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Broj: 174
Datum: 21.02.2022.god

UNIVERZITET CRNE GORE

SENATU

CENTAR ZA DOKTORSKE STUDIJE

U prilogu akta dostavljam Odluke sa LXXVII sjednice Vijeća Prirodno-matematičkog fakuteta održane 15.02.2022. godine.

UNIVERZITET CRNE GORE Prirodno-matematički fakultet

D e k a n,

Prof. dr Predrag Miranović

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Datum: 18.02.2022.god

Na osnovu člana 64 Statuta Univerziteta Crne Gore, a u vezi sa članom 41 stav 1 Pravila doktorskih studija, na LXXVII sjednici Vijeća PMF-a od 15.02.2022.godine, donijeta je

ODLUKA

I

Utvrđuje se da su ispunjeni uslovi iz člana 38 Pravila doktorskih studija za doktoranda Dražanu Radonjić.

II

Predlaže se Odboru za doktorske studije sastav komisije za ocjenu doktorske disertacije:

1. Prof. dr Mira Petrović, redovni profesor, Catalonia Institute for water Research, Spain, Prirodne nauke, (naučna oblast: hemija);
2. Prof. dr Slaviša Stanković, redovni profesor, Biološki fakultet Univerziteta u Beogradu (naučna oblast: Biologija, ekološka mikrobiologija, zaštita životne sredine);
3. Prof. dr Svetlana Perović, redovni profesor na PMF-u (naučna oblast: Biologija, ekološka mikrobiologija, zaštita životne sredine), član;
4. Prof. dr Slađana Krivokapić, vanredni profesor na PMF-u (naučna oblast: Biologija, Fiziološka ekologija), član i
5. Prof. dr Danilo Mrdak, vanredni profesor na PMF-u (naučna oblast: Biologija, Genetika populacija) član.

III

Odluka se dostavlja Odboru za doktorske studije Univerziteta Crne Gore.

DEKAN
Prof. dr Predrag Miranović

ISPUNJENOST USLOVA DOKTORANDA

OPŠTI PODACI O DOKTORANDU	
Titula, ime, ime roditelja, prezime	Mr Dražana Radonjić
Fakultet	Prirodno-matematički fakultet
Studijski program	Biologija
Broj indeksa	1/12
NAZIV DOKTORSKE DISERTACIJE	
Na službenom jeziku	Dinamika emergentnih supstanci u vodi (EmS) i endokrino-uznemiravajućih hemikalija (EDCs) u ekosistemima rijeke Morače i Skadarskog jezera
Na engleskom jeziku	Dynamics of Emerging Water Substances (EmS) and Endocrine-Disrupting Chemicals (EDCs) in River Moraca and Skadar Lake ecosystems
Naučna oblast	Ekologija, Biologija

MENTOR/MENTORI			
Prvi mentor	Prof. Dr. Mira Petrović	Catalan Institute for water Research, Spain	Prirodne znanosti, Polje Hemija

KOMISIJA ZA PREGLED I OCJENU DOKTORSKE DISERTACIJE		
Dr Mira Petrović, redovi profesor	Catalan Institute for water Research, Spain	Prirodne znanosti, Polje Hemija
Dr Slaviša Stanković, redovni profesor	Biološki fakultet, Univerzitet u Beogradu	Biologija, ekološka mikrobiologija, zaštita životne sredine
Dr Svetlana Perović, redovni profesor	Prirodno-matematički fakultet, UCG	Biologija, ekološka mikrobiologija, zaštita životne sredine
Dr Sladjana Krivokapić, vanredni profesor	Prirodno-matematički fakultet, UCG	Biologija, Fiziološka ekologija
Dr Danilo Mrdak, vanredni profesor, honorarno	Prirodno-matematički fakultet, UCG	Biologija, Genetika populacija

Datum značajni za ocjenu doktorske disertacije	
Sjednica Senata na kojoj je data saglasnost na ocjenu teme i kandidata	24.03.2017
Dostavljanja doktorske disertacije organizacionoj jedinici i saglasanost mentora	21.01.2022.

Sjednica Vijeća organizacione jedinice na kojoj je dat prijedlog za imenovanje komisija za pregled i ocjenu doktorske disertacije	15.02.2022.godine

ISPUNJENOST USLOVA DOKTORANDA

U skladu sa članom 38 pravila doktorskih studija kandidat **je/nije** cjelokupna ili dio sopstvenih istraživanja vezanih za doktorsku disertaciju publikovao u časopisu sa **(SCI/SCIE)/(SSCI/A&HCI)** liste kao prvi autor.

