hesperitina bilo je ovisno o koncentraciji citokinina, te je kontrola imala najveću koncentraciju hesperitina. Dodatne analize, sa različitim tipovima i koncentracijama citokinina, su neophodne da bi se uspostavio model citokinin-indukovane ovisnosti promjene koncentracije istraživanih flavonoidnih konstituenata kod vrste *Knautia sarajevensis*.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BC-02

Total phenolic content variation in Herzegovinian populations of *Hypericum perforatum* L.

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Keywords:
total phenolics,
Hypericum perforatum,
St. John's wort.

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Abstract: *Hypericum perforatum* L. (St. John's wort), Hypericaceae, is a perennial herb, which above-ground parts are used in traditional medicine. Concentrations of total phenolic content in above-ground organs of two *Hypericum perforatum* infraspecific taxa from four Herzegovinian populations were determined. Three populations were typical *H. perforatum* subspecies and one was infraspecific taxa with unresolved taxonomic position (*H. perforatum* ssp. *angustifolia*). The lowest concentrations of total phenolic content were recorded for *H. perforatum* ssp. *perforatum* population Hutovo Blato (6.62 and 8.97 mg/g DW in flowers and leaves respectively), and the highest in *H. perforatum* ssp. *angustifolia* population Podveležje (14.86 and 21.79 mg/g DW in flowers and leaves respectively). Newman-Keuls test showed significant interpopulation and infraspecific differences. The observed chemical variations among plant parts were detected. Interpopulation differences in *H. perforatum* ssp. *perforatum* could be related to different habitats conditions. Observed differences between two taxa from the same population Podveležje, where environmental effects were excluded, could support opinions about *H. perforatum* ssp. *angustifolia* as separate taxon. Further investigations are necessary for confirmation of such findings.

Sažetak

Hypericum perforatum L. (kantarion, Gospina trava), Hypericaceae, je višegodišnja biljka, čiji se nadzemni dijelovi koriste u tradicionalnoj medicini. Određene su koncentracije ukupnih fenola u nadzemnim organima dva infraspecijska taksona *H. perforatum* iz četiri hercegovačke populacije. Tri populacije su tipična podvrsta *H. perforatum*, a jedna je infraspecijski takson sa neriješenim statusom (*H. perforatum* ssp. *angustifolia*). Najniže koncentracije ukupnih fenola su utvrđene za *H. perforatum* ssp. *perforatum* u populaciji Hutovo Blato (6.62 mg/g DW cvijet i 8.97 mg/g DW list), a najveće za *H. perforatum* ssp. *angustifolia* u populaciji Podveležje (14.86 mg/g DW cvijet i 21.79 mg/g DW list). Newman-Keuls test pokazao je značajne interpopulacijske i infraspecijske razlike. Uočene su hemijske varijacije između istraživanih biljnih dijelova. Interpopulacijske razlike taksona *H. perforatum* ssp. *perforatum* mogu se dovesti u vezu sa različitim uslovima staništa. Uočene razlike između dva taksona iz iste populacije Podveležje, gdje je isključeno djelovanje različitih ekoloških faktora, mogu ići u prilog mišljenjima da je *H. perforatum* ssp. *angustifolia* poseban takson. Neophodna su daljnja istraživanja da bi se potvrdili ovi nalazi.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BC-03

Potentiometric characterization and determination of amino acids and their mixtures in non-aqueous media

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Keywords:
L-histidine,
β-alanine,
non-aqueous titration

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Abstract: L-histidine is an α-amino acid with an imidazole functional group. It is a common coordinating ligand in metalloproteins, is a part of catalytic sites in certain enzymes, and has important role in hemoglobin. Another α-amino acid, β-alanine, is not used in the biosynthesis of any major proteins or enzymes. It is formed *in vivo* by the degradation of dihydrouracil and carnosine, and is a component of the naturally occurring peptides carnosine and anserine and also of pantothenic acid, which itself is a component of coenzyme A.

In this paper L-histidine and β-alanine were studied pottentiometrically, as single and in a binary mixture (1:1). Their acid-base properties were studied by use of potentiometric titrations that were carried out using non-aqueous solvents,-tetrabutylammonium hydroxide in toluene/methanol solution, perchloric acid in acetic acid anhydride, and perchloric acid standard solution in acetic acid anhydride. Amino acids were dissolved in glacial acetic acid solution and acetonitrile in 1:10 ratio. The generated potentiometric data were used for defining buffering capacities (buffer strength) for both amino acids and for determination of the distributions diagrams of corresponding species.

Sažetak

L-histidin je α-amino kiselina sa imidazolnom funkcionalnom grupom. Obično je koordinirajući ligand kod metaloproteina i aktivno je katalitičko mjesto nekih enzima, te ima važnu ulogu kod hemoglobina. β-Alanin se ne koristi kod biosinteze važnih enzima ili proteina. L-histidin nastaje *in vivo* raspadanjem dihidrouracila i karnozina. U sastavu je prirodnih peptida karnozina i anserina, te pantotenske kiseline koja je komponenta koenzima A.

U ovom istraživanju određivane su potenciometrijskim metodama aminokiseline L-histidin i β-alanin, pojedinačno i u smjesi (1:1). Njihova kiselo-bazna svojstva okarakterizirana su- potenciometrijskim titracijama u nevodenim otapalima – tetrabutilamonijev hidroksid u otopini toluena/metanola, perklorna kiselina i anhidrid octene kiseline, standardna otopina perklorne kiseline u anhidridu octene kiseline. Ledena octena kiselina i acetonitril u omjeru 1:10 korišteni su kao otapalo za aminokiseline. Generirani podaci dobiveni direktnom potenciometrijom poslužili su za definiranje kapaciteta (jakost pufera) za obje aminokiseline i za određivanje odgovarajuće distribucije specija.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BC-04

Antioxidant Activity of *Achillea clypeolata* Sm.

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Keywords:
Achillea clypeolata,
antioxidant activity,
flavonoid content,
phenolic content

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Abstract: *Achillea clypeolata* Sm. commonly known as yellow yarrow is an endemic species of the genus *Achillea*. Different species of genus *Achillea* are known for their antioxidant activities, but *A. clypeolata* antioxidant activity is investigated for the first time in this paper. Antioxidant activity of leaf, flower and root methanolic extracts is determined by DPPH and total reducing power assay. Total phenolic and total flavonoid content were estimated using standard chemical assay procedures. Highest total phenolic and flavonoid content was observed for flower methanolic extracts (64.70 μg GAE/ml and 1.09 μg RE/ml, respectively). Total reducing power ranged between 10.66 mg AAE/ml for root extract to 11.90 mg AAE/ml flower extract. Antioxidant activity was analyzed *in vitro* using DPPH reagent and expressed as %RSC. All extracts showed similar antioxidant activities. Significant positive correlations between antioxidant activity assays and total flavonoid and phenolic content indicate that these compounds contribute to antioxidant activity of plants. According to these results, *A. clypeolata* can be used as potential natural antioxidants source.

Sažetak

Achillea clypeolata Sm. u narodu poznata kao žuta hajdučka trava je endemska vrsta iz roda *Achillea*. Iako su biljne vrste iz ovog roda poznate po svojoj antioksidativnoj aktivnosti, antioksidativna aktivnost vrste *A. clypeolata* nije do sada određivana. Antioksidativna aktivnost metanolnih ekstrakata lista, cveta i korena određena je DPPH i metodom za određivanje ukupne redukcione moći. Sadržaj fenolnih jedinjenja i flavonoida određen je standardnim metodama, koje su u širokoj upotrebi. Najveći sadržaj flavonoida i fenolnih jedinjenja detektovan je kod metanolnog ekstrakta cveta (64.70 μg GAE/ml i 1.09 μg RE/ml, respektivno). Ukupna redukciona moć kreće se između 10.66 mg AAE/ml za ekstrakt korena, do 11.90 mg AAE/ml za ekstrakt cveta. Antioksidativna aktivnost, određena DPPH metodom, izražena je kao %RSC, i prema ovoj metodi svi ekstrakti pokazali su sličnu aktivnost. Značajna korelacija između metoda određivanja antioksidativne aktivnosti i metoda za određivanje ukupnih fenola i flavonoida ukazuje na to da ova jedinjenja imaju doprinos u ukupnoj antioksidativnoj aktivnosti biljaka. Prema dobijenim rezultatima, *A. clypeolata* se može smatrati potencijalnim izvorom prirodnih antioksidanasa.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BC-05

Cd influence on accumulation of compounds of ascorbate-glutathione cycle during vegetation of barley

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Keywords:
cadmium,
compounds of ascorbate-glutathione cycle,
ascorbic acid, glutathione,
vegetation of barley

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Abstract: The analysis of the experimental data has shown the interrelation of the ascorbate-glutathione cycle components with the malondialdehyde (MDA) content, with oxidative reactions in barley (Hordeum vulgare L.) being enhanced with the increase in Cd exposure time. Particularly pronounced oxidative processes related to MDA accumulation were reported on day 80 of vegetation due to rather inactivation of the ascorbate-glutathione cycle components. Only on day 20 of Cd exposure, an increase was noted in the ascorbic acid content, whereas in the following periods the contents of ascorbic acid and glutathione were reduced.

Sažetak

Analiza eksperimentalnih podataka je pokazala interkorelaciju komponenti askorbinsko-glutationskog ciklusa i sadržaja malondialdehida (MDA) sa oksidativnim reakcijama u ječmu (Hordeum vulgare L.) pojačanim sa povišenjem izlaganja kadmiju. Naročito izraženi oksidativni procesi povezani sa MDA akumulacijom su zabilježeni u osamdesetom danu vegetacije usljed inaktivacije komponenti askorbinsko-glutationskog ciklusa. Povišenje sadržaja askorbinske kiseline je je primjećenou dvadesetom danu izlaganja kadmiju, dok je u ostalom period sadržaj askorbinske kiseline I glutationa bio umanjen.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-BC-06

Expression of caveolin-1 on bladder smooth muscle under psychological stress in male rats

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Keywords:
Caveolin-1,
western blot,
immunohistochemistry,
water avoidance stress.

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Abstract: Stress can generate and worsen urinary symptoms and functional urinary disorders such as interstitial cystitis (IC). Recently, it has been suggested that bladder smooth muscle caveolae might regulate pivotal signaling processes involved in contraction. Altered expression of caveolin proteins may lead to bladder dysfunction. In this study, we aimed to study caveolin-1 expression on bladder smooth muscle in water avoidance stress (WAS) model in male rats.

Twelve Wistar rats were divided into 2 groups: Control group (n: 6): which had no intervention and chronic stress group (WAS, n: 6): underwent 2 hour daily WAS for 5 days. At the end of the study intracardiac blood was withdrawn for determination of serum cortisol levels. Urinary bladders were also removed for determination of caveolin -1 expression by immunohistochemistry and western blot analyses. Chronic stress group revealed significantly higher levels of serum cortisol when compared to controls. Expression and localization of caveolin-1 showed no significance between the groups according to immunohistochemistry and western blot analyses. Our results revealed that WAS does not cause an obvious alteration in caveolin-1 expression in the bladder smooth muscle of male rats. Therefore, more studies focusing on the molecular mechanism of stress induced IC are warranted to figure out its pathogenesis.

Sažetak

Stres može uzrokovati I pogoršati simptome funkcionalnih urinarnih oboljenja kao što je interstitialni cistitis (IC). Dokazano je da kaveola glatkog mišićnog tkiva mjehura može regulirati process ključne signalizacije koji predstavlja dio kontrakcije. Promijenjena ekspresija proteina kaveolina može dovesti do disfunkcije mokraćnog mjehura. U ovom radu proučavali smo ekspresiju kaveolin-1 na glatke mišiće mokraćnog mjehura na "water avoidance stress" (WAS) model stresa u mužjacima štakora.

Dvanaest Wistar štakora je podijeljeno u dvije grupe: kontrola grupa (n:6) koja nije imala intervenciju I grupa sa hroničnim stresom (WAS, n:6): koja je bila pod WAS uticajem 2 sata dnevno, 5 dana. Na kraju studije, uzeta je intrakardijalnim krv za određivanje nivoa kortizola u serumu. Mokraćni mjehuri štakora su uzete za imunohemijsko određivanje ekspresije kaveolin-1 I za wester blot analizu.

Hronični strest je uzrokovao znatno više nivoe kortizola u serumu u poređenju sa kontrolama. Ekspresija I lokalizacija kaveolina-1 nije pokazala značajne razlike između grupa kada je riječ o imunohemijskim I western blot analizama.

Naši rezultati su pokazali da WAS ne uzrokuje vidljive alteracije u ekspresiji kaveolina-1 u glatkim mišićima mokraćnog mjehura mužjaka štakora. Zbog toga je neophodan veći broj studija o molekularnomk mehanizmu stresa induciranog sa IC koje će osigurati razumijevanje njegove patogeneze.

POSTER PRESENTATIONS

Organic and Medicinal Chemistry

(OMC)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-01

Quantification of Organochlorine Pesticides in Selected Food Samples by GC/ECD

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Keywords:
GC/ECD;
D-SPE;
QuEChERS;
Food samples;
Organochlorine pesticides

Abstract: Some of organochlorine pesticides (OPCs) are widely used in agronomy. Nowadays most of them are banned by EU legislation and proper MRL values are established. Fifteen different OCPs: four isomers of HCH (α, β, γ and δ), heptachlor epoxide, heptachlor, aldrine, dieldrine, endrine, 4.4`DDE, 4.4`DDD, 4.4`DDT, α and β isomer of endosulphane, endosulphane sulphate were analyzed. The samples of oranges, lemons, strawberries, lettuces, apples and wheat that were obtained from local markets were analyzed. Extraction of OCPs and cleaning of extracted samples were performed by QuEChERS dispersive SPE method. The samples were analyzed by GC/ECD. Multiple pesticides were found in some samples, and value of investigated OCPs was higher than MRL values directed by EFSA. The most contaminated was lemon bark. In that sample four pesticides, γ– HCH, β– HCH, heptachlor epoxide and endrine, exceeded MRL values.

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Sažetak

Neki od organohlornih pesticida (OCPs) imaju široku upotrebu u agronomiji. Većina njih je zabranjena odgovarajućim propisima Evropske unije sa uspostavljenim MRL vrijednostima. Petnaest različitih OCPs: četiri izomera HCH (α, β, δ, γ), heptahlor epoksid, heptahlor, aldrin, dieldrin, endrin, 4.4`DDE, 4.4`DDD, 4.4`DDT, α i β izomer endosulfana i endosulfan sulfat su analizirani. Ispitivani uzorci su bili: naranča, limun, zelena salata, jagoda, jabuka i pšenica. Ekstrakcija i prečišćavanje dobijenih uzoraka izvršeno je disperznom SPE po QuEChERS metodi. Uzorci su analizirani GC/ECD metodom. U pojedinim uzorcima je pronađeno više vrsta OCPs pesticida, i te vrijednosti su bile veće od dozvoljenih vrijednosti propisanih od strane EFSA. Najviše kontaminiran uzorak je limun, i to kora limuna. U tom uzorku su pronađena četiri pesticida, γ –HCH, β -HCH, heptahlor epoksid i endrin čije izmjerene vrijednosti prelaze vrijednosti MRL

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-02

Determination of Certain Phenolic Compounds in *Crataegus monogyna* and *Crataegus microphylla* by HPLC-ED

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Keywords:
Crataegu monogyna Jacq.,
Crataegus microphylla C. Koch,
flavonoids,
phenolic acids,
HPLC-ED.

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Abstract: Investigations of *Crataegus* species is typically focused on the identification and quantification of flavonoids, phenolic acids and anthocyanins, which have been shown to have pharmacological activity. The main flavonoids and phenolic acids found in *Crataegus* species are hyperoside, vitexin, quercetin, rutin, chlorogenic acid, gallic acid and caffeic acid. The aim of the work was to determin the content of some phenolic compounds of two *Crataegus* species growing in Bosnia and Herzegovina. In this study, ethanolic extracts of fruits, leaves and flowers of *Crataegus monogyna* and *Crataegus microphylla* were prepared by Soxhlet and ultrasonic extraction. The content of hyperoside, caffeic acid and gallic acid were determined by HPLC method with electrochemical detection.

The content of hyperoside in the investigated extracts varied from 0 to 19.28 mg g^{-1} of extract while content of gallic acid ranged from 0.015 to 1.76 mg g^{-1} of extract, and caffeic acid whose content varied from 0.16 to 2.72 mg g^{-1} extract.

Sažetak

Istraživanja vrsta roda *Crataegus* fokusirana su na identifikaciju i kvantifikaciju flavonoida, fenolskih kiselina i antocijanina, koji su pokazali da imaju faramakološko dejstvo. Glavni flavonoidi i fenolske kiseline pronađeni u vrsta roda *Crataegus* su hiperozid, viteksin, kvercetin, rutin, hlorogenska kiselina, galna kiselina i kafena kiselina. Cilj rada bio je određivanje sadržaja nekih fenolskih spojeva u različitim vrstama roda *Crataegus* koje rastu u Bosni i Hercegovini. U ovom istraživanju, etanolni ekstrakti plodova, lišća i cvijetova *Crataegus monogyna* i *Crataegus microphylla* su pripremljeni Soxhlet i ultrazvučnom ekstrakcijom. Sadržaj hiperozida, kafene kiseline i galne kiseline određen je HPLC metodom sa elektrohemijskom detekcijom. Sadržaj hiperozida u ispitivanim ekstraktima je varirao od 0 do 19.28 mg g^{-1} ekstrakta, galne kiseline se kretao od 0.015 do 1.76 mgg^{-1} ekstrakta, a kafene kiseline od 0.16 do 2.72 mg g^{-1} ekstrakta.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-03

Tyrosinase and Lipoxygenase Inhibition and Antioxidant Activity of an Aqueous Extract from *Epilobium angustifolium* L. Leaves

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Keywords:
Epilobium angustifolium L., tyrosinase, lipoxygenase inhibitory activities and antioxidant effects.

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Abstract: Herbs have been utilized to treat acute and chronic disorders since thousand years. *Epilobium angustifolium* L. (Onagraceae) is used as herbal and digestive plant all over the world. The *Epilobium* extracts are reported to have analgesic, antimicrobial, antimotility, antiproliferative, antiinflammatory, antitumor and antiandrogenic activities. Phytochemical screenings of aerial parts of *Epilobium* species revealed the presence of steroids, triterpenes, fatty acids, phenolic acids, macrocyclic tannins and flavonoids. In the present study, the antioxidant activity and tyrosinase, lipoxygenase inhibitor activities of *E. angustifolium L.* have been examined. Total phenolic and total flavonoid content, reducing power, superoxide anion radical scavenging, hydroxyl radical scavenging, 2,2-diphenyl-1-picryl-hydrazyl (DPPH) radical scavenging, 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) radical scavenging activities were used to evaluate the antioxidant activities. The results were compared with natural and synthetic antioxidants. The aqueous extract of *E. angustifolium* exhibited strong tyrosinase (EC_{50}= 33.03 ± 3.71 µg/ml) and lipoxygenase inhibitory activities (EC_{50}= 0.57 ± 0.06 µg/ml). The extract also showed good antioxidant activity in all antioxidant tests. According to these results, *E. angustifolium* may be considered as an important source for pharmaceutical, cosmetic and food manufactures due to its tyrosinase, lipoxygenase inhibitory activities and antioxidant effects.

Sažetak

Ljekovito bilje se koristi za liječenje akutnih i hroničnih poremećaja već hiljadama godina. *Epilobium angustifolium* L. (Onagraceae) je biljka koja se koristi u prehrani i liječenju širom svijeta. Kako navode izvještaji *Epilobium* ekstrakti imaju analgetsku, antimikrobnu, antidijarojitsku, antiproliferativnu, antiupalnu, antitumornu i antiandrogenu aktivnost. Fitohemijske provjere nadzemnih dijelova *Epilobium* vrsta otkrile su postojanje steroida, triterpena, masnih kiselina, fenolnih kiselina, makrocikličnih tanina i flavanoida. U ovom istraživanju antioksidativna i inhibitorska aktivnost tirozinaze i lipoksigenaze *E. angustifolium L.* je istražena. Ukupni sadržaj fenola i flavonoida, redukcijska moć, istiskivanje superoksidnog anionskog radikala, istiskivanje hidroksil radikala, istiskivanje 2,2-difenil-1-pikril-hidrazil (DPPH) radikala, istiskivanje 2,2'-azino-bis(3-etilbenzotiazolin-6-sulfonska kiselina) (ABTS) radikala su aktivnosti korištene za određivanje antioksidativne aktivnosti. Rezultati su upoređeni sa prirodnim i sintetskim antioksidansima. Vodeni ekstrakt *E. angustifolium* je pokazao jaku tirozinaza (EC_{50}= 33.03 ± 3.71 µg/ml) i lipoksigenaza inhibitorsku aktivnost (EC_{50}= 0.57 ± 0.06 µg/ml). Ekstrakt je također pokazao dobru antioksidativnu aktivnost u svim antioksidativnim ispitivanjima. Sukladno ovim rezultatima,, *E. angustifolium* se može smatrati kao značajan izvor za farmacetsku, kozmetičku i prehrambenu proizvodnju zbog inhibitorske aktivnosti i antioksidativnih efekata tirozinaze i lipoksigenaze

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-04

Total Polyphenols, Flavonoids and Antioxidant Activity of Methanolic Extracts of Some *Crataegus* Fruits

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Keywords:
Polyphenols,
Flavonoids,
Hawthorn fruits,
Antioxidant activity.

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Abstract: Fruits of two *Crataegus* species (*C. monogyna and C. rhipidophylla*) from natural populations were analyzed for total polyphenols, total flavonoids and antioxidant activity using aqueous methanol and acidified aqueous methanol extraction mixtures. Phenolic and flavonoid content were determined using standard spectrophotometric assays. Results for total polyphenols were expressed as gallic acid equivalents and for total flavonoids, rutin and quercetin were used as standards. Generally, in both extraction systems higher content of total polyphenols and total flavonoids was found for *C. monogyna*. In aqueous methanol extracts total polyphenols ranged between 23.66–28.50 mg GAE/g DW; total flavonoids ranged between 0.99-1.689 mg RE/g DW and 0.436–0.806 mg QE/g DW. In acidified aqueous methanol extracts total polyphenols ranged between 24.93–28.62 mg GAE/g DW; total flavonoids ranged between 0.964–1.530 mg RE/g DW and 0.151–0.213 mg QE/g DW. The highest antioxidant activity determined by DPPH showed *C. monogyna* with higher values in acidified methanolic extracts. The highest correlation was determined between total polyphenols and antioxidant activity in aqueous methanol extracts. The results obtained in this study indicate that investigated hawthorn fruits can be considered as a natural source of phenolic compounds with good antioxidant capacity.

Sažetak

Plodovi dvije vrste gloga (*C. monogyna* i *C. rhipidophylla*) iz prirodnih populacija analizirani su na sadržaj ukupnih polifenola, ukupnih flavonoida i antioksidacijsku aktivnost u vodeno-metanolnim i zakiseljenim vodeno-metanolnim ekstraktima. Sadržaj fenola i flavonoida je određen standardnim spektrofotometrijskim metodama. Rezultati za ukupne polifenole su izraženi u ekvivalentima galne kiseline dok su rutin i kvercetin korišteni kao standardi u određivanju ukupnih flavonoida. Generalno, u oba ekstrakciona sistema veći sadržaj ukupnih polifenola i ukupnih flavonoida je određen za *C. monogyna*. U vodeno-metanolnim ekstraktima sadržaj ukupnih fenola je bio između 23.66–28.50 mg GAE/g s.u; ukupnih flavonoida između 0.99-1.689 mg RE/g s.u. i 0.436–0.806 mg QE/g s.u. U zakiseljenim vodeno-metanolnim ekstraktima sadržaj ukupnih fenola je bio između 24.93–28.62 mg GAE/g s.u; ukupnih flavonoida između 0.964–1.530 mg RE/g s.u i 0.151–0.213 mg QE/g s.u. Najveću antioksidacijsku aktivnost, određenu DPPH metodom, imali su zakiseljeni metanolni ekstrakti *C. monogyna*. Najveća korelacija je određena između sadržaja ukupnih polifenola i antioksidacijske aktivnosti za vodene metanolne ekstrakte. Rezultati dobiveni u ovoj studiji ukazuju da se plodovi ispitivanih vrsta glogova mogu smatrati prirodnim izvorom fenolnih jedinjenja sa dobrom antioksidacijskom aktivnošću.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-05

Total Monomeric Anthocyanins, Proanthocyanidins and Antioxidant Activity of Methanolic Extracts of Some *Crataegus* Fruits

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Keywords:
Anthocyanins,
Proanthocyanidins,
Hawthorn fruits,
Antioxidant activity.

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Abstract: Fruits of two *Crataegus* species (*C. monogyna and C. rhipidophylla*) from natural populations were analyzed for total monomeric anthocyanins, total proanthocyanidins and antioxidant activity using aqueous methanol and acidified aqueous methanol extraction mixtures. Anthocyanins were determined by a pH differential method, proanthocyanidins with acid butanol assay, and results were expressed as cyanidin-3-glucoside equivalents and cyanidin chloride equivalents, respectively. In both extraction systems, higher anthocyanin content and proanthocyanidin content were obtained for *C. monogyna*. In aqueous methanol extracts total monomeric anthocyanins ranged from 0.580 to 0.686 mg CGE/g DW, and proanthocyanidins from 12.892 to 14.187 mg CE/g DW. In acidified aqueous methanol extracts total monomeric anthocyanins ranged from 0.628 to 0.688 mg CGE/ g DW, and proanthocyanidins from 13.575 to 15.451 mg CE/g DW. The highest antioxidant activity determined by DPPH showed *C. monogyna* in both extraction systems. The highest correlation was determined between proanthocyanidins content and antioxidant activity in aqueous methanol extracts. Overall results showed that investigated fruits can serve as good source of bioactive compounds in human diet, food and pharmaceutical industry.

Sažetak

Plodovi dvije vrste glogova (*C.monogyna* i *C. rhipidophylla*) iz prirodnih populacija analizirani su na sadržaj ukupnih monomernih antocijanina, ukupnih proantocijanidina i antioksidacijsku aktivnost u vodeno-metanolnim i zakiseljenim vodeno-metanolnim ekstraktima. Antocijanini su određeni pH diferencijalnom metodom, a kiselinsko-butanolna metoda je korištena za određivanje ukupnih proantocijanidina. Rezultati su izraženi u ekvivalentima cijanidin-3-glukozida, odnosno ekvivalentima cijanidin hlorida. U oba ekstrakciona sistema veće vrijednosti sadržaja antocijanina i proantocijanidina su dobivene za *C. monogyna*. U vodeno-metanolnim ekstraktima sadržaj ukupnih monomernih antocijanina je bio u opsegu od 0.580 do 0.686 mg CGE/g s.u. i proantocijanidina od 12.892 do 14.187 mg CE/g s.u. U zakiseljenim metanolnim ekstraktima sadržaj ukupnih monomernih antocijanina se kretao od 0.628 do 0.688 mg CGE/ g s.u., i proantocijanidina od 13.575 do 15.451 mg CE/g s.u. Najveća antioksidacijska aktivnost, određena DPPH metodom, izmjerena je u ekstraktima *C. monogyna*. Najveća korelacija je određena između sadržaja proantocijanidina i antioksidacijske aktivnosti u vodenim metanolnim ekstraktima. Sveukupni rezultati ukazuju da plodovi ispitivanih vrsta gloga mogu poslužiti kao dobar izvor bioaktivnih jedinjenja u ishrani kao i prehrambenoj i farmaceutskoj industriji.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-06

Synthesis of Some Coumarins and Comparison of Their Antioxidant Activities

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Keywords:
Coumarin,
Synthesis,
Antioxidant activity

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Abstract: Coumarins are naturally occuring benzopyrone derivatives and found in nature in a great variety of plants where they have an important effect on plant biochemistry and physiology. Recently, coumarins and their derivatives were extensively studied for their antioxidative and enzyme inhibitory properties. Furthermore, the coumarin derivatives, used as selective MAO inhibitors, are also widely reported. Pechmann, Perkin, Knovenegal, Reformatsky and Wittig reactions are some of the commonly employed reactions for the syntheses of coumarins and its derivatives. The Pechmann's reaction is widely used in the synthesis of 4-substituted coumarins in good yields. In these reactions, mineral acids, Lewis acids, ionic liquids and etc. have been employed as catalyst. In this work; 4-methyl-7-hydroxy-, 4-propyl-7-hydroxy- and 4-methyl-7-methoxy- coumarin compounds were synthesized by using oxalic acid or bismuth nitrate as catalysts. They were purified either crystallization or column chromatography. Structures of these products were characterized by spectroscopic methods (IR,^{1}H-NMR, ^{13}C-NMR, MS). Furthermore, the obtained coumarins were compared according to antioxidant activity by DPPH method. 4-Methyl-7-methoxy coumarin showed the best activity.

Sažetak

Kumarini su benzopironski derivati zastupljeni u prirodi u velikom broju biljaka, gdje pokazuju značajan uticaj na biohemiju i fiziologiju biljaka**.** Nedavno su izvršena opsežna proučavanja antioksidativnih i enzimskih inhibitorskih svojstava kumarina i njihovih derivata. Nadalje, derivati kumarina su korišteni kao selektivni MAO inhibitori, što stoji u mnogim izvještajima. Reakcije Pechmanna, Perkina, Knovenegaal, Reformatskog i Wittiga su često korištene reakcije za sintezu kumarina i njihovih derivata. Pechmann-ova reakcija se naširoko koristi za sintezu 4-substituiranih kumarina, sa dobrim prinosima. U ovim reakcijama kao katalizatori se koriste mineralne kiseline, Lewisove kiseline, jonske tečnosti itd. U ovom radu 4-metil-7-hidroksi-, 4-propil-7-hidroksi- i 4-metil-7-metoksi-kumarinski spojevi su sintetizovani uz korištenje oksalatne kiseline ili bizmut nitrata kao katalizatora. Prečišćeni su kristalizacijom ili hromatografijom na kolonama. Struktura ovih produkata okarakterizirana je spektroskopskim metodama (IR,^{1}H-NMR, ^{13}C-NMR, MS). Nadalje, antioksidativna aktivnost dobijenih kumarina je upoređena DPPH metodom. Najbolju aktivnost je pokazao 4-metil-7-metoksi kumarin.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-07

Catecholase-Mimetic Activity of Fe(II) Complex with New N_2O_2 Donor Schiff Base Ligand

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Keywords:
Schiff base,
catecholase-mimetic activity,
3,5-Di-*tert*-butylcatechol,
Michaelis-Menten kinetics.

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Abstract: There is continuing interest in the biomimetic catalytic activity of transition metal complexes, which may serve as structural and functional models for various metalloenzymes. The chemistry of mononuclear iron(II) complexes has aroused considerable interest as iron has been found in active sites of the large number of metalloenzymes. Metal complex based functional metalloenzyme models are of considerable interest both as sources of mechanistic information on enzyme reactions and as possible starting points for developing biomimetic catalysts for synthetic applications. In this study, a new N_2O_2 donor Schiff-base and its Fe(II) complex were synthesized by condensation of 2-aminobenzylamine with 6-formyl-7-hydroxy-5-methoxy-2-methylbenzopyran-4-one and by using an appropriate Fe(II) salt, respectively. The prepared compounds were characterized by elemental analysis, FT-IR, and NMR. The catecholase-mimetic activity of the Schiff Base Fe (II) complex was performed for the oxidation of 3,5-di-*tert*-butylcatechol (3,5-DTBC) in methanol at 25 C, where the electronic spectra were recorded at different time intervals. The yield of the quinone (3,5-DTBQ) was determined from the measured absorbance at 400 nm of the resulting solution. The compatibility of catalytic reaction with Michaelis-Menten kinetics was also investigated.

NOTE: *This study has been supported by The Scientific and Technological Research* Council *of Turkey (TÜBİTAK) through project no: 113Z604.*

Sažetak

Stalan je interes za biomimetske katalitičke aktivnosti kompleksa prijelaznih metala koji mogu poslužiti kao strukturni i funkcionalni modeli za razne metaloenzime. Razlog velikoh interesovanja za hemiju kompleksa mononuklearnog željeza (II) je prisustvo željeza na aktivnim mjestima velikog broja metaloenzima. Funkcionalni modeli metaloenzima zasnovani na metalnim kompleksima su važni dvojako, kao izvori informacija o mehanizmu enzimskih reakcija i kao osnove za početak i razvoj biomimetskih katalizatora za sintetičke aplikacije. U ovom istraživanju sintetiziran je novi N_2O_2 donor Schiffove baze i njegov Fe (II) kompleks kondenzacijom 2-aminobenzilamina sa 6-formil-7-hidroksi-5-metoksi-2-metilbenzopiran-4-onom koristeći odgovarajuću Fe (II) sol, redom. Pripremljeni spojevi su karakterizirani elementarnom analizom, FT-IR-om i NMR-om. Kateholazno-mimetska aktivnost kompleksa Schiffove baze Fe (II) je izvedena za oksidaciju 3,5-di-terc-butilkatehola (3,5-DTBC) u metanolu na 25 °C a elektronski spektri su bilježeni pri različitim vremenskim intervalima. Prinos hinona (3,5-DTBQ) je određen mjerenjem apsorbancije otopine na 400 nm. Ispitivana je i usklađenost katalitičke reakcije sa kinetikom Michaelis-Menten-ove reakcije.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-08

Kinetic Studies on Catecholase-like Activity of New Schiff Base Cu(II) Complex

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Keywords:
Schiff base,
catecholase activity,
3,5-Di-*tert*-butylcatechol,
Michaelis-Menten kinetics

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Abstract: The oxidation of organic substrates with molecular oxygen under mild conditions is of great interest for industrial and synthetic processes. Active copper and iron centers dominate the field of biological oxygen chemistry and play a vital role in catalysis. Catechol oxidase is a type III active site protein containing copper which catalyzes the oxidation of *o*-diphenols to the corresponding *o*-quinones in a process known as catecholase activity.

In this study, a new Schiff-base and its Cu(II) complex were synthesized by condensation of 2-aminobenzylamine with 6-formyl-7-hydroxy-5-methoxy-2-methylbenzopyran-4-one and by using an appropriate Cu(II) salt, respectively. The prepared compounds were characterized by elementel analysis, FT-IR, and NMR. In order to determine the kinetics parameters of catechol oxidase-like activity of Schiff base Cu(II) complex, the oxidation of the 3,5-di-*tert*-butylcatechol (3,5-DTBC) was measured at 25°C by monitoring the increase of the absorption band at 390-400 nm of the product 3,5-di-*tert*-butylcatequinone (3,5-DTBQ). The compatibility of catalytic reaction with Michaelis-Menten kinetics also investigated by the method of initial rates by monitoring the growth of the 390–400 nm band of 3,5-DTBQ as a function of time.

NOTE:*This study has been supported by The Scientific and Technological Research Council* of *Turkey (TÜBİTAK) through project no: 113Z604.*

Sažetak

Oksidacija organskih supstrata s molekularnim kisikom pod blagim uvjetima rekacije je od velikog interesa za industrijske i sintetičke procese. Aktivni bakar i željezo centri dominiraju u području biološke kemije kisika i igraju vitalnu ulogu u biohemijskoj katalizi. Katehol oksidaze je tip III protein sa aktivnim mjestom koja sadrži bakar i koji katalizira oksidaciju O-difenola u odgovarajuće O-kinon u procesu poznatom kao kateholna aktivnost. U ovom istraživanju, nova Schiffova baza i kompleks sa Cu (II), je sintetiziran kondenzacijom 2-aminobenzilamina sa 6-formil-7-hidroksi-5-metoksi-2-methilbenzopiran-4-ona i uz pomoć odgovarajuće Cu (II) soli. Pripremljeni spojevi su karakte rizirani pomoću elementarne analize , FT-IR i NMR. Da bi se odredili kinetički parametri kompleksa Schiffove baze sa Cu (II) koji djeluje kao katehol oksidaza, oksidacija 3,5-di-tert-butilkatehol (3,5-DTBC) je mjerena na 25°C praćenjem povećanje apsorpcije proizvoda 3,5-di-tert-butylcatequinone (3,5-DTBQ) na 390-400 nm. Kompatibilnost katalitičke reakcije sa Michaelis-Mentenovom kinetikom, također istraživana metodom početne brzine rekacije praćenjem povecanja apsorpcije3,5-DTBQ na 390-400 nm u funkciji vremena.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-09

Electrochemical synthesis and characterization of poly [Co(salabza)] on Platinum electrode

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Keywords:
Schiff base metal complex, electropolymerization

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Abstract: Conducting polymer films have a wide variety of applications in many fields including electroanalysis, electrocatalysis, biosensors and corrosion protection. These films have been generally produced by electrochemical way. Electropolymerization allows uniform coating on irregular surfaces and easy electrochemical control of the film thickness. Interest in building conducting polymers containing complexed transition metals is ever-increasing, especially because metal centres can be electrically connected via the polymer skeleton. Such applications as for electrode modifiers, electrocatalysis and sensors, are especially interesting, since one can expect the electrochemical conversion of a whole multi-layer electroactive film. In recent years, the electropolymerization of various Schiff base-metal complexes have been investigated. Researchers have incorporated Schiff base complexes into polymers, generating new materials with useful mechanical, thermal, chemical and electronic properties.

In this study, electrochemical polymerization of Co(II)-(*N*,*N'*-bis(salicylidene)-2-aminobenzylamine (poly[Co(salabza)] have been achieved by Cyclic Voltammetry (CV) technique on the platinum electrode in non-aqueous acetonitrile solution consist 0.15 M $LiClO_4$ as supporting electrolyte. The characterization of the polymers was done by using FT-IR, UV-vis, CV, Scanning Electron Microscopy (SEM) techniques.

Sažetak

Provodljivi polimeri imaju široku primjenu u oblastima elekroanalize, elektrokatalize, biosenzora i zaštite od korozije. Polimerni filmovi se uglavnom dobijaju elektrohemijskim putem. Elektropolimerizacija omogućava ravnomjerno nanošenje filma na neravne površine i lahku elektrohemijsku kontrolu debljine filma. Sve je veći interes za stvaranje provodnjivih polimera koji sadrže prelazne metale u kompleksu zbog mogućnosti da se metalni centri mogu elektro-vezati preko polimernog kostura. Pogotovo je zanimljiva njihova primjena kao elektrodnih modifikatora, senzora u elektrokatalizi jer se može očekivati elektrokemijska konverzija višeslojnog elektroaktivnog filma. U poslednje vrijeme istraživana je elektropolimerizija raznih metalnih kompleksa sa Schiff-ovim bazama. Istraživači su inkorporirali komplekse sa Schiff-ovim bazama u polimere, stvarajući nove materijale s korisnim mehaničkim, termičkim, hemijskim i elektronskim osobinama.. Elektrokemijska polimerizacija Co(II)-(N,N'-bis(saliciliden)-2-aminobenzilamina (poli[Co(salabza)] postignuta je cikličnom voltametrijom (CV) na platinskoj elektrodi u nevodenoj otopini acetonitrila se 0,15 M $LiClO_4$-om kao pomoćnim elektrolitom. Polimeri su karakterizirani FT-IR-om , UV-Vis-om, CV–om i SEM tehnikom (skenirana elektronska mikroskopija).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-10

Total Phenolic and Flavonoid Content and Antioxidant Activity of Two *Crataegus* Species from Bosnia

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Keywords:
Crataegus
Total phenolics
Flavonoids
Antioxidant activity
ABTS
DPPH

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Abstract: Hawthorn is the common name for *Crataegus* species in *Rosaceae* family. There are over 1000 species of *Crataegus* distributed primarily in Asia, Europe and North America.
The aim of this work is to determine the total phenolic and total flavonoid content as well as antioxidant activity of two *Crataegus* species; *C. monogyna* and *C. microphylla* growing wild in Bosnia. Extracts of leaves and flowers (LF), and berries (B) were prepared by ultrasound-assisted extraction using ethanol as solvent. Total phenolic content was determined by Folin-Ciocalteu method and content varied from 51,50 mgGAE/g for *C. monogyna* (B), to 66.25 mgGAE/g for *C. monogyna* (LF). Total flavonoid content was determined using $AlCl_3$ method. The lowest content of flavonoids was found for *C. microphylla* (B), 0.22 mgQE/g, and the highest for *C. monogyna* (LF), 8.74 mgQE/g. Two spectrophotometric methods, DPPH and ABTS, were used for determination of the antioxidant activity of the samples. The best antioxidant was sample of *C. microphylla*, by both antioxidant methods applied. Extract from the leaves and the flowers (LF) had IC_{50} value of 1.09 mg/mL for DPPH, and extract from the berries (B) had IC_{50} of 0.41 mg/mL for ABTS method. There was no correlation between total phenolic and flavonoid content and antioxidant activity.

Sažetak

Glog je uobičajeno ime za vrste roda *Crataegus*, porodice *Rosaceae*. Postoji preko 1000 vrsta *Crataegus* rasprostranjenih uglavnom u Aziji, Evropi i Sjevernoj Americi. Cilj ovog rada je da se odredi sadržaj ukupnih fenola i flavonoida kao i antioksidacijska aktivnost dvije vrste roda *Crataegus*; *C. monoyna* i *C. microphylla* koje divlje rastu u Bosni. Ultrazvučna ekstrakcija listova i cvjetova (LF) i plodova (B) urađena je uz etanol kao rastvarač. Ukupan sadržaj fenolskih spojeva je određen Folin-Ciocalteu metodom i njihov sadržaj je varirao od 51,50 mgGAE/g za *C. monogyna* (B), do 66.25 mgGAE/g za *C. monogyna* (LF). Sadržaj flavonoida je određen metodom sa $AlCl_3$. Najniži sadržaj imao je uzorak *C. microphylla* (B), 0.22 mgQE/g, a najviši uzorak *C. monogyna* (LF), 8.74 mgQE/g. Dvije spektrofotometrijske metode, DPPH i ABTS, su korištene za određivanje antioksidacijske aktivnosti uzoraka. Najbolji antioksidans, po obje metode, je bio uzorak *C. microphylla*. Ekstrakt listova i cvjetova (LF) je imao IC_{50} 1.09 mg/mL za DPPH, a ekstrakt plodova (B) vrijednost IC_{50} od 0.41 mg/mL za ABTS metod. Nije nađena korelacija između sadržaja ukupnih fenola i flavonoida i antioksidacijske aktivnosti.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-11

Chemical Composition and Antioxidant Activity of Four Asteraceae Essential Oils

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Keywords:
Essential oil
Achillea millefolium L.
Arnica montana L.
Artemisia absinthium L.
Artemisia annua L.
Antioxidant activity

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Abstract: Hydrodistilled volatile oils from the aerial parts of four plants of Asteraceae family, *Achillea millefolium* L., *Arnica montana* L., *Artemisia absinthium* L., and *Artemisia annua* L. were analyzed by GC/MS. More than one hundred and fifty compounds were identified in all samples, ranging from 71.5%-97.8% of the total oil. Essential oils showed significant differences in their content and chemical composition. The yield of oil varies from 0.07% for *A. montana* to 0.18% for *A. annua*. A high percentage of oxygenated monoterpenes is the main characteristic of *A. millefolium* and *A. absinthium* essential oils with camphor (19.2%) and *iso*-ascaridol (21.9%) as the major constituents, respectively. In contrast, the main component of *A. annua* oil was oxygenated sesquiterpene selina-3,11-dien-6-α-ol (9.6%), while the chemical composition of *A. montana* oil was characterized by a high content of saturated fatty acids with *n*-hexadecanoic acid (15.5%) as the main constituent. Antioxidant activity was tested using four different methods, DPPH, ABTS, Reducing power, and Phosphomolybdenum Assay. The highest antioxidant activity had essential oil of *A. montana* using DPPH and ABTS method, while *A. absinthium* oil showed the best ability to reduce Fe ions. In addition, it was found that all essential oils analyzed are significantly weaker antioxidants than chlorogenic acid used as a standard.