Spisak radova doktoranda iz oblasti doktorskih studija koje je publikovao u časopisima sa (upisati odgovarajuću listu)

(dati spisak radova koji sadrži: prezimena i imena autora, naziv naučnog rada, ime izdavača, mjesto i godinu izdavanja, DOI, link ka radu i dokaz za JRC)

1. Dražana Radonjić, Application of the model of cylindrical reactor for self-purification by indigenous microorganisms, Chemical Industry and Chemical Engineering Quarterly, Beograd, Srbija 2021., https:dio.org/10.2298/CICEQ201126006R, http://www.ache.org.rs/CICEQ/UDC0504(479.16):579.26
2. Dražana Radonjic, Emergenti u vodi-rizik po zdravlje i ekološki disbalans, 0350-5049:Voda i sanitarna tehnika, časopis udruženja za tehnologiju vode i saniterno inženjerstvo-Beograd.Beograd, Srbija 2015., UDK: 502.51:628.1 (M52)
3. Dražana Radonjic, Marijana Krivokapić, Mirjana Miloradov Vojinović, Izvori, pojava i sudbina emergenata u vodama donjeg toka rijeke Morače -lokalitet Vukovci, 0354-3285 Ecologica, Naučno-stručno društvo za zaštitu životne sredine, Beograd, Srbija 2014. UDC:628.161.3.09 (M51)

Obrazloženje mentora o korišćenju doktorske disertacije u publikovanim radovima

Radovi sa rezultatima iz oblasti doktorske disertacije mr Dražane Radonjić objavljeni su domaćim i međunarodnim časopisima (ukupno 3 rada).

Posebno se izdvaja rad pod nazivom: „Application of the model of cylindrical reactor for self-purification by indigenous microorganisms", koji je doktorantkinja objavila u časopisu Chemical Industry and Chemical Engineering Quarterly, koji se nalazi na Sci listi naučnih časopisa. Nastao je kao dio preporuka nakon urađenih istraživanja u doktorskoj disertaciji. Na osnovu rada ispitano je korišćenje modela cilindričnog reaktora u svrhu autopurifikacije autohtonim mikroorganizmima.

Izršena je detaljna analiza farmaceutski aktivnih komponenti (PhACs), a posebno nesteroidnih antiinflamatornih lekova (NSAID) koji su su sve češće deo organske materije recipijentnih reka, posebno u njihovom donjem toku, odnosno, utvrđena je njihova koncentracija prije ulaska u cilindrični reaktor i poslije izlaska iz reaktora. Pod pretpostavkom da se koncentracija NSAID i PhACs u vodi može smanjiti samopročišćavanjem, što se provlačilo kroz cijelu disertaciju, dokazano je da takvi procesi rezultiraju modifikacijom fenotipa u autohtonoj mikrobiološkoj populaciji. Imajući u vidu navedenu predpostavku, konstruisan je eksperimentalni model, koji podrazumeva da se voda kreće, brzinom protoka po jedinici vremena od 0,005 m/s; dužina cilindričnog reakora je iznosila 432 m. Za godinu dana primene modela cilindričnog reaktora za povećanje kapaciteta samopročišćavanja od strane autohtonih mikroorganizama, autopročišćavanje je povećano za 28,05%, fenotip autohtonih mikroorganizama se promenio za 24,62%, dok je ukupna koncentracija pojedinih PhACs, mikrozagađivača i NSAID smanjena za 4,19.

Studija predstavlja odličnu teoriju za bolji regionalni razvoj i ekološku održivost.

Drugi rad koji se izdvaja jeste "Emergenti u vodi-rizik po zdravlje ljudi i ekološki disbalans" kojim je dat značajan doprinos aktualnim svjetskim problemima u istraživanju i prikazivanju rezultata nalaženja Emergentnih supstanci u površinskim vodama. Naučni rad je dio doktorske disertacije a predstavlja dio „Skrininga" Emergentnih supstanci u vodi, primarna istraživanja na kojima se zasniva i na osnovu kojih je nadograđena Disertacija. Osim što tretira problematiku koja je aktuelna u široj svjetskoj javnosti, prepoznaje problem u mogućem uticaju na zdravlje i ekološki disbalans. Dobijeni rezultati pokazuju prisustvo Emergentnih supstanci u vodi istraživanih lokaliteta (Vukovci, „Lijevi" i „Desni" krak rijeke Morače, Tanki rt-ispod mosta, i „Kraljeva glavica" Skadarsko jezero) od čega je bilo najznačajnije pronaženje i identifikacija sredstava za higijenu, deterdžena, ostataka estrogenih hormona, farmaceutika i ostalih. Identifikovano je prisustvo lipolitskih, proteolitskih, kao i koliformnih bakterija. Na ovaj način ovaj segment istraživanja iz Disertacije čini ovaj rad prvim ovakvim u crnogorskoj naučnoj bazi.

I rad objavljen u časopisu Ecologica, pod imenom: „Izvori, pojava i sudbina emergenata u vodama donjeg toka rijeke Morače -lokalitet Vukovci", segmentalno objašnjava pitanja fizičkih, hemijskih i bioloških procesa, koji utiču na sadržaj, transformaciju i kretanje konstituenata u vodi. Veliki broj hemikalija izaziva ogroman pritisak na životnu sredinu (u radu je prikazano prisustvo 76 hemikalija koje su identifikovane na lokalitetu Vukovci) javno zdravlje i naravno biosferu. Poseban osvrt u radu je dat prikazivanjem mikrobiološkog statusa lokaliteta Vukovci. Što se tiče prisutva emergenata u vodi izdvajaju se: deterdženti, sredstva za ličnu higijenu kao i prisustvo zapaljivih materija i ostaci koroziova.

Datum i ovjera (pečat i potpis odgovorne osobe)

U Podgorici, 18.02.2022. godine,

MP

DEKAN

Prilog dokumenta sadrži:

1. Potvrdu o predaji doktorske disertacije organizacionoj jedinici
2. Odluku o imenovanju komisije za pregled i ocjenu doktorske disertacije
3. Kopiju rada publikovanog u časopisu sa odgovarajuće liste
4. Biografiju i bibliografiju kandidata
5. Biografiju i bibliografiju članova komisije za pregled i ocjenu doktorske disertacije sa potvrdom o izboru u odgovarajuće akademsko zvanje i potvrdom da barem jedan član komisije nije u radnom odnosu na Univerzitetu Crne Gore

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Broj: 102

Datum: 21.01.2022.god

Na osnovu člana 33 Zakona o upravnom postupku, nakon uvida u službenu evidenciju, Prirodno-matematički fakultet izdaje

P O T V R D U

MSc Dražana Radonjić, student doktorskih studija na Prirodno-matematičkom fakultetu u Podgorici, dana 21.01.2022.godine dostavila je ovom fakultetu doktorsku disertaciju pod nazivom "Dinamika emergentnih supstanci u vodi (EmS) i endokrino-uznemiravajućih hemikalija (EDCs) u ekosistemima rijeke Morače i Skadarskog jezera" na dalje postupanje.

Univerzitet Crne Gore Prirodno-matematički fakultet

DEKAN

Prof. dr Predrag Miranović

Na osnovu člana 37. Pravila doktorskih studija Univerziteta Crne Gore dajem sledeću

SAGLASNOST

Rad pod nazivom: "Dinamika emergentnih supstanci u vodi (EmS) i endokrino-uznemiravajućih hemikalija (EDCs) u ekosistemima rijeke Morače i Skadarskog jezera", autora mr. Dražane Radonjić, diplomiranog biologa, zadovoljava kriteijume doktorske disertacije prepisane Statutom Univerziteta Crne Gore I Pravila doktorskih studija.

MENTOR

Prof. Dr. Mira Petrović

U Geroni, 17.01.2022

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DRAŽANA RADONJIĆ

Biology Department of the Faculty of Natural Sciences and Mathematics, University of Montenegro, Podgorica, Montenegro

SCIENTIFIC PAPER

UDC 504(497.16):579.26

APPLICATION OF THE MODEL OF CYLINDRICAL REACTOR FOR SELF-PURIFICATION BY INDIGENOUS MICROORGANISMS

Article Highlights

- Kinetic model of the autotrophic biofilm reactor is researched through its efficiency in the water
- The level of auto-purification is proven higher with the help of the kinetic model
- Decrease in NSAID concentrations is proven, which poses a significant ecological restoration aspect
- Study presents an excellent theory to better regional development and ecological sustainability

Abstract

Pharmaceutically active compounds (PhACs), in particular, nonsteroidal anti-inflammatory drugs (NSAIDs) are in increasingly wider usage, and as such are more and more frequently part of the organic matter of recipient rivers, especially in their lower courses. To indicate their significance as pollutants, as well as the significant role that the presence of autochthonous microflora plays in solving this issue, we undertook to perform this experiment. The experiment, titled "Application of the model of cylindrical reactor in self-purification by indigenous microorganisms", was conducted during a one-year period at the location of Vukovci, in the lower course of the Morača river. Assuming that the concentration of NSAIDs and PhACs in water can be reduced through self-purification, it has been proven that such processes result in a modification of phenotype in the indigenous microbiological population. Having the above-mentioned premise in mind, we constructed the experiment model, which entails kineticism of water, whereas the defined volume flow rate per unit time was 0.005 m/s, through the known distance of 432 m. Over one year of application of the model of the cylindrical reactor for enhancing self-purification capacity by indigenous microorganisms, auto-purification increased by 28.05%, the phenotype of the indigenous microorganisms changed by 24.62%, whereas the total concentration of particular PhACs, micropollutants, and NSAIDs decreased by 4.19%.