Sažetak

Esencijalna ulja izolirana hidrodestilacijom iz nadzemnih dijelova četiri biljne vrste porodice Asteraceae, *Achillea millefolium* L., *Arnica montana* L., *Artemisia absinthium* L. i *Artemisia annua* L., analizirana su primjenom GC/MS. Više od stotinu i pedeset komponenata je identificirano u svim uzorcima, što predstavlja 71.5%-97.8% ukupnog ulja. Esencijalna ulja pokazuju značajne razlike u sadržaju i hemijskom sastavu. Prinosi ulja se razlikuju od 0.07% za ulje *A. montana* do 0.18% za ulje *A. annua*. Visok procenat oksigeniziranih monoterpena je glavna karakteristika esencijalnih ulja *A. millefolium i A. absinthium*, sa kamforom (19.2%), odnosno *izo*-askaridolom (21.9%), kao glavnim konstituentom. Nasuprot tome, glavna komponenta esencijalnog ulja *A. annua* je oksigenizirani seskviterpen selina-3,11-dien-6-α-ol (9.6%), dok je hemijski sastav ulja *A. montana* karakteriziran visokim sadržajem zasićenih masnih kiselina, sa *n*-heksadekanskom kiselinom (15.5%) kao glavim konstituentom. Antioksidativna aktivnost je određena primjenom četiri različite metode, DPPH, ABTS, redukcijska moć i fosfomolibdatnom metodom. Najbolju antioksidativnu aktivnost, primjenom DPPH i ABTS metode, imalo je esencijalno ulje *A. montana*, dok je ulje *A. absinthium* pokazalo najbolju sposobnost da reducira jone Fe. Uz navedeno, nađeno je da su sva esencijalana ulja znatno slabiji antioksidansi od hlorogenske kiseline koja je korištena kao standard.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-12

Synthesis and Characterization of 1,4-naphthoquinone Derivatives

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Keywords:
naphthoquinones,
sulfanyl naphthoquinones,
amino naphthoquinones

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Abstract: The chemistry of quinones is of considerable interest since this class of compounds includes many natural products and numerous important synthetic products. The naphthoquinone chromophore has been found to possess potent antimalarial, antifungal, antibacterial, anti-inflammatory, and antitumor activities. Reactions of various nucleophiles such as thiols or amines with naphthoquinones represent a common synthetic route to many fused heterocyclic rings which have been used as synthetic intermediates in medicinal chemistry and for dyestuffs. In consideration of these, herein, a series of some interesting 1,4-naphthoquinone derivatives have been synthesized from the reactions of 2,3-dichloro-1,4-naphthoquinone with nucleophiles in the presence of triethylamine or Na_2CO_3 in ethanol at room temperature or reflux. The structures of novel compounds were determined by micro analysis, FTIR, ^{1}H NMR, ^{13}C NMR, and MS.

Sažetak

Hemija kinona je prilično interesantna budući da ova klasa spojeva uključuje mnoge prirodne produkte i važne brojne sintetske produkte. Nađeno je da kromofor naftokinona posjeduje jaku antimalaričnu, antifungalnu, antibakterijsku, antiupalnu i antitumornu aktivnost. Reakcije raznih nukleofila kao što su tioli ili amini sa naftokinonima predstavljaju opći sintetski put za mnoge spregnute heterociklične prstenove koji se koriste kao sintetički intermedijeri u medicinskoj hemiji i u sredstivama za bojenje. Uzimajući ovo u obzir, serija od nekoliko interesantnih 1,4-naftokinonskih derivata je sintetizirana u reakciji 2,3-dihlor-1,4-naftokinona sa nukleofilima, u prisustvu trietilamina ili Na_2CO_3 u etanolu pri sobnoj temperature ili refluksu. Strukture novih spojeva određene su mikroanalizom, FTIR, ^{1}H NMR, ^{13}C NMR, i MS.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-13

Investigation of Commercial Peppermint Oils of Japan and Turkey Origin by Chiral GC/MS

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Keywords:
Commercial Peppermint oil,
essential oil,
GC-MS

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Abstract: Peppermint oil is isolated from the plant *Mentha piperita L*, which is an aromatic perennial herb belonging to the family of Lamiaceae found all over the world. Peppermint oils of several mentha species can be used for pharmaceutical and nutritional aspects, as natural additives in medicine, drugs, foods, mouthwash, toothwash, chewing gum and confectionary because of their antiviral, antibacterial, antifungal, pesticidal, antiinflammatory and antimicrobial properties and pain decreasing and immunity increasing activities.

The aim of this study was to investigate the difference of the chemical composition of several commercial peppermint oils because their pharmaceutical activities such as muscle, head, nerve, rheumatic pain and spasms relieving effects are not equal. According to the literatüre survay, the best medicinal therapy is obtained with Japanese peppermint oil, but this mint oil is very expensive. The desire to know what is the effective criterion between the Turkish and Japanese peppermint oil. Chemical composition of these mint oils were investigated by GC/MS, chiral GC/MS, IR and determination by optical rotation, in order to find out which chemical substances may cause this difference.

Three commercial Japanese oil samples, bought in Germany, one Turkish commercial oil sample, and one nutritional peppermint oil obtained by Clevenger method from the mint leaves were used for this investigation.

Sažetak

Ulje peperminta je izolirano iz biljke *Mentha piperita L*, koja je aromatska cjelogodišnja biljka iz porodice Lamiaceae i koja se može pronaći diljem svijeta. Pepermint ulja od nekoliko vrsta mente se mogu koristiti u farmaceutske i prehrambene svrhe, kao prirodni aditivi u medicini, lijekovima, hrani, vodici za ispiranje usta, pastama za zube, žvakaćim gumama i konditorskim proizvodima, ali i zbog svojih antivirusnih, antibakterijskih, antigljivičnih, pesticidalnih, antiupalnih i antimikrobnih svojstava kao i zbog smanjenja bolova i jačanja imuniteta. Cilj ovog istraživanja je da se ispita razlika između hemijskog sastava nekoliko komercijalnih pepermint ulja zbog toga što njihovo farmaceutsko djelovanje kao što je ublažavanje mišićne boli, glavobolje, bolova živaca, reumatskih bolova i efekti ublažavanja grčeva nije isto. U skladu s literaturnim pretraživanjem, najbolja medicinska terapija se dobije sa Japanskim pepermint uljem, ali ovo ulje je veoma skupo. Želja je bila da se spozna šta je efektivni kriterij između turskog i japanskog pepermint ulja. Hemijski sastav ovih mentinih ulja ispitan je sa GC/MS, hiralnim GC/MS, IR i određena je optička rotacija, u cilju da se otkrije koja hemijska tvar čini razliku. Tri uzorka komercijalnog japanskog ulja, kupljenih u Njemačkoj, jedan uzorak komercijalnog turskog ulja i jedan uzorak pepermint ulja dobijen Clevengerovom metodom iz lišća mente su korišteni za ispitivanje. Dobijeni su različiti rezultati sa IR, hiralnim GC/MS i optičkom rotacijom zbog razlike u hemijskom sastavu ovih pet uzoraka ulja mente.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-14

Antiacetylcholinesterase, Antielastase and Antioxidant Activities of Some Ketoxime Tetradecanoic Acid Methyl Ester Isomers

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Keywords:
Acetylcholinesterase,
elastase,
antioxidant,
inhibitor,
ketoxime esters.

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Abstract: Oximes and *O*-substituted oximes are important compounds in organic and medicinal chemistry due to their practical applications in several drugs, biologically active compounds and as therapeutic immuno-agents. Recently, biological activity of oxime compounds has attracted more interest. In this study, we aimed to investigate the inhibition effect to both acetylcholinesterase, and elastase, and antioxidant activities of some ketoxime tetradecanoic acid methyl ester isomers. With this aim, the mentioned ketoxime ester isomers were synthesized and characterized for the first time from their corresponding keto ester isomers. According to literature survey, there is no data about the inhibition of acetylcholinesterase which is an important criteria in Alzheimer disease by these ketoxime esters. Besides, the antielastase and antioxidant activities of these ketoxime esters were not studied until today. All the test compounds exhibited antiacetylcholinesterase, antielastase and antioxidant activities in this study. The enzyme inhibitory and antioxidant activities of these mentioned isomers were found to increase dose dependently. According to the experimental results of this study, the mentioned ketoxime esters may be used as a drug in Alzheimer disease and in pharmacy industry with their excellent antiacetylcholinesterase, antielastase and antioxidant activities tested in this study.

Sažetak

Oksimi I o-substituirani oksimi su važna jedinjenja u organskoj i medicinskoj hemiji zbog praktičnih aplikacija u lijekovima, biološki aktivnim jedinjenjima i terapeutskim imuno-agentima. Biološka aktivnost oksima privlači sve više pažnje. U ovoj studiji ispitivali smo inhibicioni uticaj acetilholinesteraze i elastaze kao i antioksidativne osobine nekih ketoksim tetradekanoičnih kiselih metilnih esterskih izomera. Da bi se izveo ovaj eksperiment, ketoksim esterski izomeri su po prvi put sintetizirani i karakterizirani od odgovarajućih keto ester izomera. Pregled literature je pokazao da nema podataka o inhibiciji acetilholinesteraze koja je važan pa rametar u Alzeheimerovoj bolesti i koja je povezana sa ketoksim esterima. Također, nema podatka o prethodnim studijama na antielastazama i o antioksidativnoj aktivnosti ketoksim estera. Sva testna jedinjenja u ovom radu su pokazala antiacetilholinesterazu, antielastazu i antioksidativnu aktivnost. Enzimske inhibitorne i antioksidativne aktivnosti pomenutih izomera su se povećavale sa dozom. Eksperimentalni podaci rada su pokazali da se steri ketoksima mogu koristiti kao lijekovi u liječenju Alzheimerove bolesti i u farmaceutskoj industriji na osnovu svojih odličnih antiacetilhloinesteraznih, antielastaznih i antioksidativnih osobina proučavanih u ovom radu.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-15

The Investigation of Reactions Between Polyhalogenated Dienes and Aliphatic Mercaptans

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Keywords:
Mercaptans,
polyhalogenated dienes,
S-substituted-1-buten-3-yne,
S-substituted polyhalogenobuta-1,3-diene

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Abstract: As it is known polyhalogenated diene compounds possess a broad spectrum of useful properties such as good dielectrics, refrigerant and heat-transfer agents, and also aerosol, lubricant and floatation agents and hold algicidal, bactericidal and fungicidal activities. Various polyhalogenated dienes express high antitumour activity. The formation of C–S bonds is one of the most important reactions in numerous synthesis of intermediates and targets with biological and pharmaceutical impact, and in molecular precursors for the development of materials. The aim of this study is to investigate the reactions between aliphatic mercaptans and polyhalogenated dienes such as 1,1,2,4,4-pentachlorobuta-1,3-diene and 1-bromo-1,2,4,4-tetrachlorobuta-1,3-diene. The reactions were investigated with different molar ratio of mercaptans. Even though it was planned on yielding the S-substituted polyhalogenobuta-1,3-diene compounds, the S-substituted-1-buten-3-yne compounds were also formed as a product of the reactions.

Sažetak

Polihalogenirani dieni posjeduju široki spektar korisnih osobina kao što su dobre dielektrične, rashladne osobine kao I osobinu prevođenja toplote, mogu se koristiti kao aerosol, mazivo I plutajući agenti te posjeduju algicidalnu, baktericidalnu I fungicidalnu aktivnost. Različiti polihalogenirani dieni pokazuju visoku anticancer aktivnost. Nastanak C-S veza je jedna od najvažnijih reakcija u brojnim sintezama međuprodukata I targetiranju sa biološkim I farmaceutskim impaktom kao I molekularni prekursori u razvoju novih materijala.

Cilj ove studije je bio ispitati reakciju između alifatskih merkaptana I polihalogeniranih diena kao što su 1,1,2,4,4-pentahlorobuta-1,3-dien i 1-bromo-1,2,4,4-tetraclorobuta-1,3-dien. Reakcija je ispitana sa različitim molarnim udjelima markaptana. Iako je očekivano povećanje prinosa S-supstituiranih polihalogenobuta-1,3-dienskih jedinjenja, S-substituirani-1.buten-3-in jedinjenja su također nastala kao produkti reakcije.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-16

Elastase and Collagenase Inhibitory Activities of Ethanolic Extract from *Epilobium angustifolium* L. Leaves

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Keywords:
Epilobium angustifolium L., elastase and collegenase inhibitory activities.

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Abstract: The genus *Epilobium* is widely distributed all over the world and consists of over 200 species. Various members of the genus *Epilobium* have been used in folk medicine internally for prostate disease, menstrual and gastrointestinal disorders, rectal bleeding and externally as antiphlogistic. In Russia, due to a sweet and pleasant taste, it is usually consumed as tea for the treatment of stomach ulceration, gastritis and sleeping disorders. Elastase is the only enzyme capable of degrading elastin, an insoluble elastic fibrous protein of animal connective tissue. Elastase is known to cause rheumatoid arthritis, pulmonary emphysema, and other chronic inflammatory diseases by the protein degradation of human tissues. And also collagenases are endopeptidases that digest native collagen in the triple helix region. Collagens are the major fibrous component of animal extracellular connective tissue. Of particular interest is the relationship between collagenase and rheumatoid arthritis, metastasis, wound debridement, herniated disc treatment, angiogenesis, tissue repair, and cirrhosis. In this study, we have investigated the elastase and collagenase inhibitory activities of the ethanolic extract from E. *angustifolium* L. for the first time. The enzyme inhibitory activities of this extract were found to increase dose dependently. For this reason, this extract can be used in cosmetic industries due to their excellent elastase and collegenase activities observed in this study.

Sažetak

Rod *Epilobium* je raširen širom svijeta i sadrži preko 200 vrsta. Različiti članovi roda *Epilobium* koriste se u narodnoj medicini, interno za liječenje bolesti prostate, menstrualnih i stomačnih poremećaja, krvarenja rektuma i za vanjsku upotrebu protiv upala. U Rusiji zbog slatkog i ugodnog ukusa, često se koristi kao čaj za liječenje čireva u stomaku, gastritisa i poremećaja sna. Elastaza je jedini enzim koji je u stanju da razgradi elastin, nerastvorljivi elastični vlaknasti protein u vezivnim tkivima životinja. Poznato je da elastaza uzrokuje reumatoidni artritis, plućni emfizemu i druge hronične upalne bolesti usljed razgradnje proteina ljudskih tkiva. Kolagenaze su također endopeptidaze koje razgrađuju prirodni kolagen u području trostrukog heliksa. Kolageni su glavne vlaknaste komponente životinjskog vanćelijskog vezivnog tkiva. Od značajnog interesa je veza između kolagenaze i reumatoidnog artritisa, metastaza, uklanjanja mrtvog tkiva sa rane, liječenja diskushernije, angiogeneze, zacijeljivanja tkiva i ciroze. U ovom radu, ispitana je inhibitorna aktivnost elastaze i kolagenaze etanolskog ektrakta iz E. *angustifolium* L., po prvi put. Nađeno je da inhibitorske aktivnosti oba enzima ovog ekstrakta povećavaju dozu ovisno jedan od drugog. Zbog ovoga, ekstrakt se može koristiti u kozmetičkoj industriji usljed odličnih aktivnosti elastaze i kolagenaze ispitanih u ovom radu.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-17

Biomarkers for Alzheimer's Disease, amyloid beta peptide (1-42) and total tau protein, highly increased in CSF of patients with hydrocephalus-postoperation status

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Keywords:
CSF Biomarkers**,** Amyloid beta peptide, Total tau protein; Hydrocephalus, Alzheimer's Disease, ELISA.

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Abstract: Cerebrospinal fluid (CSF) used to be the most informative fluid in biomarkers discovery for neurodegenerative disease prognosis as is in direct, physical contact with brain. Some products of brain specific activities are reflected in CSF. The core candidate CSF biomarkers proteins β-amyloid 1–42 (Aβ42) and total tau protein (T-tau) have a high performance to identify AD, as well as other neurodegenerative diseases and impaired mental function such Hydrocephalus (Hyd). Both proteins are linked to hallmark lesions of AD, amyloid plaques, and neurofibrillary tangles. We investigated levels of the Aβ42 and T-tau in lumbar punctured CSF samples collected from 47 Controls, 23 AD and 10 Hydrocephalus age matched patients and 10 ventricular CSF samples of patients in early childhood using ELISA-s, specifically constructed to measure tau isoforms and β-amyloid containing both the 1st and 42nd amino acids. Comparing with Control values for T-tau (287±49 pg/ml) and Aβ42 (645±52 pg/ml) high concentrations of T-tau (619±37pg/ml), ($p<0,001$) and low concentration of Aβ42 (382±42 pg/ml) ($p<0,01$) in the AD patients where detected. In elderly and in early childhood of patients with Hyd postoperation status, both biomarkers where highly significantly increased ($p<0,001$) compared with C and AD. Combination of both biomarkers differentiate AD from controls and other pathochemical conditions even in early stage. The fact that the T-tau and Aβ42 are present in CSF of very young patients with AD like pathology, may help early prediction for development of neurological disorders.

Sažetak

Cerebrospinalna tekućina (CSF) od svih fluida daje najviše podataka pri otkrivanju biomarkera za predviđanje neurodegenerativnih bolesti jer je u direktnom kontaktu sa mozgom. Neki produkti specifičnih moždanih aktivnosti se prenose u CSF. Glavni kandidati za CSF biomarkere β-amiloid 1–42 (Aβ42) i ukupni tau protein (T-tau) imaju visoku sposobnost identificiranja AD, drugih neurodegenerativnih bolesti i oštećenja mentalne funkcije poput hidrocefalusa (Hyd). Oba biomarkera ukazuju na AD lezije, amiloidne plakove i neurofibrilarna klubad. Ispitivali smo nivoe Aβ42 i T-tau u lumbalno punktiranim uzorcima CSF 47 kontrolna, 23 AD i 10 pacijenata sa Hyd slične starosne dobi i 10 ventrikularnih CSF uzoraka pacijenata rane životne dobi (novorođenčad), koristeći ELISA metodu specifično dizajniranu za mjerenje tau izoformi i β-amiloida sa obje 1. i 42. aminokiselinom. U odnosu na kontrolne vrijednosti za T-tau (287±49 pg/ml) i Aβ42 (645±52 pg/ml), kod AD su nađene visoke koncentracije T-tau (619±37 pg/ml), ($p<0,001$) i niske koncentracije Aβ42 (382±42 pg/ml) ($p<0,01$). Kod starijih kao i kod veoma mladih pacijenata sa Hyd postoperativnim statusom oba biomarkera su izrazito značajno uvećana ($p<0,001$) u odnosu na kontrolu i AD. Kombinacijom vrijednosti oba biomarkera diferencira se AD od kontrolnih i drugih patohemijskih slučajeva čak i u ranoj fazi. Činjenica da su T-tau i Aβ42 prisutni i u CSF veoma mladih pacijenata-novorođenčadi sa patologijom sličnom AD, može pomoći u ranoj predikciji razvoja neurodegenerativnih poremećaja.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-18

^{1}H NMR study of *trans,trans*-2,5-distyryl-furans and 2,5-distyryl-thiophenes

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Keywords:
^{1}H NMR,
distyryl-furan derivatives,
distyryl-thiophene derivatives

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Abstract: Organic molecules with delocalized π-electrons and electron donor and electron acceptor groups at the two opposite ends have been widely investigated owing to their ability to absorb light and to generate charge separation. The design and study of these *push–pull* systems have attracted our attention because of their properties to perform useful photoinduced functions such as fluorescent sensing, solar energy conversion, optical information storage and effects of non−linear optics. ^{1}H NMR spectral study of *trans*, *trans* isomers of 2,5-distyryl-furans and 2,5-distyryl-thiophenes, bearing an electron acceptor (nitro) and an electron donor (methoxy or dimethylamino) groups have been made. The ^{1}H NMR resonances of ethylenic protons in positions 2 and in position 5 of the furan/thiophene ring are discussed. Chemical shifts of ethylenic nuclei are influenced by the electronic effect of substituents causing shielding or deshielding of adjacent hydrogens. Comparison of chemical shifts was made with model compounds.

Sažetak

Organske molekule s delokaliziranim π elektronima koje na suprotnim krajevima sadrže elektron donorske i elektron akceptorske skupine, predmet su brojnih istraživanja zbog svojih fotoapsorpcijskih sposobnosti i generiranja nosioca naboja pa stoga i mogućnosti da obavljaju korisne fotoinducirane funkcije kao što su pohranjivanje optičkih informacija, pretvorba solarne energije i fluorescentno osjećanje iona. Ovdje je prikazana ^{1}H NMR analiza *trans, trans* izomera 2,5-distirilfurana i 2,5-distiriltiofena funkcionaliziranih elektron akceptroskom grupom (nitro) i elektrondonorskom grupom (metoksi ili dimetilamino) s naglaskom na pomake etilenskih protona u položaju 2 i 5 na furanskom odnosno tiofenskom prstenu. Napravljena je i usporedba kemijskih pomaka s modelnim spojevima.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-19

Determination of Gas-phase Basicity of Selected Amines, Guanidines and Phosphazenes Using Trichotomy Formula

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Keywords:
trihotomna formula,
amini, gvanidini,
fosfazeni,
bazičnost,
teorija funkcionala gustoće,
protonski afiniteti.

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Abstract: Three groups of organic bases: amines, guanidines and phosphazenes together with three known proton sponges: 1,8-bis(dimethylamine)naphthalene (DMAN), 1,8-bis(tetramethyl guanidine)naphthalene (TMGN) and 1,8-bis(hexamethyltriaminophosphazenyl)naphthalene (HMPN) were analyzed using trichotomy formula. Geometries and energies of neutral, protonated and cation-radical forms of molecules were calculated using DFT and *ab initio* methods. In all three investigated groups of organic bases, presence of aliphatic substituents resulted in proton affinity increase, lower values for Koopmans' energy and medium increase in relaxation energy. Aromatic substituents have resulted in almost similar values of proton affinities for amines and guanidines, while they had lower values for selected phosphazenes. Results of trichotomy analysis for proton sponges, when compared to monosubstituted naphthalenes, have shown an increase of proton affinity values by ~20, ~14 i ~24 kcal mol^{-1} compared to DMAN, TMGN and HMPN, which led to lower values of Koopmans' ionization energies and increase of formation energies of the protonated form in the reaction between cation-radical and neutral hydrogen. Relaxation energy did not have a significant influence.

Sažetak

Trihotomnom analizom ispitane su tri skupine organskih baza: amini, gvanidini i fosfazeni, te poznate tri protonske spužve: 1,8-bis(dimetilamino)naftalen (DMAN), 1,8-bis(tetrametilgvanidino)naftalen (TMGN) i 1,8-bis(heksametiltriaminofosfazenil)naftalen (HMPN). Geometrijske strukture i energije neutralne, protonirane i kation-radikalske forme molekule računate su korištenjem DFT i *ab initio* modela. Kod sve tri skupine baza, alifatski supstituenti povećavaju protonski afinitet tako što dolazi do izraženog smanjenja Koopmansove energije i umjerenog povećanja energije relaksacije. Aromatski supstituenti rezultirali su protonskim afinitetima koji su ostali približno nepromijenjeni kod amina i gvanidina, odnosno umjereno sniženi kod fosfazena. Kod protonskih spužvi, trihotomna analiza u odnosu na odgovarajuće monosupstituirane naftalene pokazala je povećanje PA koje iznosi ~20, ~14 i ~24 kcal mol^{-1} za DMAN, TMGN i HMPN što je bila posljedica smanjivanja Koopmansovih energija ionizacije, kao i povećanja energije nastanka protonirane forme u reakciji spajanja kation-radikala i neutralnog vodika, dok energija relaksacije nije imala značajniji utjecaj.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-20

Determination of Ascorbic Acid and Total Anthocyanin Content in Four *Crataegus* Species Growing Wild in Bosnia

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Keywords:
Crataegus monogyna Jacq.,
Crataegus microphylla,
C. Koch,
ascorbic acid,
total anthocyanins.

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Abstract: Plants of the genus *Crataegus*, Rosaceae, are widely distributed and have long been used in folk medicine for the treatment of various ailments such as cardiovascular disorders, as well as disorders of central nervous system and immune system diseases. The aim of this work was to determine content of ascorbic acid and total anthocyanins in some *Crataegus* species (*C. monogyna* Jacq., *C. microphylla* C. Koch, *C. macrocarpa* Hegetschw. and *C. subsphaericea* Gand). The content of ascorbic acid was done by iodometric titration. Plant extracts were prepared by maceration with acetic acid. The highest content of ascorbic acid (10.47 mg/100 g dry sample) was obtained for the sample of *C. subsphaericea* (berries). Total anthocyanin content was determined by the pH differential method, which is a rapid and simple spectrophotometric method. It is based on the anthocyanin structural transformation that occurs with a change in pH (colored at pH 1.0, and colorless at pH 4.5). Extracts of the investigated samples were prepared by Soxhlet, ultrasonic extraction, maceration with buffer, and maceration with ethanol. The most efficient method of extraction was maceration with ethanol. The results showed that the highest concentration of total anthocyanin (10.59 mg/100 g dry sample) was found in the sample of *C. subsphaericea* berries.

Sažetak

Biljke roda *Crataegus*, Rosaceae, su dosta raširene i imaju dugu tradiciju u narodnoj medicini za tretman različitih bolesti kao što su oboljena srca (kardiovaskularna oboljenja), oboljenja centralnog nervnog i imunog sistema. Cilj ovog rada jeste da se odredi sadržaj askorbinske kiseline i ukupni antocijanini u nekim biljnim vrstama roda *Crategus* (*C. monogyna* Jacq., *C. microphylla* C. Koch, *C. macrocarpa* Hegetschw. i *C. subsphaericea* Gand). Sadržaj askorbinske kiseline je određivan titracijom sa jodom. Priprema uzoraka je izvršena maceriranjem sa acetatnom kiselinom. Najveći sadržaj askorbinske kiseline (10.47 mg/100 g suhog uzorka) je dobiven u *C. subsphaericea* (plod). Sadržaj ukupnih antocijanina je određivan pH diferencijalnom metodom koja je brza i jednostavna spektrofotometrijska metoda. Bazirana je na strukturnoj transformaciji antocijanina koja se dešava sa promjenom pH (obojeno pri pH 1.0 i bezbojno pri pH 4.5). Ekstrakti ispitivanih uzoraka su pripremljeni Soxhlet i ultrazvučnom ekstrakcijom, maceracijom sa puferom i etanolom. Najefikasinija metoda ekstrakcije je maceracija sa etanolom. Rezultati pokazuju da je najveći sadržaj ukupnih antocijanina nađen u *C. subsphaericea* (plod) (10.59 mg/100 g suhog uzorka).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-21

Spectrophotometric Determination of Ascorbic Acid with 2,6-dichlorophenolindophenol in Selected Pharmaceutical Preparations

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Keywords:
Ascorbic acid, 2,6-dichlorophenolindophenol, pharmaceuticals.

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Abstract: The physiological functions of ascorbic acid (AA also named vitamin C) are largely dependent on the oxido-reductive properties of this vitamin. In view of the widespread use of AA, a large number of methods have been developed for quantifying AA content in natural and fortified food samples and pharmaceuticals. The aim of this paper was to determine the content of AA with 2,6-dichlorophenolindophenol (2,6-DCPIP) in some pharmaceutical samples of vitamin C. The method is based on the reaction between AA and 2,6-DCPIP where the blue form of 2,6-DCPIP is reduced to a colourless compound 2,6-DCPIPH_2, and AA is oxidized to dehydroascorbic acid (DHAA). The reaction was monitored spectrophotometrically by measuring the absorbance intensity at 588 nm. The linear range of AA concentration from 2.90 x 10^{-6} molL^{-1} to 4.76 x 10^{-3} molL^{-1}. Also the influence of interfering substances such as citric acid and D-(-)sorbitol were investigated. Comparative evaluation of the method is made with the iodometric titration. The results obtained by spectrophotometric method are in a good agreement with the results obtained by titration as well as the values on the label of the investigated samples. The proposed method is simple, cheap and fast for determination of AA in pharmaceutical samples.

Sažetak

Uloga askorbinske kiseline (AK takođe poznata i kao vitamin C) u organizmu vezuje se za učešće ovog vitamina u oksido-redukcionim procesima. Zbog široke upotrebe AK, razvijen je veliki broj metoda za njeno određivanje u uzorcima hrane, hrane obogaćene sa AK i u farmaceutskim preparatima. Cilj ovog rada je određivanje AK u izabranim farmaceutskim preparatima vitamina C sa 2,6-dihlorfenolindofenolom (2,6-DCPIP). Metoda je bazirana na reakciji između AK i 2,6-DCPIP pri čemu se plavo obojeni 2,6-DCPIP reducira do bezbojnog spoja (2,6-DCPIPH_2), a AK se oksidira do dehidroaskorbinske kiseline (DHAK). Reakcija je praćena spektrofotometrijski mjerenjem intenziteta apsorbanse na 588 nm. Dobivena je linearna zavisnost u području koncentracija 2,90 x 10^{-6} molL^{-1} do 4,76 x 10^{-3} molL^{-1}. Kao poredbena metoda korištena je titracija sa jodom. Također je ispitivan uticaj interferirajućih supstanci kao što su limunska kiselina i D-(-) sorbitol. Dobiveni rezultati spektrofotometrijskom metodom pokazali su dobro slaganje sa rezultatima dobivenim jodometrijskom titracijom kao i sa vrijednostima na deklaraciji. Predložena metoda je jednostavna, jeftina i brza za određivanje AK u farmaceutskim preparatima.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-22

Essential Oil Composition of *Laserpitium latifolium* L.

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Keywords:
Laserpitium latifolium
Essential oil
GC/MS/MS triple quadrupole system

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Abstract: *Laserpitium latifolium* L. (family Apiaceae), common name broad-leaved surmounting, is perennial plant. It is widespread in most of Europe and it has aromatic substances which make it useful as a medicinal, especially for animals. The root has been believed to strengthen the stomach and is able to lower fevers. As a medicinal plant it has been transplanted outside its natural habitat. Essential oil was obtained by hydrodistillation in a Clevenger's apparatus for 3 h and chemical composition analysis was performed by a GC/MS/MS triple quadrupole system. The identification was done by comparing the retention time, retention indices and mass fragmentation pattern of the peaks with literature or standard compounds run under the same conditions. Quantitative analysis of each oil component, expressed in relative percentages of area, was carried out by peak area normalization measurements. The essential oil content in the *Laserpitium latifolium* was found to be 0.164% based on the dry weight. Twenty six constituents, representing 98.9% of the oil were identified. The chemical composition of the oil is characterized by high amount of monoterpenes, of which hydrocarbons were 88.6% and oxygenated monoterpenes 7.6%. The main constituents identified in *L. latifolium* essential oil were sabinene (47.8%), *α*-pinene (25.0 %) and *β*-pinene. (7.1%).

Sažetak

Laserpitium latifolium (porodica Apiaceae), u narodu poznata kao javorak, je višegodišnja biljka. Široko je rasprostranjena u većem delu Evrope, s obzirom da sadrži aromatične komponente ima lekovito dejstvo posebno za životinje. Veruje se da koren ove biljke pomaže pri stomačnim oboljenjima i pri smanjenju groznice. Kao lekovitia biljka presađena je sa svog prirodnog staništa. Etarsko ulje ove biljke dobijeno je hidrodestilacijom u trajanju od 3 h u aparaturi po Klevendžer-u, a hemijska analiza urađena je GC/MS/MS metodom sa triple tandem kvadripol detektorom. Identifikacija komponenata vršena je poređenjem retencionih vremena, retencionih indeksa i masama fragmentisanih osnovnih pikova sa literaturom ili standardima snimljenim pod istim uslovima. Kvantitativna analiza svake komponente ulja prikazana je kao relativan procenat površine pika, pritom je vršena normalizacija merenja površine ispod pika. Prinos etarskog ulja *L. latifolium* je 0,164% računajući na suvu biljku. U ulju je identifikovano 26 komponenti što predstavlja 98,9% ulja. Hemijski sastav ulja karakteriše veliki sadržaj monoterpena od čega su ugljovodonični 88,6% i oksidovani monoterpeni 7,6%. Dominantne komponente u etarskom ulju *L. latifolium* su: sabinen (47.8%), *α*-pinen (25.0 %) i *β*-pinen (7.1%).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-23

Synthesis and biological activity of new derivatives based on aminoanthraquinones

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Keywords:
anthraquinone,
thiourea, thiazole,
triazole,
amino acid,
antioxidant activity, protein tyrosine kinase activity,
antimicrobial activity.

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Abstract: In spite of the well-studied chemistry of dyes and anticancer drugs based on 9,10-anthraquinone, many anthraquinone derivatives remain still unknown. Therefore, the aim of our work was synthesis and investigation of biological activity of new N-benzoyl-N'-(9,10-dioxo-9,10-dihydroanthracen-1-yl)-thioureas, N-(9,10-dioxo-9,10-dihydroanthracene-1-yl)-2-(N-benzoyilimino) thiazoles, [(5-phenyl-4H-1,2,4-triazol-3-yl)amino]anthracene-9,10-diones, and amino acid derivatives of 2-chloro-N-(9,10-dioxo-9,10-dihydroanthracene-1-yl)acetamide. The influence of new derivatives of the 9,10-anthraquinone with benzoylthiourea, thiazole, triazole and amino acid fragments on the activity of membrane-associated tyrosine kinase was investigated. Inhibitors of protein tyrosine kinase activity of the membrane fraction, as promising agents to search for new potential anticancer agents among the studied compounds were discovered. Compounds with antioxidant properties and effect on lipid peroxidation and oxidative modification of protein were found among new derivatives of the 9,10-anthraquinone. Substances with antibacterial and antifungal activities against the test-cultures *S. aureus*, *M. luteum* and *A. niger* have identified among amino acid derivatives of the 9,10-anthraquinone.

Sažetak

Iako je hemija boja I anticancer lijekova zasnovanih na 9,10-antrakinonu jako proučavana, još uvijek je mnogo derivata antrakinona nije poznato. Zbog toga je cilj ovog rada bio sinteza I proučavanje biološke aktivnosti novih N-benzoil-N'-(9,10-diokso-9,10-dihidroantracen-1-il)-tiourea, N-(9,10-diokso-9,10-dihidroantracen-1-il)-2-(N-benzoilimino)tiazola, [(5-fenil-4H-1,2,4-triazol-3-il)amino]antracen-9,10-diona, i derivata amino kiselina 2-hloro-N-(9,10-diokso-9,10-dihidroantracene-1-il)acetamida. Uticaj novih derivata 9,10-antrakinona sa benzoiltioureom, tiazolnim, triazolnom i fragmentima amino kiselina na aktivnost tirozin kinaze povezane sa membranom je ispitivana. Među testiranim jedinjenjima su pronađeni novi inhibitori aktivnosti protein tirozine kinaze kao dijela membrane, koji se mogu koristiti kao potencijalna antikancer jedinjenja. Jedinjenja sa antioksidativnim osobinama i uticajem na lipidnu peroksidaciju i oksidativne modifikacije proteina su također pronađene među novim derivatima 9,10-antrakinona. Jedinjenja sa antibakterijskom i antifungalnom aktivnošću protiv testnih kultura *S. aureus*, *M. luteum* i *A. Niger* su identificarene među amino kiselinskim derivatima 9,10-antrakinona.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-MC-24

The importance of determining metals from human hair

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Keywords:
hair samples,
metals determination,
AAS,
Medical and forensic significance

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Abstract: In this study, is described the determination of the concentrations metals Zn, Cd and Cd in hair of subjects residing in the city of Sarajevo. The analysis of the metals in hair, has been done in a group of sixteen subjects of different sexes and different age. The group is made up of an equal number of respondents of both sexes. The results of the determination of the concentrations metals Zn, Cd and Pb give a general picture of the contents this metals in the hair and body of the subjects from the area of Sarajevo. Concentration of these metals allows us to gain an insight into the quality of food, the quality of the environment (air, water, ground), possible ways of contamination by toxic metals (Cd, Pb). The content of zinc in the hair of the respondents is in direct correlation with the concentration of lead and cadmium. Results of the analysis enable undertaking of lifestyle changes, so level of Zn can be normalized. Also, undertaking a detox program or measures to avoid intoxication in cases of elevated toxic metals content (Cd, Pb). Undertaking measures to correct the content of metals in the body can directly impact on the health of the respondents.

Sažetak

U ovom radu je opisano određivanje koncentracije metala Zn, Cd i Pb u kosi ispitanika koji žive u gradu Sarajevu. Analiza metala u kosi vršena je u grupi od šesnaest ispitanika različtih spolova i različite životne dobi. Grupa je sačinjena od jednakog broj ispitanika oba spola. Rezultati ispitivanja koncentracije metala Zn, Cd i Pb daju opću sliku o sadržaju navedenih metala u kosi odnosno organizmu grupe ispitanika sa područja Sarajeva. Izmjerene koncentracije ovih metala omogućavaju sticanje uvida u kvalitet ishrane, kvalitet životne sredine (zrak, voda, tlo), načine moguće kontaminacije toksičnim metalima (Cd, Pb). Koncentracija cinka u kosi ispitanika je u direktnoj korelaciji sa koncentracijom olova i kadmija. Rezultati analize omogućuju poduzimanje mjera za normaliziranje nivoa cinka u slučajevima narušenog balansa. U slučajevima povišenog sadržaja toksičnih metala (Cd, Pb), moguće je poduzimanje mjera kojim bi se toksikacija izbjegla ili izvršila detoksikacija. Poduzimanjem mjera radi korekcije sadržaja metala u organizmu, moguće je direktno uticati na zdravstveno stanje ispitanika.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-25

Antioxidant Activity of Chlorogenic Acid and Ester Analogues

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Keywords:
Antioxidant activity,
Chlorogenic acid,
Chlorogenic acid derivatives,
Structure-activity relationship

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Abstract: Chlorogenic acid (3-CQA), an ester of caffeic acid and quinic acid, is a major phenolic compound in coffee and well known as a potent antioxidant. In this study two 3-CQA derivatives were prepared. Chlorogenic acid was esterified with methanol over Amberlite IR120-H to obtain methyl chlorogenate (Me-CQA), while 3′,4′-dimethoxy methyl chlorogenate (3′,4′-diMeO-Me-CQA) was prepared from 3-CQA by treatment with diazomethane. The structure of these derivatives was confirmed by spectroscopic methods (NMR, MS, IR). These compounds were tested for antioxidant properties to find a relationship between structure and antioxidant activity. Eight methods were selected in order to cover a diversity of mechanistic approaches: DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging, Galvinoxyl radical scavenging, ABTS [2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)] method, DMPD (*N*,*N*-dimethyl-*p*-phenylene-diamine) method, Phosphomolybdenum Assay, Reducing Power, Metal Chelating Activity and ORAC-$_{OH}$. (Oxygen Radical Absorbance Capacity). In most of these tests 3-CQA showed the highest antioxidant activity in comparison to its derivatives.

Sažetak

Hlorogenska kiselina (3-CQA), ester kafene kiseline i kinske kiseline, glavni je fenolski spoj u kafi i poznata kao moćan prirodni antioksidans. U ovom radu pripremljena su dva derivata 3-CQA. Da bi se priredio metil hlorogenat (Me-CQA), 3-CQA je esterificirana metanolom preko Amberlita IR120-H, a za pripremanje 3′,4′-dimetoksi metil hlorogenata (3′,4′-diMeO-Me-CQA), 3-CQA je tretirana diazometanom. Struktura ovih derivata je potvrđena spektroskopskim metodama (NMR, MS, IR). Za ove spojeve određivan je antioksidativni kapacitet kako bi se našla veza između strukture i antioksidativne aktivnosti. Ukupno je korišteno osam metoda kako bi se obuhvatila raznolikost mehanističkog pristupa i to: "hvatanje" slobodnih radikala DPPH (2,2-difenil-1-pikrilhidrazil) i galvinoksil, ABTS [(2,2'-azino-bis(3-etilbenzotiazolin-6-sulfonska kiselina)] metoda, DMPD (*N*,*N*-dimetil-*p*-fenilendiamin) metoda, fosfomolibdatna metoda, moć redukcije, sposobnost helatacije i ORAC (kapacitet apsorpcije radikala kisika). U većini ovih testova, 3-CQA je pokazala veću antioksidativnu aktivnost u odnosu na svoje derivate.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-26

Antioxidant Activity of Rosmarinic Acid, Gallic Acid and Their Derivatives

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Keywords:
Antioxidant activity
Rosmarinic acid
Gallic acid

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Abstract: Phenolic acids are widespread phytochemicals that possess prominent antioxidant activity. Gallic acid is found in almost all plants, while rosmarinic acid, an ester of caffeic acid and 3,4-dihydroxyphenyllactic acid, is found mainly in plants of Lamiaceae family.

The aim of this work was to determine antioxidant activity of rosmarinic acid (RA), gallic acid (GA), and their derivatives obtained by methylation with diazomethane. The structure of the resulting derivatives was confirmed by NMR and MS. Determination of antioxidant activity was performed by five different methods, DPPH, ABTS, Phosphomolybdenum Assay, Reducing Power, and Metal Chelating Activity. Gallic acid was more effective antioxidant than rosmarinic acid in most of the assays applied, while their methylated derivatives had very low or no antioxidant activity. Gallic acid had better antioxidant activity in DPPH, ABTS and Reducing Power method, while rosmarinic acid had better antioxidant activity in Phosphomolybdenum Assay. All samples analyzed did not show ability to chelate metal ions and validity of the method was confirmed using EDTA as a positive probe.

Sažetak

Fenolske kiseline su široko rasprostranjena vrsta fitohemikalija koje posjeduju značajnu antioksidacijsku aktivnost. Galna kiselina se nalazi u gotovo svim biljkama, dok se ruzmarinska kiselina, ester kafeinske i 3,4-dihidroksifenilmliječne kiseline, nalazi uglavnom u biljkama porodice Lamiaceae. Cilj ovog rada je bio odrediti antioksidacijsku aktivnost ruzmarinske kiseline, galne kiseline i njihovih derivata dobivenih metiliranjem diazometanom. Struktura nastalih derivata potvrđena je primjenom NMR i MS. Određivanje antioksidacijske aktivnosti vršeno je pomoću pet metoda, DPPH, ABTS, fosfomolibdatnom, metodom redukcijske moći i sposobnosti helatiranja. Galna kiselina se pokazala kao efikasniji antioksidans od ruzmarinske kiseline u većini primjenjenih testova, dok su njihovi metilirani derivati imali veoma nisku ili nikakvu antioksidacijsku aktivnost. Galna kiselina je imala bolju antioksidacijsku aktivnost kod DPPH, ABTS i metode redukcijske moći, dok je ruzmarinska kiselina pokazala bolju aktivnost primjenom fosfomolibdatne metode. Ispitivani uzorci nisu pokazali sposobnost helatiranja, a valjanost metode je potvrđena upotrebom EDTA kao pozitivne probe.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-27

Synthesis and Characterization of Sulfur Containing Ethoxy 1,4-Benzoquinones

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Keywords:
Sulfur-containing 1,4-benzoquinones,
Nucleophilic reactions of quinones, thiols.

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Abstract: In recent years, the nucleophilic reactions of substituted-1,4-benzoquinones have been a central focus of general interest in organic chemistry because of the fact that it is a convenient way to obtain new compounds that are building blocks have some principal molecular properties that make them attractive to the organic chemists. Sulfur-containing 1,4-benzoquinones are well known to be used for the construction of biologically important compounds which possess antitumor, antibacterial, antifungal, antimalarial and cytotoxic activities. We aimed at discovering new 1,4-benzoquinone derivatives possessing sulfur atoms in the side chain since chemical modifications of this class of compounds with sulfur groups lead to diverse biological properties. New sulfur-containing ethoxy1,4-benzoquinone scaffold such as 2,6-Diethoxy-3,5-di(thio)-1,4-benzoquinone promising new biologically active compounds were synthesized from the reactions of substituted-1,4-benzoquinones and thiols with a base and solvent at room temperature. Various spectroscopy techniques (FT-IR, ^{1}H NMR, ^{13}C NMR, MS) have been employed to clarify the structures of obtained compounds.

Sažetak

Posljednjih godina nukleofilne reakcije supstituiranih-1,4-benzokinona su u centralnom fokusu i od općeg interesa u organskoj hemiji zbog činjenice da predstavljaju pogodan način za dobijanje novih spojeva koji su gradivni blokovi i imaju neka od osnovnih molekulskih svojstava zbog čega su privlačni organskim hemičarima. Dobro je poznato da se 1,4-benzokinoni, koji sadrže sumpor upotrebljavaju u izgradnji važnih bioloških spojeva koji posjeduju antitumorne, antibakterijske, antifungalne, antimalarijske i citotoksične aktivnosti. Ciljali smo da otkrijemo nove 1,4-benzokinonske derivate koji sadrže atome sumpora u bočnom lancu, pošto hemijska modifikacija ove klase spojeva sa sumpornim grupama vodi ka raznolikim biološkim svojstvima. Novi etoksi-1,4-benzokinon koji sadrži sumpor, kao što je 2,6-dietoksi-3,5-di(tio)-1,4-benzokinon je obećavajući biološki aktivni spoj sintetiziran u reakciji supstituiranih 1,4-benzokinona i tiola uz bazu i rastvarač pri sobnoj temperaturi. Različite spektroskopske tehnike (FT-IR, ^{1}H NMR, ^{13}C NMR, MS) su korištene radi pojašnjenja strukture dobijenih spojeva.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-28

Mechanism of s-n Bond Formation in Oxidative Condensation of Aliphatic Amine and Mercaptothiazolil Anion by Natrium-hypochlorite

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Keywords:
morpholine,
electrophilic, complex,
aliphatic amines.

Abstract: The mechanism of the S-N bond formation is the reaction between thiazolyl disulphide and morpholine has been studied. Most of the reactions were performed in aqueous suspension of thiazolyl disulphides with sodium hypochlorite and morpholine. It was confirmed that the S-N bond formation in the reaction between morpholine and thiazolyl disulphite is not a two-steps reaction, S_{N1} like reaction, and that the heterolytic breaking of the S-S bond in disulphide is not the first step of the reaction. The S-N bond formation can be explaned as a nucleophilic substitution of di-coordinated sulphur assisted by the effect of the electrophile. In the first step of the reaction, the electrophilic species attack by morpholine. The structure of the complex and transition state for nucleophilic displacement at the di-coordinated sulphur atom are given, according to the „three atoms in the line“ theory.

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Sažetak

U ovom radu ispitivan je mehanizam stvaranja S-N veze u reakciji između 2,2-benz-tiazolil disulfida i morfolina. Većina reakcija izvođena je u vodenoj suspenziji tiazolil disulfida sa natrijum hipohloritom i morfolinom. Utvrđeno je da stvaranje S-N veze u reakciji tiazolil disulfida i morfolina nije dvostepena reakcija i da ne obuhvata heterolitičko raskidanje S-S veze kao prvu fazu reakcije. Formiranje S-N veze okarakterisano je kao nukleofilna supstituciona reakcija na di-koordinativnom sumporu kod tiazolil disulfida koja je potpomognuta efektom elektrofila. U prvoj fazi reakcije elektrofilna vrsta napada disulfidnu vezu gradeći kompleks, koji zatim podliježe nuklefilnom napadu morfolina. Data je vjerovatna struktura kompleksa kao i prelazno stanje za nukleofilnu supstituciju na di-koordinativnom sumporovom atomu koji se uklapa u teoriju „linearnosti tri atoma“ u prelaznom stanju.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-OMC-29

Interactions of Melatonin and copper(II) melatonin complex with pUC19 DNA

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Keywords:
Melatonin
pUC19 DNA
antioxidant

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Abstract: Melatonin (N-acetyl-5-methoxytryptamine) is the main secretory product of the pineal gland of mammals. It is well known as a free radical scavenger and antioxidant involved in different biological and physiological regulation such as modulation of circadian rhythms, seasonal reproduction, retinal physiology and sleep regulation. Earlier studies have shown that melatonin protects DNA from oxidative stress and free radicals attack. In this study, the interaction of melatonin, copper and synthesized complex of copper and melatonin with supercoiled plasmid pUC19 DNA was investigated by spectroscopic methods and agarose gel electrophoresis. Absorption titration with melatonin and pUC19 DNA showed that no major difference was observed in the value of λ_{max} of pUC19 DNA alone and pUC19 DNA in the presence of different melatonin concentrations. The electrophoretic results indicated the slower migration speed for pUC19 DNA treated with 200 μM melatonin solution only. Bands were not completely resolved indicating interaction of melatonin with pUC19 DNA but with low cleavage efficiency.

Sažetak

Melatonin (N-acetil-5-metoksitriptamin) je glavni produkt sekretorne pinealne žlijezde kod sisara. Poznat je kao antioksidant i „hvatač“ slobodnih radikala, te je uključen u različite biološke i fiziološke reakcije, regulira dnevni bioritam organizma, reprodukciju, fiziologiju vida, te ciklus spavanja i buđenja. Ranija istraživanja su pokazala da melatonin štiti DNA od oksidativnog stresa i uticaja slobodnih radikala. U ovom istraživanju posmatran je uticaj melatonina, bakra i ranije sintetiziranog kompleksnog spoja bakra i melatonina, sa plazmidnom DNA (pUC19 DNA), posmatranom spektroskopskom metodom i agaroznom gel elektroforezom. Titracija melatonina sa pUC19 DNA nije pokazala značajne promjene naksimalne abosrbanse same pUC19 DNA i pUC19 DNA u prisustvu različtih koncentracija melatonina. Elektroforetska migracija je sporija u odnosu na sam pUC19 DNA, tretiran sa 200 μM melatoninom. Trake nisu u potpunossti razdvojene što ukazuje na interakciju melatonina s pUC19 DNK, ali s niskom učinkovitosti cijepanja pUC19 DNK

POSTER PRESENTATIONS

Physical and Theoretical Chemistry

(PTC)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-01

Influence of preparation process on viscoelastic properties of two emulsion formulations

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Keywords:
rheology,
viscoelastic properties,
cosmetic emulsions

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Abstract: Rheological properties are crucial for cosmetic formulations, determining product's properties during production and application. O/W emulsions (pH 6.86–7.10) were prepared with decyl-oleate as internal phase. A-formulations contained K-stearate, while N-formulations contained polyglyceryl-stearate and -behenate as principal emulsifiers. The formulations were prepared by adding the water to the oil phase (NA and AA) or vice versa (NB and AB). Oscillatory measurements were performed on Haake RheoStress using double gap cylinder. In amplitude sweep at low stresses all samples behaved as viscoelastic solids. With increasing stress, phase angles increased to >80°. Crossover of storage and loss moduli for AA happened at nine times higher stress compared to the other formulations, forming lamellar crystalline gel network. Linear viscoelastic region showed that AA was much more stabile. Frequency sweep showed NA and AB to be liquid-like, but crossover of storage and loss moduli and decrease of phase angle indicate poor spreadability at faster rubbing rates. In NB and AA decrease in complex viscosity indicates better spreadability. Stability of phase angles and storage and loss moduli indicate more elastic behavior. New nonionic emulsifier was more independent of processing, unlike anionic emulsifier. However, AA formulation gives much better feel properties, needed in cosmetic formulations.

Sažetak

Reološke osobine su ključne za kozmetičke formulacije, budući da određuju osobine proizvoda tokom njegove proizvodnje i aplikacije. A-formulacije su sadržavale K-stearat, a N-formulacije poligliceril-stearat i –behenat, kao glavne emulgatore. Formulacije su pripremljene dodajući vodenu u masnu fazu (NA i AA) ili obrnuto (NB i AB). Oscilatorna mjerenja su izvršena na Haake RheoStress korištenjem cilindra sa duplim zazorom. Pri promjeni amplitude, kod niskih napona smicanja svi uzorci su se ponašali kao viskoelastična čvrsta tijela. Povećanjem napona smicanja, fazni uglovi su se povećali do >80°. Križanje modula elastičnosti i viskoznosti za AA se desilo pri devet puta većem naponu smicanja u poređenju sa ostalim formulacijama, te formira lamelarnu kristalnu gel mrežu. Linearni viskoelastični region je pokazao da je AA mnogo stabilnija. Promjena frekvencije je pokazala da su NA i AB slične tečnostima, ali križanje modula elastičnosti i viskoznosti i smanjenje faznog ugla ukazuju na slabu razmazivost pri višim brzinama nanošenja. Kod NB i AA smanjenje kompleksnog viskoziteta indicira bolju razmazivost. Stabilnost faznog ugla i moduli elastičnosti i viskoznosti ukazuju na više elastično ponašanje. Novi neionski emulgator je bio više neovisan o metodi izrade za razliku od anionskog emulgatora. Međutim, AA formulacija daje mnogo bolje osjetne osobine potrebne u kozmetičkim formulacijama.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-02

DFT study of guaiazulene

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Keywords:
guaiazulene,
chemical reactivity descriptors

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Abstract: Quantum mechanics provides the mathematical apparatus for determining numerous properties of chemical systems, whereas computer programs carry out the necessary calculations. Guaiazulene is starting compound in many reactions for obtaining azulene derivatives with significant pharmacological activity. Calculations for guaiazulene were done using software Spartan 10. The guaiazulene molecule was optimized by B3LYP/6-31G* method. Chemical hardness, total energy, electronic chemical potential and electrophilicity were calculated and used to predict relative stability and reactivity of guaiazulene. Results of DFT study showed that guaiazulene possess good reactivity and behaves as nucleophile. These results were in good accordance with former experimental research about this compound.

Sažetak

Kvantna mehanika obezbjeđuje matematički aparat za određivanje brojnih osobina hemijskih sistema, gdje računarski programi izvršavaju neophodne proračune. Gvajazulen je početna supstanca u mnogim reakcijama za dobivanje azulenskih derivata koji imaju značajna farmakološka djelovanja. Proračuni za gvajazulen su dobiveni korištenjem programa Spartan 10. Molekula gvajazulena je optimizirana metodom B3LYP/6-31G*. Hemijska tvrdoća, totalna energija, elektronski hemijski potencijal i elektrofilnost su izračunati i iskorišteni za predviđanje relativne stabilnosti i reaktivnosti gvajazulena. Rezultati DFT studije su pokazali da gvajazulen posjeduje dobru reaktivnost i da se u reakcijama ponaša kao nukleofil. Ovi rezultati se dobro slažu s dosadašnjim eksperimentalnim istraživanjima na ovom spoju.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-03

Chemical reactivity and stability predictions of some coumarins using Spartan sofware

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Keywords:
coumarins,
chemical reactivity descriptors,
Spartan software

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Abstract: Three synthesized coumarin derivatives were studied for their quantum-chemical properties. These compounds are commonly used as starting material for many chemical reactions. In order to explore the theoretical-experimental consistency, DFT global chemical reactivity descriptors (chemical hardness, total energy, electronic chemical potential and electrophilicity) were calculated for these compounds using standard Spartan 10 software. Complete geometry optimization was carried out by B3LYP/6-31G* level of theory.

Some quantum-chemical calculations correlated well with experimental work; mechanisms of reactions with these compounds as starting material were partially explained by these calculated parameters. These calculations were once more proof that by means of mathematical models it is possible to describe chemical interactions and simulate the behavior of chemical systems – molecules and reactions.

Sažetak

Za tri sintetizirana kumarinska derivata ispitana su njihova kvantno-hemijska svojstva. Ispitivani spojevi polazne su komponente u mnogim hemijskim reakcijama. U svrhu istraživanja teoretsko-eksperimentalne dosljednosti, DFT deskriptori globalne hemijske reaktivnosti (hemijska tvrdoća, totalna energija, elektronski hemijski potencijal i elektrofilnost) su izračunati za ove supstance koristeći standardni Spartan 10 program. Kompletna geometrijska optimizacija je urađena na B3LYP/6-31G* teorijskom nivou.

Neke kvantno-hemijske kalkulacije se dobro slažu s eksperimentalnim istraživanjima na ovim spojevima. Mehanizmi reakcija u kojima su ovi spojevi početni reaktanti mogu se djelimično objasniti rezultatima ovih proračuna. Ovo izračunavanje je još jedan u nizu dokaza da je pomoću matematičkih modela moguće opisati hemijske interakcije i simulirati ponašanje hemijskih sistema – molekula i reakcija.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-04

TD-DFT Studies of Poly(Oxyethylene)-Substituted Zinc Phthalocyanines in Photodynamic Therapy of Cancer

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Keywords:
Phthalocyanine,
TD-DFT,
Photodynamic Therapy,
Photosensitizer.

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Abstract: The interaction of light with the metallophthalocyanine molecule accompanying of the oxygen in the cancer cell lead to photodynamic therapy (PDT) of cancer as a photosensitizer. Therefore, the electronic structure, the photophysical and excited state properties of metallophthalocyanine should be clarified as much detail as possible. Especially for the large molecules such as metallophthalocyanines, time-dependent density functional theory (TDDFT) is a very powerfull tool for precisely calculation of excited state energies and many related response properties.

An accurate description of the molecular structures, molecular orbitals and UV-vis spectra of tetra- and octa- Poly(oxyethylene) substituted zinc phthalocyanines have been provided DFT and TD-DFT calculations to explore the effects of tetra-chlor substitution on the electronic structure and the excited state properties. The calculated results are in good agreement with the experimental data, indicating that the method and the basis set selected are feasible for calculating such a large molecule as tetra- and octa- Poly(oxyethylene) substituted zinc phthalocyanines. The results of photophysical and photochemical measurements indicates zinc phthalocyanines have a potential as photosensitizers in applications where singlet oxygen is required.

Sažetak

Interakcija svjetla sa molekulom metaloftalocijanina koja prati kisik u ćelijama kancera predstavlja fotodinamičnu terapiju („photodynamic therapy”- PDT). Ova interakcija u PDT terapiji predstavlja fotopojačivać. Zbog toga, elektronska struktura, fotofizičke osobine i osobine pobuđenog stanja metaloftalocijanina moraju biti potpuno definisane. Vremenski ovisna funkcionala teorija gustoće (“time-dependent density functional theory”-TDDFT) je jako važno sredstvo za preciznu kalkulaciju energija pobuđenih stanja i drugih osobina vezanih za ova energetska stanja, naročito kod velikih molekula kakve su metaloftalocijanini[1].

Precizan i tačan opis molekularnih struktura, molekulskih orbitala I UV-Vis spektara tetra- i okta-poli(oksietilenom) substituiranih cink ftalocijanina je dat sa DFT I TD-DFT proračunima da bi se ispitao uticaj tetra-hlor substituenata na elektronsku strukturu i osobine pobuđenih stanja. Izračunate vrijednosti se slažu sa eksperimentalnim podacima, pokazujući da se metoda i postavljena baza za kalkulaciju mogu primjeniti na velike molekule kao što su tetra- i okta-poli(oksietilenom) substituiranih cink ftalocijanina. Rezultati fotofizičkih i fotohemijskih određivanja pokazuju da se cink ftalocijanini mogu koristiti kao fotopojačivaći u primjenama koje zahtjevaju prisustvo singletnog kisika[2].

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-05

Comparison of acid and basic dyes sorption ability onto Bottom Ash

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Keywords:
bottom ash,
adsorption, acid dye,
basic dye,
sorption ability

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Abstract: In recent years, removal of dyes from wastewaters has received great attention because estimated amount of dye stuffs annually released in environment is 10^5 ton. Some low cost adsorbents have been developed from industrial waste products such as activated slugs, baggase fly ash and coal fly ash. The bottom ash (BA) is a coarse, granular, incombustible by-product of power plants. It is an undesired collected material, whose disposal has always been a matter of concern. It can be evaluated as adsorbent for dye removal from colored effluents. Sorption ability of eight textile dyes on the bottom ash were compared and correlated with their chemical structures. In general, acid dyes were more preferred by the sorbent than the basic dyes. The removal efficiency for acid dyes follows the order Lanaset Green B > Acid Black 63 > Lanaset Red 2B > Acid Brilliant Yellow G > Lanaset Red G. The results showed that bottom ash had higher affinity for anthraquinone dyes than the azodyes but metal complex dyes could not be adsorbed. On the other hand, sorption efficiency of the BA for basic dyes decreased in the order Victoria Blue (tri aryl methane dye) > Methylene Blue (thi-azin dye)> Safranin T (di-azin dye).

Sažetak

Posljednjih godina velika pažnja se poklanja procesu uklanjanja boja iz otpadnih voda zbog toga što prosječna dozvoljena količina boja otpuštenih u okoliš godišnje iznosi 10^5 tona. Adsorbenti niskih cijena nabavke proizvedeni iz industrijskih otpadnih produkata kao što su aktivni mulj, otpad iz industrije šećera, I pepeo nastao sagorjevanjem uglja se danas sve više primjenjuju za uklanjanje boja. Pepeo koji nastaje kao grubi, granularni, negorljivi nusprodukt u elektranama ("bottom ash" - BA) se može koristizi za uklanjanje boja iz otpadnih voda.. To je otpadni materijal, čije je uklanjanje uvijek bilo problem.

Sposobnost sorpcije osam tekstilnih boja na BA je poređena sa njihovim hemijskim strukturama. Općenito, kisele boje imaju boje sorptivne osobine od baznih boja. Efikasnost uklanjanja kiselih boja slijedi niz Lanaset Green B > Acid Black 63 > Lanaset Red 2B > Acid Brilliant Yellow G > Lanaset Red G. Rezultati su pokazali da BA ima veći afinitet za antrakinolne boje nego za azoboje dok se metalni kompleksi boja nisu mogli apsorbovati. Sa druge strane, sorptivna fikasnost BA za bazne boje se smanjivala u nizu Victoria Blue (tri aril metan boja) > metilen plavo (ti-azin boja)> Safranin T (di-azin boja).

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-06

Investigation of Cisplatin on the Activity of Catalase

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Keywords: Cisplatin, catalase, inhibition

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Abstract: The inhibitory effect of cis platinum (II) diammine dichloride was tested in an *in vitro* experiment on the activity of the enzyme catalase. It is known that certain salts of platinum affect the cells of a living organism in various ways. Cis-platinum (II) diammine dichloride or cisplatin is an effective anti-cancer drug, and chloroplatinic acid elicits strong allergy. It is expected that these salts have influence to other parts of the human organisam and their influence on the activity of the enzymes is particularly significant. We opted for the enzyme catalase, whose role in the body is very important especially in relation to the occurrence and level of free radicals. Manometric method, using a modified method by Schubert-in, measured by the amount of released O_2 generated by the interaction of the substrate H_2O_2 and catalase, with and without the presence of cisplatin. Assuming that the true Michaelis-Menten's model, the value of Km, V_{max} and type of inhibition were calculated over Lineweaver-Burk's diagrams and inhibition constant Ki over Dixon's diagram, on the basis of certain initial velocity of corresponding substrate concentration and cisplatin. In this paper, it is shown that cisplatin is a weak inhibitor of the enzyme catalase and the type of inhibition is non-competitive.

Sažetak

Ispitan je, u *in vitro* eksperimentu, inhibitorni uticaj cis platina (II) diamindihlorida na aktivnost enzima katalaze. Poznato je da neke soli platine utiču na ćelije živog organizma na razne načine. Cis platina (II) diamindihlorid ili cisplatin je efikasan antikancer lijek, a heksahloroplatinatna (IV) kiselina izaziva snažnu alergiju. Za očekivati je da ove soli utiču i na druge dijelove organizma a posebno je značajno poznavanje njhovog uticaja na aktivnost enzima. U ovom radu koristili smo enzim katalazu čija je uloga u organizmu veoma važna zbog pojave slobodnih radikala. Gasometrijskom metodom, korištenjem modifikovane metode po Schubert-u, mjerena je količina izdvojenog O_2 nastalog interakcijom supstrata H_2O_2 i katalaze, bez i u prisustvu cisplatin. Uz pretpostavku da vrijedi Michaelis-Menten-ov model, vrijednosti Km, V_{max} i tip inhibicije su računate preko Lineweaver-Burk-ovog dijagrama a konstanta inhibicije Ki preko Dixon-ovog dijagrama, na osnovu određenih početnih brzina u funkciji odgovarajućih koncentracija supstrata i cisplatina. U ovom radu je pokazano da je cisplatin slab inhibitor enzima katalaze i da je tip inhibicije nekompetitivan.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-07

Mathematical models of release kinetics of diazepam from solid dispersions

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Keywords:
diazepam solid dispersions, release models

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Abstract: According to the biopharmaceutics classification system diazepam belongs in the class II drugs. Inadequate dissolution rate of diazepam can be the limiting factor for its absorption rate. The aim of the present study was preparation of diazepam solid dispersions using various carriers like polyethylene glycol 2000, polyethylene glycol 4000 and polyvinylpyrrolidone K30, estimation of solubility and dissolution rate of prepared diazepam solid dispersions and comparison of these data to that of pure diazepam. The solid dispersions were prepared by solvent evaporation method. Phosphate buffer pH 6.8 was used as dissolution medium. Solid dispersions of diazepam with polymers resulted in increased solubility and dissolution rate of diazepam (highest with polyvinylpyrrolidone K30). The rate release kinetics of diazepam from the solid dispersions followed Hixson-Crowell cube root law. The correlation coefficient (r^2) values of the Hixson-Crowell's cube root model were slightly higher (0.9665 to 0.9977) when compared to the zero and first order release model. The high values of regression coefficients suggested that all formulations followed Korsmeyer-Peppas model of release kinetics. The low values of the release exponent (< 0.45) indicated that the mechanism of diazepam release from all the formulations could be described as a Fickian diffusion mechanism.

Sažetak

Prema biofarmaceutskom sistemu klasifikacije diazepam spada u lijekove klase II. Neadekvatna brzina otapanja diazepama može biti ograničavajući faktor za njegovu brzinu apsorpcije. Cilj ovog istraživanja je bio da se pripreme čvrste disperzije diazepama koristeći razne nosače kao što su polietilenglikol 2000, polietilenglikol 4000 i polivinilpirolidon K30, procijeni topivosti i brzina otapanja pripremljenih čvrstih disperzija diazepama i uporede podaci sa podacima čistog diazepama. Čvrste disperzije su izrađene metodom evaporacije otapala. Kao disolucijski medij korišten je fosfatni pufer pH 6.8. Čvrste disperzije diazepama s polimerima pokazuju povećanu topivost i brzinu otapanja diazepama (najviše disperzija sa polivinilpirolidonom K30). Brzina kinetike oslobađanja diazepama iz čvrstih disperzija slijedi Hixson-Crowell-ov zakon kubnog korijena. Vrijednosti koeficijenata korelacije (r^2) Hixson-Crowell-ovog modela kubnog korijena su nešto više (0,9667-0,9977) u odnosu na modele oslobađanja nultog i prvog reda. Visoke vrijednosti koeficijenata regresije sugerišu da sve formulacije slijede Korsmeyer-Peppas model kinetike oslobađanja. Niske vrijednosti eksponenta oslobađanja (< 0,45) ukazuju da se mehanizam oslobađanja diazepama iz svih formulacija može opisati Fick-ovim mehanizmom difuzije.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-08

Ionic strength and counteranion type influence on formation of PAH/PSS multilayers and correlation with polyelectrolyte complex formation in solution

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Keywords:
polyelectrolyte multilayers, polyelectrolyte complexes, quartz crystal microbalance, Hofmeister series.

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Abstract: The formation of polyelectrolyte multilayers of polyallylammonium cation (PAH) and polystyrenesulfonate anion (PSS) was investigated in aqueous solutions of sodium electrolytes (NaX, X = F, Cl, Br, I, NO_3, ClO_4) at 25 °C by means of quartz crystal microbalance with dissipation monitoring (QCM-D). The obtained results were compared with the results of polyelectrolyte complexation in solution. The QCM-D measurements indicated that increase in ionic strength led to larger thickness of deposited layers and assymetric incorporation of polymers into nanoassemblies (the amount of polycation was higher than that of polyanion). Anions influenced the film thickness at higher ionic strengths considerably. The largest deposition of material was noticed in the case of nitrate and perchlorate anions. This is in accordance with DLS and spectrophotometric experiments in which anion specific aggregation of positive colloid complexes and the formation of precipitates containing larger amount of PAH with respect to PSS was observed. The complexation enthalpies were also correlated with the thickness of deposited films, following the Hofmeister series. The more enthalpically disfavourable complexation process in solution was, the larger was the amount of material deposited. The results can be explained by different counteranion distributions around polycation, caused by differences in the corresponding hydration enthalpies.

Sažetak

Nastajanje polielektrolitnih višeslojeva polialilamonijevog kationa (PAH) i polistirensulfonatnog aniona (PSS) istraženo je u vodenim otopinama natrijevih soli (NaX, X = F, Cl, Br, I, NO_3, ClO_4) pri 25 °C upotrebom kvarc-kristalne mikrovage uz praćenje disipacije (QCM-D). Dobiveni rezultati su uspoređeni s rezultatima kompleksiranja polielektrolita u otopini. QCM-D mjerenja pokazala su da porast ionske jakosti dovodi do porasta debljine slojeva i asimetrične ugradnje polimera u nanokompozite (količina vezanih polikationa je veća od količine vezanih polianiona). Pri višim ionskim jakostima pokazan je izrazit utjecaj aniona na debljinu filma. Najviše polilelektrolita u višeslojevima vezano je u prisustvu nitratnih i perkloratnih aniona. Rezultati su u skladu s DLS i spektrofotometrijskim mjerenjima kod kojih je uočena anion specifična agregacija pozitivnih koloidnih kompleksa i nastajanje taloga koji sadrži veću količinu PAH-a prema PSS-u. Entalpije kompleksiranja polielektrolita u otopini su također povezane s debljinom filma u prisutnosti odgovarajućih aniona te slijede Hofmeisterovu seriju. Što je entalpijski nepovoljnije kompleksiranje u otopini, to je veća količina polielektrolita vezana u višeslojevima. Rezultati se mogu objasniti različitom raspodjelom protuaniona oko lanca polikationa uzrokovanom razlikama u odgovarajućim entalpijama hidratacije.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-09

Inhibition of Iron Corrosion with Lavender Extracts as Eco-acceptable Inhibitors

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Keywords:
Inhibition
Lavander
Iron Corrosion

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Abstract: Inhibition of iron corrosion with lavender extracts in seawater as corrosion media has been studied using *Lavandula hybrida* Reverchon from Istria peninsula (Croatia). One lavender extract is prepared by ultrasonic extraction with water as a solvent, and the second is used as a water extract after hydrodistillation. The total phenolic content of the extracts was determined spectrophotometrically according to the Folin-Ciocalteu method. Extract prepared with ultrasound extraction had higher content of phenolic compounds and it was used for corrosion tests.

Inhibition efficiency was studied using potentiodynamic polarization technique. Values calculated from potentiodynamic polarization and polarization curves showed that lavender extracts behaves as a mixed-type inhibitor in seawater. The results obtained showed that the lavender extracts *Lavandula hybrida* Reverchon could serve as an effective inhibitor of the corrosion of iron in seawater solution.

Sažetak

Inhibicija korozije željeza sa ekstraktima lavande u morskoj vodi kao korozionom mediju je proučavana korištenjem uzorka *Lavandula hybrida* Reverchon iz Istre (Hrvatska). Jedan ekstrakt lavande je pripremljen ultrazvučnom ekstrakcijom uz vodu kao rastvarač, a drugi je uzet kao vodeni ekstrakt nakon hidrodestilacije. Ukupan sadržaj fenola je određen spektrofotometrijski Folin-Ciocalteu metodom. Estrakt pripremljen ultrazvučnom ekstrakcijom je imao veći sadržaj fenolskih spojeva i korišten je za koroziona ispitivanja. Efikasnost inhibicije je određena potenciodinamičkom metodom. Vrijednosti dobivene potenciodinamičkom polarizacijom kao i polarizacione krive su pokazale da se ekstrakt lavande ponaša kao mješoviti inhibitor u morskoj vodi. Dobiveni rezultati su pokazali da testirani uzorci ekstrakata *Lavandula hybrida* Reverchon mogu poslužiti kao inhibitori korozije željeza u morskoj vodi.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-10

Investigation of potentially contaminated areas in the FBiH with depleted uranium

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Keywords:
ammunition depleted uranium,
contamination,
alpha-spectrometry,
detrmination of uranium

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Abstract: During the war in Bosnia, depleted uranium was used on several locations in Bosnia and Herzegovina, including the area Hadzici. Estimated amount of used ammunition is close to three tons. Only a fraction of depleted uranium penetrator, detected in the surface ground layer was removed. A certain number of ground, moss and subterranean water samples have been collected in december 2013, for the purpose of evaluation of two decade long contamination from depleted uranium ammo usage. The colected samples were subjected to radiochemical separation and alpha- spectrometric analysis. The results of the examination showed that the uranium was present in the amount of 0,6 to 1,8 μg/kg in the ground samples, 0,2 to 7,0 μg/kg in the moss samples and 0,36 to 1,04 μg/L in the subterranean water. The activity ratio of U-234/U-238 in three moss samples, as well as one ground sample, showed the presence of depleted uranium. Analyzed water samples indicated a natural relation of uranium isotopes. Tests shows that the presence of depleted uranium deserves detailed examination of radioactivity, radioecology assessment and evaluation of population exposure

Sažetak

Tokom rata u BiH, osiromašeni uran je upotrebljen na nekoliko lokacija u BiH, uključujući područje Hadžića. Procjenjena količina upotrebljene municije iznosi približno 3 tone. Samo dio penetratora od osiromašenog urana, detektovan u površinskom sloju tla, je uklonjen.U decembru 2013.godine je prikupljen određen broj uzoraka tla, mahovina i podzemnih voda, u cilju procjene kontaminacije dvije decenije nakon upotrebe municije od osiromašenog urana. Prikupljeni uzorci su podvrgnuti radiohemijskoj separaciji i alfa spektrometrijskoj analizi. Rezultati ispitivanja pokazuju da sadržaj urana u uzorcima tla iznosi od 0.6 do 1.8 mg/kg, u uzorcima mahovina od 0.2 do 7.0 mg/kg, i uzorcima vode od 0.36 do 1.04 μg/L. Odnos aktivnosti $^{234}U/^{238}U$ u tri uzorka mahovina, kao i jednom uzorku tla ukazuje na prisustvo osiromašenog urana. Analizirani uzorci vode pokazuju prirodan odnos uranovih izotopa. Ispitivanja pokazuju da prisustvo osiromašenog urana zavređuje detaljno ispitivanje radioaktivnosti, radioekološku procjenu i procjenu izloženosti stanovništva.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-11

Spectrophotometric Analysis of Caffeine in Energy Drinks

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Keywords:
caffeine,
extraction,
energy drinks,
spectrophotometry

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Abstract: Young people, especially students, are the major consumers of energy drinks that contain caffeine because of its pronounced stimulatory effect on the central nervous system. However, excessive consumption of caffeine can cause a range of adverse health effects such as insomnia, headache, gastrointestinal complaints, heart palpitations. Harmful effects of caffeine is classified as a form of the disease (World Health Organization's International Classification of Diseases, ICD-10). Although there are no regulatory requirements to control or label food products with their caffeine content, numerous studies have been conducted to determine the caffeine content in the most frequently consumed beverages using different methods. This work was done by quantification of caffeine in energy drinks available in the local market by UV/Vis spectrophotometry. UV/Vis spectrum of caffeine was recorded in different solvents. The best agreement with literature data were obtained by UV/Vis spectrum of caffeine in dichloromethane. Extraction of caffeine from energy drinks was performed with dichloromethane. In accordance with the Lambert-Beer law, the absorbance was measured at a wavelength of 274 nm at room temperature. For most samples obtained values of caffeine content are higher than declared.

Sažetak

Mladi ljudi, pogotovo studenti, su danas glavni konzumenti energetskih pića, koji sadrže kofein zbog njegovog izraženog stimulatornog efekta na centralni nervni sistem. Pretjerana konzumacija kofeina može prouzročiti niz neželjenih posljedica po zdravlje, kao što su nesanica, glavobolja, probavne smetnje, lupanje srca. Štetno djelovanje kofeina je klasificirano kao vid bolesti (World Health Organization's International Classification of Diseases, ICD-10). Iako ne postoje regulatorni Zahtjevi za kontrolu ili oznaku prehrambenih proizvoda na sadržaj kofeina, brojna istraživanja su provedena kako bi se odredio sadržaj kofeina u najčešće konzumiranim pićima pomoću različitih metoda. U ovom radu je vršena kvantifikacija kofeina u energetskim pićima dostupnim u lokalnim marketima primjenom UV/VIS spektrofotometrije. UV/VIS spektar kofeina sniman je u različitim rastvaračima. Najbolje slaganje sa literaturnim podacima dobijeno je za UV/VIS spektar kofeina u dihlormetanu. Ekstrakcija kofeina iz energetskih pića vršena je sa dihlometanom. Sukladno Lambert-Beerovom zakonu, apsorbancija je mjerena na talasnoj dužini od 274 nm na sobnoj temperaturi. Za većinu ispitivanih uzoraka dobijene vrijednosti sadržaja kofeina su više od deklarisanih.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-12

Activity Coefficients for $CdCl_2$ in 2-Methylpropan-2-ol (5 mass %) + Water Mixed Solvent from Potentiometric Measurements with Cadmium-Selective Electrode

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Keywords:
cadmium chloride,
activity coefficients,
cadmium-selective electrode,
aqueous mixture of 2-methylpropan-2-ol

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Abstract: The potential difference (pd), *E*, of the galvanic cell without a liquid junction: Cd-ISE | $CdCl_2$(*b*) in Z | AgCl(s) | Ag(s), where ISE stands for ion-selective electrode, was measured at different temperatures (20, 25, 30, and 35 °C) and various $CdCl_2$ molalities, *b*, in aqueous mixture with 5 mass % 2-methylpropan-2-ol (Z). From these values and using literature data for stability constants of the chlorocadmium complexes, the values for the standard pd, E^o (molal scale), were obtained at each temperature. The standard pd data are served to calculate the stoichiometric mean molal activity coefficients of $CdCl_2$. The agreement between the results for the activity coefficient obtained with cadmium-selective electrode in the present work with to those obtained using amalgam electrode, are discussed.

Sažetak

U ovom radu mjerena je elektromotivnost (E) galvanskog članka bez prijenosa: Cd-ISE | $CdCl_2$(*b*) u Z | AgCl(s) | Ag(s)pri raznim molalitetima $CdCl_2$ (b) u Z (Z označava korišteno miješano otapalo), te pri raznim temperaturama od 20, 25, 30 i 35 °C. Potenciometrijski podaci su obrađeni korištenjem podataka za konstante stabilnosti klorokadmijevih kompleksa. Rezultat te obrade je standardna molalna elektromotivnost članka (E^o) za pojedinu temperaturu. Iz vrijednosti E^o dobiveni su srednji stehiometrijski koeficijenti aktiviteta $CdCl_2$ u Z. Te su vrijednosti uspoređene s onima koje su dobivene potenciometrijski korištenjem zasićene kadmij-amalgamske electrode, Cd(Hg), u istom ili sličnom sustavu.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-13

The Effect of H_2PtCl_6 on the Belousov-Zhabotinsky Reaction

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Keywords:
Belousov-Zhabotinsky reaction
Oscillation
Ferroin
Catalyst

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Abstract: Oscillating reactions are insufficiently studied in relation to the known catalytic effects of noble metals. In this work, the effect of concentration H_2PtCl_6 on the reaction system Belousov-Zhabotinsky reaction, which was comprised of malonic acid, potassium bromate, sulfuric acid and ferroin, was investigated. The reaction was performed in a thermostated, stationary, closed, constantly stirred reactor, with a accurately defined concentrations of reactants, at constant temperature of 25°C. Simultaneously, potentiometric method with platinum and saturated calomel electrode, and gasometric method were used. Change in the system potential, volume of evolved CO_2, number, amplitude and time of oscillations were monitored. The volume of evolved CO_2 during the time followed the rate law of first-order reaction. Oxidation rate constants of malonic acid were calculated using Guggenheim method. It was found that H_2PtCl_6 does not affect the order of the reaction but affects the value of the rate constant. Increasing concentration of H_2PtCl_6, number of oscillations increases, oscillations amplitude decreases, and time of the oscillating period extends.

Sažetak

Oscilirajuće reakcije su nedovoljno istražene u odnosu na poznate katalitičke efekte plemenitih metala. U ovom radu ispitivan je uticaj koncentracije H_2PtCl_6 na reakcioni sistem reakcije Belousov-Zhabotinsky, koga su činili malonska kiselina, kalijum bromat, sulfatna kiselina i feroin. Reakcija je izvođena u stacionarnom, zatvorenom reakcionom sudu koji je termostatiran na 25 °C, uz stalno miješanje reaktanata tačno definisanih koncentracija. Simultano su korištene potenciometrijska metoda, uz platinsku i zasićenu kalomelovu elektrodu i gasometrijska metoda. Istovremeno je mjeren potencijal reakcionog sistema, volumen izdvojenog CO_2, broj, amplituda i vrijeme trajanja oscilacija. Volumen izdvojenog CO_2 u toku vremena je slijedio zakon za brzinu reakcije I reda. Konstante brzine oksidacije malonske kiseline računate su Guggenheimovom metodom. Nađeno je da H_2PtCl_6 ne utiče na red reakcije, ali utiče na vrijednost konstante brzine reakcije. Porastom koncentracije H_2PtCl_6 povećava se broj oscilacija, smanjuje amplituda oscilacija i produžava vrijeme trajanja oscilirajućeg perioda.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-14

Temperature Influence on the Extent of the Belousov-Zhabotinsky Reaction

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Keywords:
Belousov-Zhabotinsky reaction
Oscillation
Catalyst
Activation energy

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Abstract: One of the most historically significant and studied oscillating reaction is the Belousov-Zhabotinsky reaction which reaction system involves oxidation of organic substrates bromate ion in acidic media and with various catalysts. In this work, the effect of temperature on the reaction system Belousov-Zhabotinsky containing malonic acid as a substrate, and catalyst cerium(IV)sulfate or ferroin was investigated. The reaction were performed in a thermostated, stationary, closed, constantly stirred reactor with a accurately defined concentrations of reactants at different temperatures (25°C≤T≤40°C). Simultaneously, potentiometric method with platinum and saturated calomel electrode and gasometric method were used. At the same time, change in the system potential, volume of evolved CO_2, and time of oscillations were monitored. Extent of Belousov-Zhabotinsky reaction is defined as the percent of malonic acid reacted. Oxidation rate constant of malonic acid were calculated using Guggenheim method based on the volume of evolved CO_2. Values of the activation energy were calculated using the Arrhenius equation. Lower values of activation energy, extent and time of oscillations were obtained for ferroin in relation to cerium(IV)sulfate catalyst used.

Sažetak

Jedna od istorijski najznačajnih i najviše istraživanih oscilirajućih reakcija je reakcija Belousov-Zhabotinsky čiji reakcioni sistem predstavlja oksidaciju organskog supstrata bromatnim jonom, u kiseloj sredini i uz razne katalizatore. U ovom radu je određivan uticaj temperature na reakcioni sistem Belousov-Zhabotinsky koji je sadržavao malonsku kiselinu kao supstrat i katalizatore cer(IV) sulfat ili feroin. Reakcija je izvođena u termostatiranom, stacionarnom, zatvorenom reakcionom sudu, uz stalno miješanje tačno definisanih koncentracija reaktanata, na različitim temperaturama (25°C ≤T ≤40°C). Simultano su korištene potenciometrijska metoda uz platinsku i zasićenu kalomelovu elektrodu i gasometrijska metoda. Istovremeno je vršeno mjerenje potencijala sistema, volumen izdvojenog CO_2 i vrijeme trajanja oscilacija. Doseg Belousov-Zhabotinsky reakcije definisan je preko procenta izreagovane malonske kiseline. Konstante brzine oksidacije malonske kiseline računate su Guggenheimovom metodom na osnovu volumena izdvojenog CO_2. Izračunate su vrijednosti energije aktivacije preko Arrheniusove jednačine. Niže vrijednosti energije aktivacije, dosega i vremena trajanja oscilacija su dobijene za feroin u odnosu na korišteni katalizator, cer(IV) sulfat.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-15

Competitive Sorption of Thionine with Cs and Sr on zeolites

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Keywords:
Zeolite, thionine,
adsorption,
Cesium,
Strontium

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Abstract: The natural and synthetic zeolites are candidate buffer materials for geological disposal sites to inhibit groundwater flow and thus retard the movement of radionuclides. The radionuclides of Cs and Sr are main fission products stored in geological formations. The presence of competing inorganic and organic cations in groundwater may control the interaction of the radionuclides with surrounding solid phases. Although competition of inorganic cations with the radionuclides for sorption on the solid phases has been extensively studied limited researches are reported on the influence of organic cations. Thionine (TH) is the smallest cationic thiazin dye which may replace with Cs and Sr on sorbent material. In this work, sorption of TH on natural and synthetic zeolites was investigated in the presence of Cs^+ and Sr^{2+} cations. The natural zeolite consisted of mainly clinoptilolite whilst the synthetic zeolite produced from fly ash composed of analcime and sodalite. The data obtained from long term equilibration upto two months well fit with the homogeneous surface diffusion and pseudo-second-order kinetic models. Distribution coefficients (K_D) were nearly the same on both zeolite and were not influenced by Cs^+ and Sr^{2+} ions.

Sažetak

Prirodni i sintetski zeoliti su kandidati za puferski materijal na geološkim odlagalištima, radi usporavanja toka podzemnih voda, čime usporavaju i pomjeranja radionuklida. Radionuklidi Cs i Sr su glavni fisioni produkti koji su pohranjeni u geološke formacije. Prisustvo kompetirajućih neorganskih i organskih kationa u podzemnim vodama može kontrolisati interakciju radionuklida sa okolnim čvrstim fazama. Iako je opsežno istražena kompeticija neorganskih kationa sa radionuklidima za sorpciju na čvrstoj fazi, postoji ograničen broj objavljenih istraživanja o uticaju organskih kationa.

Tionin (TH) je najmanja kationska tiazin boja koja može da se zamjeni sa Cs i Sr na sorpcijskom materijalu. U ovom radu je ispitana sorpcija TH na prirodne i sintetske zeolite u prisustvu Cs^+ i Sr^{2+} kationa. Prirodni zeoliti su uglavnom bili sačinjeni od klinoptilolita dok je sintetički zeolit proizveden od pepela koji je sačinjen od analcita i sodalita. Prikupljeni podaci tokim dugoročnog uravnoteženja (u toku dva mjeseca), se dobro slažu sa modelom homogene površinske difuzije i kinetičkim modelom pseudo-drugog-reda. Distribucioni koeficijenti (K_D) su bili gotovo isti na oba zeolita i nisu bili pod uticajem Cs^+ i Sr^{2+} jona.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-16

Retention of Eosin Yellow onto aluminium modified Fuller's Earth

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Keywords:
Adsorption,
Eosin Y,
Fuller's Earth,
Aluminum,
Surface modification.

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Abstract: Eosin Y, which is bromine derivative of fluorescin, a yellow fluorescence dye with slightly acidic, highly water-soluble properties. They are widely used in dyeing textiles, ink manufacturing and coloring cosmetics. This anionic organic substance is one of the problematic contaminants in industrial waste water. Thus, removal of these substances from the effluent to the desired level is required before they are discharged into large bodies of water. The removal by adsorption process is an economical method when locally available low cost materials are used as adsorbents. Clays minerals, modified with inorganic cations may be alternative adsorbent for acid dye removal due to abundance of the material and low cost compared with other natural adsorbents. In this study, Al-modified Fuller's Earth were prepared by adding Al-chlorhydrol solution to the clay suspension using conductometric titration method. The adsorbents were obtained by changing amount of clay and the volume of acetone of 50%. The effects of adsorbent dosage, initial dye concentration and sequential adsorption on adsorption capacity were investigated. Adsorption data were analyzed by using Freundlich and Dubinin-Radushkevich (D-R) isotherms. Gibbs free energy changes were calculated using equilibrium constants derived from distribution coefficients consistent with the mean adsorption energies calculated from D-R parameters.

Sažetak

Eozinsko žuto, koji je bromni derivat fluorescina je žuta fluorescirajuća boja sa neznatnim kiselim svojstvima i izraženom rastvorljivošću u vodi. Naširoko se koristi za bojenje tekstila, u proizvodnji tinte i proizvodnji šminke. Ova anionska organska supstanca je jedan od problematičnih zagađivača koji se nalazi u industrijskim otpadnim vodama. Prema tome, potrebno je uklanjanje ove tvari iz otpadne vode do željene razine prije nego što se ispusti u veće vodene mase. Uklanjanje procesom apsorpcije je ekonomična metoda, kada se koriste jeftini, trenutno dostupni materijali kao adsorbenti. U poređenju sa drugim prirodnim adsorbentima minerali gline, modifikovani sa neorganskim kationima, mogu biti alternativni adsorbenti za odstranjivanje kiselih boja zbog zastupljenosti materijala i niske cijene u poređenju sa drugim prirodnim adsorbentima. U ovom radu, Al-modificirana Fullerova zemlja je pripremljena dodavanjem Al-hlorhidrol rastvora u suspenziju gline korištenjem konduktometrijske metode titracije. Adsorbenti su dobiveni mijenjanjem količine gline i zapremine acetona od 50%. Ispitani su efekti doziranja adsorbenta, početna koncentracija boje i sekvencijalna adsorpcija na adsorbcijski kapacitet. Podaci o adsorpciji su analizirani korištenjem Freundlich i Dubinin-Radushkevich (D-R) izotermi. Promjena slobodne Gibbsove energije je izračunata korištenjem konstante ravnoteže, derivirane iz distribucionog koeficijenta u skladu sa prosječnim apsorpcijskim energijama, izračunatim iz DR parametara.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-17

Electrochemical characterization of (1E)-1-N-{[4-(4-{[(E)-N-(3-aminophenyl)carboxyimidoyl]phenoxy}butoxy) phenyl] methilidene} benzene -1,3-diamine

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Keywords:
Schiff base,
electrochemistry,
oxidation,
voltammetry

Abstract: Oxido-reduction properties of a newly synthesized Schiff base were investigated by cyclic voltammetry and differential pulse voltammetry. Measurements were conducted in a three electrode voltammetric cell in a non-aqueous media. Glassy carbon was used as a working electrode, platinum wire as counter electrode and non-aqueous Ag/Ag^+ electrode as a reference electrode. Inert atmosphere was acomplished by system purging with high purity argon Ar 5 (ϕ_{Ar} = 99,999 %) before each measurement. Cyclyc voltammograms revealed one oxidation peak of the investigated Schiff base ($E_{p,a}$ = 0,69), which increased with increasing concentration (c = 3,1 $\cdot 10^{-5}$ mol dm^{-3}... 1,25 $\cdot 10^{-4}$ mol dm^{-3}) and scan rate (v = 50...300 mV/s). Differential pulse voltammetry showed one oxidation peak $E_{p,a}$ = 0,69 V, which also increased with increasing concentration.

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Sažetak

Ispitivana su oksido-redukcijska svojstva novosintetizirane Schiffove baze uporabom cikličke i diferencijalne pulsne voltametrije. Mjerenja su izvedena u troelektrodnoj ćeliji u nevodenom mediju pri sobnoj temperaturi, a inertna atmosfera je postignuta propuhivanjem sustava argonom visoke čistoće Ar 5 (ϕ_{Ar} = 99,999 %), prije svakog mjerenja. Kao radna elektroda korištena je elektroda od staklastog ugljika, protuelektroda je bila platinska žica, a kao referentna elektroda je korištena Ag/Ag^+ elektroda za nevodeni medij. Rezultati cikličke voltametrije su pokazali da se ispitivana Schiffova baza oksidira (uočen je jedan oksidacijski strujni vrh u anodnom dijelu voltamograma na potencijalu $E_{p,a}$ = 0,69 V, a visina oksidacijskog strujnog vrha raste s povećanjem koncentracije (c = 3,1 $\cdot 10^{-5}$ mol dm^{-3}...1,25 $\cdot 10^{-4}$ mol dm^{-3}) i brzine promjene potencijala (v = 50...300 mV/s). Diferencijalnom pulsnom voltametrijom je također uočen jedan oksidacijski strujni vrh pri $E_{p,a}$ = 0,69 V, koji se povećavao s povećanjem koncentracije ispitivane Schiffove baze.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-PTC-18

Conductivity of ammonium bromide in aqueous butan-2-ol of lower mass fraction

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Keywords:
butan-2-ol + water mixtures, NH_4Br, association to ion-pairs, thermodynamic quantities

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Abstract: Molar conductivity of dilute solutions of ammonium bromide in binary mixture of butan-2-ol and water with 10 mass. % of alcohol were measured in the temperature range from 15 °C to 35 °C. Data were processed using conductivity model based on the Lee-Wheaton equation. A three-parameter adjustment did not give uniform values for the association distance *R*. Therefore, the Bjerrum critical distance was chosen as a fixed value of that parameter ($R = q$). By repeated treatment, the limiting molar conductivity (Λ_o) and the ion-pair formation constant (K_A) were solved at each temperature, and the thermodynamic quantities of the association reaction (ΔG^o, ΔH^o and ΔS^o) were derived at 25 °C. The obtained thermodynamic quantities, together with Walden product, were compared with literature data for ammonium bromide in mixtures with butan-2-ol mass fraction (w) 70, 80, 90 and 95 %. From the thermodynamic quantities it is seen that the association reaction is spontaneous, endothermic and leads to an increased disorder in the system; all these features are more pronounced in mixtures with a higher alcohol content.

Sažetak

Mjerena je vodljivost razrijeđenih otopina amonijevog bromida u smjesi butan-2-ola i vode s 10 mas. % alkohola pri pet temperatura u području od 15 °C do 35 °C. U obradi je korišten model provodnosti utemeljen na jednadžbi Lee-Wheaton. Podešavanje triju parametara nije dalo ujednačene vrijednosti asocijacijskog razmaka *R*. Stoga je za fiksnu vrijednost tog parametra odabran Bjerrumov kritični razmak ($R = q$). Ponovljenom obradom dobivena su rješenja za graničnu molarnu provodnost (Λ_o) i konstantu asocijacije (K_A) pri svakoj temperaturi, te su izvedene termodinamičke veličine za reakciju asocijacije (ΔG^o, ΔH^o i ΔS^o) pri 25 °C. Dobivene termodinamičke veličine, skupa s Waldenovim produktom, uspoređene su s onima za amonijev bromid u 70, 80, 90 i 95 mas. %-tnom butan-2-olu iz literature. Termodinamičke veličine pokazuju da je asocijacijska reakcija spontana, endotermna i vodi ka povećanju nereda u sustavu; sve te osobine više su izražene u smjesama s većim sadržajem alkohola.

POSTER PRESENTATIONS

Chemistry of Advanced Materials

(CAM)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CAM-01

Electrochemical properties of composite films of some metal oxides and carboxylic acid-doped polyanilines

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Keywords:
Composite films
Metal oxides
Carboxylic acid-doped polyanilines

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Abstract: The electrochemical synthesis of composite films of some metal oxides and carboxylic acid-doped polyanilines was done on carbon electrode. The obtained composite film was electrochemically characterized by cyclic voltammetry and impedance spectroscopy at different pH values. After characterization, electrochemical properties of composite films was compared with electrochemical properties of corresponding copolymer in order to study changes in capacitive behaviour.

Sažetak

Sinteza kompozitnog filma odabranih metalnih oksida i karboksilnom grupom dopiranih polianilina vršena je elektrohemijskim putem na grafitnoj elektrodi. Nastali kompozitni film elektrohemijski je okarakterisan metodama ciklične voltametrije i impedancijske spektroskopije pri različitim pH vrijednostima. Nakon karakterizacije je izvršeno poređenje elektrohemijskih svojstava nastalog kompozita sa odgovarajućim kopolimerom, s ciljem ispitivanja promjena u kapacitivnom ponašanju.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CAM-02

Kinetics of the Conversion of $SrSO_4$ (celestite ore) to $SrCO_3$ in Solutions Containing Low CO_3^{2-} Ion Concentrations

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Keywords:
Celestite,
strontium carbonate,
ammonium bicarbonate,
ammonium carbamate,
kinetics.

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Abstract: Celestite ore which includes $SrSO_4$ as a main compound is the most important raw material used for the production of Sr compounds. In this study, concentrated celestite mineral was converted to $SrCO_3$ using solutions obtained by hydrolyzing mixture of 1:1 mole ratio of ammonium carbamate and ammonium bicarbonate (Merck) in a mechanically stirred reactor under isothermal conditions and constant stirring speed. Reactant solutions were prepared by dissolving 0.1, 0.15, 0.2, 0.3 and 0.4 moles of the mixture in 1 L distilled water. CO_3^{2-}, HCO_3^- and NH_4^+ ions and molecularly dissolved NH_3 are in equilibrium and the sum of the mole amounts of CO_3^{2-} and NH_3 was equal to the mole amount of dissolved mixture. The effects of stirring speed (300, 400 and 500 rpm), CO_3^{2-} ion concentration and temperature (293, 303, 313 and 323 K) on the conversion rate of $SrSO_4$ were investigated. The quantitative analyses of SO_4^{2-} ions in the solutions taken during certain time intervals were performed by ICP-OES. XRD was used for characterization of solid reactant and products. The effect of stirring speed on the reaction rate was negligible at 500 rpm. Concentration of CO_3^{2-} ions in the solutions has no effect on the reaction rate (zero order reaction). It is determined that reaction rate was increased by increasing temperature.

Sažetak

Celestitna ruda koja se sastoji od $SrSO_4$ kao glavne komponente, je najvažniji sirovi material korišten za proizvodnju Sr jedinjenja. U ovom radu, koncentrirana ruda celestita je prevedena do $SrCO_3$ preko rastvora dobivenih hidrolizom smjese koja se sastojala od amonij karbamata I amonij bikarbonata (Merck) u omjeru 1:1 u reaktoru sa mehaničkom mješalicom pod izotermalnim i uslovima mješanja konstantnom brzinom. Rastvori reaktanata su pripremljeni rastvaranjem 0,1; 0,15; 0,2; 0,3; i 0,4 mola smjese u 1 l destilirane vode. CO_3^{2-}, HCO_3^- i NH_4^+ ioni I and molekularno rastvoren NH_3 su bili u ekvilibrijumu, suma količinskih molova CO_3^{2-} i NH_3 je bila jednaka sumi molova rastvorene smjese. Uticaj miješanja (300, 400 and 500 rpm), CO_3^{2-} ionske koncentracije I temperature (293, 303, 313 and 323 K) na stepen konverzije $SrSO_4$ je ispitivan. Kvantitativna analiza SO_4^{2-} iona u rastvoru urađena u određenim vremenskim intervalima je izvedena metodom ICP-OES. XDR je korišten za karakterizaciju čvrstih rekatanata I produkata. Uticaj brzine mješanja na red reakcije je bio jako mali pri 500 rpm. Koncentracija CO_3^{2-} iona u rastvoru nema uticaja na red reakcije (reakcija nultog reda). Utvršeno je da se red reakcije povećava sa povećanjem temperature.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CAM-03

Molecular Dynamics Simulation of Graphene-Like Boron Carbide Nanosheet Under Biaxial Strain

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Keywords:
Molecular dynamics,
boron carbide,
biaxial strain

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Abstract: Structural properties of graphene-like monolayer boron carbide nanosheet under biaxial strain have been investigated by performing classical molecular dynamics simulations at various temperatures. For boron carbide systems, Stillinger-Weber potential energy function parameters have been modified and published in reference study [1]. Hence, we embedded these modified parameters to our molecular dynamics program. Simulations have been performed with a written FORTRAN code that uses Velocity Verlet Algorithm for solving equations of motion with a time step 10^{-17} second. Biaxial strain application has been realized with two different strain speeds (slow and fast) at 1 K, 300 K, 600 K and 900 K. Each strain steps have been simulated up to the system reached equilibrium. To obtain a relaxed structure, we applied about half a million time steps for each model. It has been found that after a few biaxial strain applications, the nanosheet structure showed segregation like deformation at 1 K. Simulations at 300 K and 600 K showed that biaxial strain mostly created ripping like deformation after merging of emerged holes on the structure. But at 900 K, structure showed folding from the ripped regions and lost hexagonal geometries.

Sažetak

Strukturne osobine nano bor karbidnog monosloja sličnog grafitu pod biaksijalnim istezanjem su ispitivane klasičnim simulacijama molekularnom dinamikom pod različitim temperaturama, Za sistem bor karbida, funkcije parametara potencijalne energije Stillinger-Webera su modificirani I objavljene u posebnoj studiji [1]. Mi smo ugradili ove modificirane parametre u naš program molekularne dinamike. Simultacije su urađene sa pisanim FORTRAN kodom koji koristi Velocity Verlet Algoritam za rješavanje jednačina kretanja u vremenskom koraku od 10^{-17} sekundi. Aplikacija biaksijalnog istezanja je realizirana sa dvije različite brzine istezanja (brza I spora aplikacija) na 1, 300, 600 I 900 K. Svako istezanje je simulirano do uspostavljanja stanja ravnoteže. Da bi dobili opuštenu strukturu, primjenili smo pola miliona koraka za svaki model. Utvrđeno je da nakon aplikacije istezanja, nanostruktura pokazuje segregaciju u obliku deformacije na 1 K. Simulacije na 300 K I 600 K pokazuju da biaksijalno istezanje dovodi do pucanja nanostruktura I do gubitka heksagonalnih geometrija.

POSTER PRESENTATIONS

Chemical Engineering

(CE)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CE-01

Crystallization of potassium-nitrate from system KNO_3-NaCl-H_2O in a semi-industrial scale facility

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Keywords:
crystallization kinetics,
fractional crystallization,
spherical crystals

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Abstract: This paper deals with defining optimal process structure of fractional crystallization of granulated KNO_3 from the tri-component system KNO_3-NaCl-H_2O. The basic of the process are defined by the authors by solving following components: 1) the synthesis of alternative process structures and verification of the selected structure for the system KNO_3-NaCl-H_2O, and 2) kinetics of crystallization of KNO_3 from this system defined by the rate of cooling of the system. This work synthesizes the optimal process structure of crystallization of granulated KNO_3 from the system of KNO_3-NaCl-H_2O. Fractional crystallization of this system is based on closed crystallization cycle between the isotherms 95^{o}C and 20 ^{o}C. The total process is composed of the two mutually connected and well synchronized processes: a) the process of isothermal evaporation at 95^{o}C and NaCl crystallization, b) the process of cooling the system through the contact surface and KNO_3 crystallization (process of crystallization of KNO3 from this system is shown in balance diagram). The kinetics of KNO_3 crystallization is particularly studied in this work in order to obtain defined size of the crystals in the range of 150-600 μm. Hydrodynamic regimes are also investigated in order to obtain particles of spherical shape.

Sažetak

Ovaj rad se bavi definisanjem optimalne procesne structure tokom frakcione kristalizacije granularnog KNO_3 iz 3-komponentnog sistema KNO_3-NaCl-H_2O. Osnove procesa su definisane od strane autora rjesavanjem sljedecih komponenata: 1) sinteze alternativnih procesnih struktura i potvrde izabrane strukture na sistemu KNO_3-NaCl-H_2O, i 2) kinetike kristalizacije KNO_3 iz ovoga sistema, definisanom brzinom hladjenja sistema. U ovom radu je sintetizovana optimalna procesna struktura za kristalizaciju granulisanog KNO_3 iz sistema KNO_3-NaCl-H_2O. Frakciona kristalizacija ovog sistema je zasnovana na zatvorenom ciklusu kristalizacije izmedju isotermi na 95^{o}C i 20 ^{o}C. Cjelokupni process se sastoji od dva medjusobno povezana i dobro sinhronizovana procesa: a) process izotermskog isparavanja na 95^{o}C i kristalizacije NaCl-a, i b) procesa hladjenja sistema kroz kontaktnu povrsinu i kristalizaciju KNO_3. Kinetika kristalizacije KNO_3 je posebno istrazivana u ovom radu u svrhu dobijanja kristala definisane velicine (150-600 μm). Hidrodinamicki rezim je takodje proucavan u svrhu dobijanja cestica sfericnog oblika.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CE-02

Study Of The Cultivation Of Some Microalgae From The District Of Bejaia (Algeria) In A Photobioreactor

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Keywords:
Microalgae,
Photobioreactor,
growth kinetics

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Abstract: Researchers in the field of the valorization of photosynthetic microalgae are constantly in progress since the last decade. These microalgae show important potential in various fields, especially in energy production. Indeed, microalgae prove to be a new source of fuels called biofuels.The aim of this work is the study of the growth of some microalgae from the "Sahel" river located in the region of "Akbou" and the "Illoulen" river situated in the region of "Ighram" (Bejaia - Algeria) in a closed system called a photobioreactor. We aim at isolating a kind of microalgae having important growth kinetics. The study of the growth kinetics of microalgae was conducted on three species; all of them were green: Ulothrix, Cladophorasp and Spirogyra. The influence of physico-chemical parameters (listed below) on the culture of the selected microalgae has been studied: influence of adding CO_2 on microalgae growth, influence of period of exposure to light, influence of bubbling of the culture medium, influence of nutriments adding on the microalgae growth. Obtained results show that the microalgae studied have significant growth kinetics.

Sažetak

Istraživači u području valorizacije fotosintetskih mikroalgi pokazuju stalni napredak u posljednjem desetljeću. Ove mikroalge pokazuju značajni potencijal u raznim područjima, posebice u proizvodnji energije. Doista, mikroalge su se pokazale kao novo biogorivo. Cilj ovog rada je proučavanje rasta nekih mikroalgi iz rijeke Sahel koja se nalazi u regiji Akbou i rijeke Illoulen koja se nalazi u regiji Ighram (Bejaia-Alžir) u zatvorenim sistemima poznatim kao fotobioreaktor. Cilj je bioizolirati specifičnu mikroalgu koja ima značajnu kinetiku rasta. Proučavanje kinetike rasta mikroalgi je provedeno na tri vrste zelenih algi: Ulothrix, Cladophora SP i Spirogyra. Utjecaj fizikalno – kemijskih pokazatelja (navedene u nastavku) na kulturi od abranih mikroalgi je ispitivan: Utjecaj dodavanja CO_2 na rast mikroalgi , utjecaj razdoblja izlaganja svjetlu, utjecaj mjehurića zraka u mediju kulture, utjecaj dodavanja nutricijenata na rastu mikroalge. Dobiveni rezultati pokazuju da mikroalge imaju značajanu kinetiku rasta .

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CE-03

Liquid-Liquid Equilibria of Ternary Systems: Aqueous Mixtures of Valeric Acid with Several Solvents

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Keywords:
Liquid phase equilibria,
Valeric acid,
Solvent,
Ternary diagram.

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Abstract: Valeric acid (n-pentanoic acid) has a very unpleasant odor and it is found naturally in the plant valerian (*Valeriana officinalis*). Volatile esters of valeric acid tend to have pleasant odors and are used in perfumes and cosmetics industry. Some esters are used also as food additives because of their fruity flavors. It is produced industrially by oxidation of amyl alcohol or by fermentation processes and can be found as a subproduct in the manufacture of adipic acid. Also as similar to other carboxylic acids, valeric acid are usually present as a waste product in the aqueous streams of the pharmaceutical, polymer, petrochemical and pulp paper industries. Any valeric acid found undesirably in aqueous solution must be removed and recovered. The economics of the recovery scheme for the removal of acid in diluted aqueous streams is important for the industrial applications, and reliable liquid-liquid equilibrium (LLE) data are required for an efficient design and operation of the related separation equipment. In this study, LLE data of (water - valeric acid – isoamyl alcohol), (water - valeric acid – ethyl valerate) and (water - valeric acid – ethyl caprylate) ternary systems were investigated at 298.15 K and atmospheric pressure, for which no such data were available in literature.

Sažetak

Valerijanska kiseline (n-pentanskakiselina) ima vrlo neprijatan miris i nalazi se u prirodi u biljci valerijani (Valeriana officinalis). Isparljivi esteri valerijanske kiseline najčešće imaju prijatan mirisi, koriste se u parfemima i kozmetičkoj industriji. Neki esteri se koristi i kao aditivi hrani zbog svog voćnog okusa. Industrijski se dobija oksidacijom amilalkohola ili fermentacijom i kao sporedni produkt u proizvodnji adipinske kiseline. Slično kao i druge karboksilne kiseline i valerijanska kiselina je otpadni produkt u vodama proizvodnog procesa lijekova, polimera, celuloze, papira i petrokemijske industrije. Valerijanska kiselina koja se neželjeno nađe u ovim vodenim otopinama mora biti uklonjena i prerađena. Za industriju je od velike važnosti ekonomičnost prerade razblaženih vodenih otopina radi uklanjanja kiseline i neophodni su pouzdani podaci o tečno/tečno-oj ravnoteži (LLE) za uspješno dizajniranje separacione opreme. Ispitivani su LLE podaci trostrukih sistema ((voda-valerijanska kiselina- *izo*amilalkohol), (voda-valerijanska kiselina-etilvalerat) i (voda-valerijanska kiselina-etilkaprilat) na 298,15 K i atmosferskom tpritisku, za koje nema dostupnih podataka u literaturi.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CE-04

Preparation and Characterization of Actived Carbon From Various Agricultural Wastes by Chemical Activation

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Keywords:
Activated carbon,
Chemical activation,
zinc chloride,
phosphoric acid.

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Abstract: Activated carbon is well known as a porous material, with large specific surface area. It has been widely used for separation of gases, recovery of solvents, removal of tastes and odours from domestic and industrial water supplies, and a catalyst supports[1]. Due to the current problems of environmental pollution, the use of activated carbon is increasing. In the carbonization process, moisture and volatile matter in the raw material is removed by heat treatment in inert atmosphere and the basic pore structure is formed. Activation prosess is an oxidation process. This is performed in two different method, pyhsical and chemical. Generally, the pysical activation is carried out by water vapor and carbondioxide. Chemical activation is achieved with chemical substances such as phosphoric acid, zinc chloride, sulfuric acid, potasium hydroxide and potasium carbonate[2-4]. In this study; activated carbon from nutshell, orange peel, and melon seeds has been successfully produced by chemical activated process using zinc chloride and phosphoric acid as activating agents. The effect of activation temperature, activation time, surface morphology and yield were studied. Functional groups of activated carbon were determined by FTIR analysis and the surface porosity of the material was examined by SEM. And also activated carbons were used acetic acid adsorption. The results of adsorption were applied adsorption isoterm charts.

Sažetak

Aktivno karbon je poznat kao aktivni materijal sa velikom specifičnom površinom. Primjena aktivnog karbona je velika u separaciji gasova, prečišćavanju rastvarača, uklanjanju ukusa i mirisa iz sistema za vodosnadbjevanje domaćinstava i industrije i kao pomoć u obavljanju funkcija katalizatora[1]. Zbog prisutnih problema sa zagađenjem okoliša, upotreba aktivnog karbona je u porastu.

U procesu karbonizacije, vlaga I volatilna materija u sirovom materijalu se uklanja zagrijavanjem u inertnoj atmosferi pri čemu se stvara osnovna porozna struktura. Proces se odvija u dvije različite metode, fizičkoj I hemijskoj. Fizička aktivacija se izvodi sa vodenom parom I karbon dioksidom. Hemijska aktivacija se postiže sa hemijskim supstancama kao što su fosfatna kiselina, cink hlorid, sulfatna kiselina, kalij hidroksid I kalij karbonat[2-4]. U ovom radu aktivni karbon je uspješno dobiven hemijski aktiviranim procesima iz ljuske oraha, kore naranđe I sjemenki dinje sa cink hloridom I fosfatnom kiselinom kao aktivnim agensima. Ispitivan je uticaj aktivacione temperature, vremena aktivacije I površinske morfologije I prinosa reakcije. Funkcionalne grupe aktivnog karbona su određene FTIR analizom dok je površinska poroznost materijala ispitana SEM metodom. Aktivni karbon je ispitivan I adsorpcijom sirćetnom kiselinom. Rezultati adsorpcije su korišteni za kreiranje adsorpcione izoterme.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CE-05

Extraction of Glycolic Acid Using Trioctylamine (TOA) and Tridodecylamine (TDA) Mixture in Different Diluents

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Keywords:
Glycolic acid,
Reactive extraction,
Amine mixture

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Abstract: Extraction of glycolic acid has been investigated from aqueous solutions by five different solutions of trioctylamine (TOA)-tridodecylamine (TDA) mixtures at 298 K. The initial organic phases were prepared by the dissolution of TOA-TDA mixture in the solvents to produce solutions with 0.194-1.163 mol/L concentration range. Dimethyl phthalate (DMP), methyl isobutyl ketone (MIBK), 2-octanone, 1-octanol, and cyclohexyleacetate (CHA) were selected as solvents. In this study, effect of solvent type and amine mixture concetration on recovery of glycolic acid has been investigated. Distribution and equilibrium data for design of separation equipments have been obtained as a result of batch extraction of glycolic acid. It has been calculated distribution coefficients (*D*), loading factors (*Z*), extraction efficiency (*E*). The maximum removal of glycolic acid has been obtained as 81.39 % with DMP and 1.16 mol/L initial concentration of TOA-TDA mixture.

Sažetak

Ekstrakcija glikolne kiseline izvedena je iz pet vodenih otopina smjese trioktilamin (TOA) tridodecilamin (TDA) na 298 K. Osnovne organske faze su pripremljene otapanjem smjese TOA-TDA u otapalima, tako da njihova koncentracija bude u rasponu od 0,194-1,163 mol/L. Dimetilftalat (DMP), metil-izobutilketon (MIBK), 2-oktanon, 1-oktanol, i cikloheksilacetat (CHA) su izabrani kao otapala. U ovom radu je ispitan uticaj vrste otapala i koncentracije smjese amina na rikaveri ekstrahirane glikolne kiseline. Distribucija i ravnotežni podaci za projektiranje opreme za separaciju nastali su kao rezultat serije ehstrakcija glikolne kiseline. Izračunati su koeficijenti distribucije (D), faktori punjenja (Z) i efikasnost ekstrakcije (E). Maksimalna količina ekstrahirane glikolne kiseline je 81.39%, i to sa DMP i početnom koncentracijom TOA-TDA smjese od 1.16 mol/L.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-CE-06

Supercritical fluids for polymer processing: The interfacial tension (IFT) at the CO_2 + PEG interface

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Keywords:
Phase equilibrium,
interfacial tension (IFT),
PEG/CO2 systems,
Capillary Rise (CR) method.

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Abstract: Knowledge of basic thermodynamic and transport data like phase equilibria, density, viscosity, dielectric constant, diffusion coefficient and interfacial tension is of fundamental importance for process design in order to satisfy economical requirements. Despite these data are widely reported in literature for pure substances, no data are available for mixtures of known compositions under pressure. Binary system of polyethylene glycol (PEG)/CO_2 as a model system to study the interactions of polymers with SCF at elevated pressures was taken under research. In the present work the interfacial tension at the (PEG)/CO_2 interface for PEGs of different molecular weights, ranging from 200 to 600, has been determined experimentally by a technique developed to study the interfacial interactions of the liquids in equilibrium with gas in a glass-windowed equilibrium cell by the Capillary Rise method.

Effect of pressure, temperature and molecular weight of polymer on the interfacial tension was investigated by using the method adapted to the measurement conditions and sample properties. Obtained results were compared to literature data and the discrepancy was lower than 2.4 %.

Sažetak

Poznavanje osnovnih termodinamičkih i prijenosnih podataka kao što su fazna ravnoteža, gustoća, viskoznost, dielektrična konstanta, koeficijent difuzije i međupovršinski napon od suštinske je važnosti za dizajniranje procesa kako bi se zadovoljili ekonomski zahtjevi. Iako ima mnogo ovih literaturnih podataka za čiste supstance, nema dostupnih podataka za smjese poznatog sastava pod pritiskom. Ispitivan je binarni sistem polietilen glikol (PEG)/CO_2 kao model za proučavanje interakcije polimera sa SCF na povišenim pritiscima. U ovom radu, eksperimentalno je određivan međupovršinski napon (PEG)/CO_2 za PEGs molekularne mase u rasponu od 200-600, tehnikom koja je razvijena da prouči međupovršinske interakcije fluida u ravnoteži s gasom u zastakljenoj ravnotežnoj ćeliji, za što je korištena kapilarna-Rise metoda. Metoda kojom je ispitivan utjecaj pritiska, temperature i molekularne mase polimera na međupovršinski napon prilagođena je uvjetima mjerenja i svojstvima uzorka. Dobiveni rezultati su upoređeni sa literaturnim i odstupanje je niže od 2,4%.

POSTER PRESENTATIONS

Education in Chemistry

(EC)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-EC-01

The effects of problem-based learning on students' achievements in primary school chemistry

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Keywords:
problem-based learning,
students' achievements,
pre-post-test design,
primary school chemistry.

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Abstract: Specific applications of cognitive and constructivist theories in problem-based learning (PBL) include connecting prior knowledge and skills with new information. This prominent instructional method is widely accepted in higher education around the world, but it also shows good results when applied in primary education of various disciplines. This paper presents effects of PBL application in primary school chemistry when learning chemical compounds in 8th grade, using questionnaires and tests of knowledge in pretest-posttest study with control (CG) and experimental (EG) groups. Students in CG were taught in usual way with teacher-centered approach, while in EG the PBL materials designed for the purpose of this study were applied. Results showed (1) significant improvement of students' achievements in EG, (2) these students are not used to this teaching method so they encountered with certain difficulties they have overcome with the help of the teacher, (3) overall interest and engagement in chemistry has increased.

Sažetak

Specifične primjene kognitivnih i konstruktivističkih teorija u problemskom učenju uključuju povezivanje prethodnog znanja i vještina s novim informacijama. Ova nastavna metoda, široko prihvaćena u visokom obrazovanju širom svijeta, pokazuje dobre rezultate i u osnovnom obrazovanju. U ovom radu prikazani su efekti primjene problemskog učenja u nastavi hemije u 8. razredu osnovne škole, prilikom obrade nastavnih sadržaja iz cjeline "Hemijski spojevi". Ispitanici su podijeljeni u kontrolnu (KG) i eksperimentalnu (EG) grupu, a podaci su prikupljeni korištenjem anketnih upitnika i testova znanja u pred-post-test okruženju. U KG je primijenjen uobičajeni frontalni oblik rada, dok su u EG primijenjeni materijali za problemsko učenje dizajnirani za ovo istraživanje. Rezultati su pokazali (1) značajno poboljšanje postignuća učenika u EG u odnosu na KG (2) da učenici nisu navikli na ovakav način učenja te su se susretali s određenim poteškoćama koje su prebrodili uz pomoć nastavnika, (3) da su interes i zalaganje učenika u nastavi hemije povećani.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-EC-02

The effectiveness of inquiry-based learning on students' achievements in secondary school chemistry

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Keywords:
teaching chemistry,
high school students,
inquiry-based learning,
effectiveness,
achievement

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Abstract: Inquiry-based learning (IBL) requires learners to involve in the learning process so they can search for knowledge by questioning and investigating. It is characterized by development of problem-solving skills and ability for inductive reasoning, increase in motivation and interest for the school subject. This paper presents results of the study on effectiveness of IBL in teaching Properties of solutions in 1st grade secondary school chemistry. Study was conducted in two secondary schools, each with one control (CG) and one experimental (EG) group. In CG teacher-centered approach, in EG IBL were used. The results showed: (1) IBL is more effective than teacher-centered approach, (2) students rather search for information individually than receive them from teacher, (3) students in EG were motivated in higher extent than students in CG, (4) application of IBL does not require additional technical and laboratory equipment, but an important role plays teachers' professional competence and creativity.

Sažetak

Učenje istraživanjem (UI) zahtijeva aktivno uključivanje učenika u proces učenja i angažiranje u potrazi za znanjem kroz postavljanje pitanja i istraživanje. Karakterizirano je razvijanjem vještina rješavanja problema, sposobnosti induktivnog zaključivanja, povećanjem motivacije za učenje i interesa za nastavni predmet. U ovom radu predstavljeni su rezultati istraživanja efikasnosti metode UI prilikom poučavanja Vrsta rastvora u prvom razredu srednje škole. Istraživanje je provedeno u dvjema srednjim školama, u svakoj s kontrolnom (KG) i eksperimentalnom (EG) grupom. U KG je primijenjen uobičajeni frontalni oblik rada, a u EG metoda UI. Rezultati su pokazali: (1) metoda UI je efikasnija od frontalnog oblika rada, (2) učenici radije tragaju sami za informacijama nego da ih primaju od nastavnika, (3) učenici EG su motiviraniji od učenika KG, (4) primjena metode UI ne zahtijeva dodatnu tehničku ni laboratorijsku opremu ali važnu ulogu ima profesionalna osposobljenost i kreativnost nastavnika.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-EC-03

Students with disabilities and chemistry education: Possibilities and difficulties

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students with disabilities, university study of chemistry, general chemistry.

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Abstract: Education of students with disabilities in B&H is regulated by law for primary and secondary education of responsible institutions (ministries). It can be implemented in regular schools with or without adopted curriculum, and in special centers for their education. This paper presents results of study conducted in two centers: for secondary school students with visual (CSSDO) and hearing (CSGR) impairments. The aim of the study was to explore their knowledge and interest in studying chemistry at university level. Results showed: (1) there is no significant difference in students' achievements on knowledge test in general chemistry (GC) in CSSDO and CSGR, (2) considering their achievements in GC, they have a chance to enroll university study of chemistry based on earlier entrance exams, (3) majority of students would like to enroll to university after secondary school, (4) but only one student would consider studying chemistry. These results show significant obstacles for students with disabilities to enroll university, especially in studying science, but also the lack of proper education for teaching staff both at university and in secondary school when it comes to education of students with disabilities.

Sažetak

Obrazovanje učenika s teškoćama u razvoju u Bosni i Hercegovini regulirano je Zakonom o osnovnom i srednjem obrazovanju odgovarajućih institucija (ministarstava). Obrazovanje se može provoditi u redovnim školama sa ili bez prilagođenog nastavnog plana i programa, te u specijalnim centrima. U ovom radu prikazani su rezultati istraživanja provedenog u Centru za slijepu i slabovidnu djecu i omladinu (CSSDO) i u Centru za slušnu i govornu rehabilitaciju (CSGR). Cilj istraživanja bio je ispitati mogućnosti i interes učenika za studiranje hemije na fakultetu. Rezultati su pokazali: (1) ne postoji statistički značajna razlika u postignućima učenika ova dva centra na testu znanja iz opće hemije, (2) prema rezultatima testa znanja, postoji mogućnost njihovog upisivanja na studij hemije, prema ranijim kriterijima polaganja prijemnog ispita, (3) većina učenika bi se voljela upisati na fakultet, (4) ali samo jedan učenik bi razmatrao studiranje hemije. Ovo istraživanje ukazuje na problem uključivanja učenika sa oštećenjem vida ili sluha u studijske programe prirodnih nauka na fakultetima, a također i nedostatak potrebnog obrazovanja za nastavno osoblje na fakultetima i u srednjim školama kada se radi o obrazovanju učenika s teškoćama u razvoju.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-EC-04

Atomic Structure Knowledge and Imagination: A Research Results from Questionnaire with First-year Chemistry Students

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Keywords:
Atomic structure
Chemistry and physics education
Learning outcomes
Scientific knowledge
Visual model

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Abstract: This research study was conducted in order to assess the students' knowledge and ideas about basic concepts in both general chemistry and general physics courses. The research topic was the atomic structure knowledge and visual models of the atom that students already have. Research examined how students' knowledge of scientific atomic theory has progressed during study year using a questionnaire as pretest and posttest, and several individual interviews given by research participants. The study results showed that students' knowledge about atomic structure has predominantly descriptive and simplified character. Students have had their alternative visions of atomic structure based on their knowledge about Rutherford or Bohr model of the atom instead of the current scientific model of the atoms. That was a case even when they successfully completed the atomic structure questionnaire. We propose different learning sequences to exceed this problem in order to help the freshmen to be prepared adequately for further more complex study. This approach is very important for the students' development of abstract thinking that is necessary for the complete scientific literacy.

Sažetak

Ova studija se odnosi na istraživanje koje je provedeno da se procijeni znanje studenata i ideje o osnovnim konceptima u oba predmeta, općoj hemiji i općoj fizici. Predmet istraživanja je bilo znanje studenata o atomskoj strukturi i njihove predstave o modelu atoma. Istraživano je znanje studenata o naučnoj teoriji o atomskoj strukturi i kako su studenti napredovali za vrijeme prve godine studija, korištenjem pred-testa, post-testa i individualnih intervjua koji su provedeni s nekoliko učesnika u istraživanju. Rezultati, prikazani u ovom radu, pokazuju da je znanje studenata o atomima i njihovoj strukturi pretežno deskriptivnog i pojednostavljenog karaktera. Studenti su imali alternativne vizije atomske strukture, koje se temelje na njihovom poznavanju Rutherfordovog i Bohrovog modela atoma, umjesto važećeg naučnog modela atoma. To je bio slučaj čak i onda kada su studenti uspješno riješili test o strukturi atoma. Kako bi se pomoglo da studenti prve godine studija hemije prevaziđu probleme razumijevanja atomske strukture predlažemo različite sekvence učenja koje bi pomogle studentima da se adekvatno pripreme za mnogo kompleksnije sadržaje studija hemije. Takav pristup je vrlo važan za razvoj apstraktnog mišljenja za cjelovitu naučnu pismenost studenata.

POSTER PRESENTATIONS

Topics related to Chemistry

(TRC)

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-TRC-01

Production and characterization of $K_{0.3}MoO_3$ thin films

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Keywords:
Thin films,
Blue bronze,
Quasi-one-dimensional materials,
Pulsed laser deposition.

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Abstract: We present the influence of production parameters (substrate temperature T_s and partial oxygen pressure p_{O2}) on granular $K_{0.3}MoO_3$ (potassium blue bronze) thin films produced by pulsed laser deposition (PLD) and analyzed by various standard techniques such as UV-vis spectroscopy, TOF-ERDA, XRD, AFM, SEM, femtosecond-Time Resolved spectroscopy (fs-TRs) and electrical transport.

In general, $K_{0.3}MoO_3$ represents a prototype of a quasi-one-dimensional (q-1D) material which exhibits transition to a collective, charge density wave state (CDW) below transition temperature Tp. Its properties are well known and described in crystal, but because of reduced dimensionality, CDW films enable a study of physical properties of these systems on meso and micro scales.

Analysis of experimental results shows that the films are composed of $K_{0.3}MoO_3$ nano-crystalline grains whose size and orientation vary with production parameters. Measurements like fs-TRs and electrical transport enable detection of phase transition, furthermore indicating that Tp in CDW ground state is some 30 K lower in films than in crystal.

Sažetak

U ovom radu je predstavljen utjecaj parametara proizvodnje (temperatura podloge Ts i parcijalni pritisak oksigena p_{02}) na granularne tanke filmove $K_{0.3}MoO_3$ (kalijeva plava bronza) proizvedene pulsnom laserskom depozicijom (PLD). Filmovi su ispitani različitim standardnim tehnikama kao što su UV-vis spektroskopija, skenirajuća elektronska mikroskopija (SEM), rendgenska difrakcija (XRD), mikroskopija atomskim silama (AFM), femtosekundna-vremenski razlučiva spektroskopija (fs-TRs) i mjerenje električnog transporta.

Općenito, $K_{0.3}MoO_3$ predstavlja prototip kvazi-jednodimenzionalnog (q-1D) materijala koji prelazi u kolektivno stanje vala gustoće naboja (VGN) na temperaturama nižim od temperature prelaza Tp. Njegova svojstva su dobro poznata i ispitana u kristalima, a zbog smanjene dimenzionalnosti, filmovi sa VGN stanjem omogućavaju proučavanje fizikalnih svojstava ovih sistema na mezo i mikro skalama.

Analiza eksperimentalnih rezultata pokazuje da su filmovi sastavljeni od nanokristalnih zrna čija veličina i orjentacija zavise od parametara proizvodnje. Mjerenja električnog transporta i fs-TRs su omogućila detekciju faznog prelaza u VGN osnovno stanje na temperaturi oko 30 K nižoj u filmu nego u kristalu.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-TRC-02

Characterization of partially crystalline metallic glass ZrCu

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Keywords:
Partially crystalline metallic glass,
Melt-spinning method,
Crystalization,
Activation energy.

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Abstract: The partially crystalline metallic glasses $Zr_{45}Cu_{55}$ and $Zr_{55}Cu_{45}$ (numbers indicate at. %) in the form of ribbons, with compositions near eutectics, were prepared by melt-spinning method in the Metal Physics Laboratory, Faculty of Science in Sarajevo.. The homogeneity and chemical composition of the samples were examined using a scanning electron microscope equipped with a device for energy dispersive analysis. The presence of crystals in the amorphous matrix was confirmed by X-ray diffraction (XRD). According to the XRD results, both sides of the quenched ribbon showed similar structure. The crystallization process was monitored by means of differential scanning calorimetry. Kinetics of the crystallization process was studied through isoconversional methods. It was found that peak crystallization temperature and activation energies are in good agreement with those for the amorphous samples. Overall activation energy of crystallization for $Zr_{45}Cu_{55}$ is evaluated at 3,7 eV, while for $Zr_{55}Cu_{45}$ it is 2,8 eV.

Sažetak

Djelimično kristalinično metalno staklo sastava $Zr_{45}Cu_{55}$ i $Zr_{55}Cu_{45}$ (brojevi označavaju atomske procente) u formi trake, sastava blizu eutektičkih, dobiveno je melt spinning metodom u Laboratoriji za fiziku metala na Prirodno-matemtičkom fakultetu u Sarajevu. Homogenost uzoraka i hemijski sastav ispitani su pomoću skenirajućeg elektronskog mikroskopa opremljenog uređajem za energetsku disperzivnu analizu. Prisustvo kristala u amorfnoj matrici je potvrđeno rendgenskom difrakcijom. Prema rezultatima XRD, obje strane trake pokazuju sličnu strukturu. Kristalizacioni proces je praćen diferencijalnom skenirajućom kalorimetrijom. Njegova kinetika je izučavana izokonverzionim metodom. Ustanovljeno je da su temperature kristalizacionog pika i aktivacione energije u dobrom slaganju sa vrijednostima za amorfne uzorke. Ukupna energija aktivacije procesa kristalizacije za $Zr_{45}Cu_{55}$ je 3,7eV a za uzorak $Zr_{55}Cu_{45}$ je 2,8 eV.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Abstract

PP-TRC-03

The Content of Total Polyphenols in Autochthonous Apple Cultivars from the Territory of Bosnia and Herzegovina

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Keywords:
polyphenols,
apple,
autochthonous cultivars

Abstract: The high number of studies in the field of human nutritionism attribute positive effect of apple to human health to apple's antioxidant characteristics, which are directly correlated with polyphenolic compounds. In this study, the content of total polyphenols was determined in the peel and in the pulp of autochthonous apple cultivars from the territory of Bosnia and Herzegovina. Study included 30 autochthonous cultivars which are grown at the same site in Srebrenik and collected during two seasons, 2012th and 2013th year. The content of total polyphenols was determined spectrophotometrically at 760 nm using Folin-Ciocalteu method. Obtained results indicate that the autochthonous apple cultivars are rich in polyphenols and the higher concentration of polyphenolics compounds were found in fruit peel.

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Sažetak

Najveći broj istraživanja u oblasti humanog nutricionizma pozitivan efekat jabuke na ljudsko zdravlje pripisuje njenim antioksidativnim osobinama koje su u direktnoj korelaciji sa polifenolnim spojevima. U ovom radu sadržaj ukupnih polifenolnih spojeva određivan je u kori i mesu autohtonih kultivara jabuke sa područja Bosne i Hercegovine. Istraživanje je obuhvatilo 30 autohtonih kultivara uzgajanih na lokalitetu Srebrenika koji su ubrani tokom dvije sezone, 2012. i 2013. godine. Sadržaj ukupnih polifenola određivan je spektrofotometrijski na 760 nm metodom Folin - Ciocalteu. Dobiveni rezultati pokazuju da su autohtoni kultivari jabuke bogati polifenolima, pri čemu je pronađena veća koncentracija polifenolnih spojeva u kori ploda.

Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

Print ISSN: 0367-4444
Online ISSN: 2232-7266

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