Keywords: pharmaceutically active compounds (PhACs), nonsteroidal anti-inflammatory drugs (NSAIDs); self-purification, water kineticism, indigenous microorganism phenotype.

Within natural aquatic environments, various physical, chemical, and biological processes occur which affect the content, transformation and fluctuation of the water constituents [1]. In most cases, river and lake waters are contaminated by waste, sewage, and pharmaceuticals, including nonsteroidal anti-inflammatory drugs (NSAIDs) and their degradation products [2-5]. Montenegro as a country, especially its central region, along with the mountain range surrounding it, is considered a hydrologically dense and rich area. An estimated average amount of 614 m^3/s flows through its surface, which amounts to 19.3

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km³ per year, with an average module of 44.4 l/s/km³. Waterflows of equal or greater capacity than this appear on less than 3% of the Earth's surface. The longest and largest river in Montenegro is Morača, with a flow length of 110 km [6].

The Morača river, with an annual intake of 4,898,300 m^3 of treated water is mostly polluted due to the continuous human impact caused by large-scale urban, industrial, and agricultural activities, which affect this water source and the ecosystem it sustains [7]. Compounds that are frequently studied in the aquatic environment are analgesics and anti-inflammatories (such as diclofenac, ibuprofen, naproxen, acetylsalicylic acid, and paracetamol) [8].

However, out of the existing and theoretically feasible surface water purification methods, there are none currently implemented in Montenegro. At present, river water purification technologies can be categorized into physical, chemical, biological, and ecological methods. Physical methods include aeration and sediment dredging [9]. Chemical methods include chemical precipitation [9] and the application of chemical algaecide [10]. Biological methods include bioremediation [11], biofilms [12], contact oxidation [13], and membrane bioreactor technology [14]. Ecological methods include ecological ponds [15], plant purification treatment [16], ecological floating beds [17], and constructed wetlands [18]. They also offer ecological benefits: they have been demonstrated to be an economical and efficient sewage treatment and management method [19], and they have become a preferred ecological method to improve the water quality of rivers in cities around the world.

As a result of the above-stated information, developing an appropriate water purification method that uses the known property of microorganisms to use pollutants in their nutrition as the basic source of carbon, whereby the properties of the microorganisms are altered, was our primary objective. These microorganisms are categorized as natural purificators - self-purificators. Self-purification, in the ecological sense, represents the process of the ecosystem itself adapting and learning to face all changes and occurrences accordingly. It can also be seen as the basis for self-support that the system provides in case its growth and development are disturbed.

Auto-purification or self-purification is a process by which the system adequately faces all the changes and occurrences almost independently. The relationship between facultative oligotrophic and heterotrophic (index FO/H) represents one of the most significant microorganism parameters used to estimate water properties from an ecological aspect [20,21] and is a very good indicator of water self-purification capacity [22]. An idea for categorization of water self-purification capacity based on the relationship between FO/H [23], describes self-purification capacity of water as low (<1), sufficient (>1), and if >10 as good capacity of self-purification.

Therefore, we ran a pilot project in which we tested the applicability of the developed cylindrical reactor mathematical model.

By definition, a cylindrical reactor is a chemical reactor and an open system. However, the principles developed for chemical reactors can be applied to most, if not all, chemically reacting systems (*e.g.*, atmospheric chemistry, metabolic processes in living organisms, etc.) [24]. It is important to highlight the significance of its approximate ideal drift, which means there is no fusion inside the moving reactionary compound in the course of the flow (axial direction). The reactor resembles a line of elementary volumes of the reactionary compound (reaction compound inside the differential volume of that sort is homogenous), and the volumes passing through the reactor do not mix with the reactionary mass (Figure 1a).

On its way from the entrance to the exit, a hypothetical elementary (differential) volume spends a certain amount of time in the reactor, during which the composition of the reactionary mass changes [25]. According to that, the values of the dependent variables are the position functions on the z-axis.

Because of its simple cylindrical design (Figure 1b), free of any additional mixing devices, it is often used. Setting the component A balance (indigenous microorganisms) as the differential volume of the reactor, results in the basic equation of multiplication of component A (indigenous microorganisms):

$$FA - (FA + d\,FA) - r\,A\,d\,V = 0$$
$$-d\,FA - r\,A\,d\,V = 0$$

FA - molar flow rate for indigenous microorganisms in the cylinder; dFA - molar velocity differential element for indigenous microorganisms; dV - differential volume element; rA - the numerical value of indigenous microorganisms.

Therefore, the development of optimization functions of the model means that the number of replicas of indigenous microorganisms that would be self-supporting to the whole system should be met, which was our goal at the beginning.

However, the system also has its flaws. The main shortcoming is the size of the system itself, as it needs a large surface, and must be kept in the state of kinetic energy at all times. Also, an adequate flow

rate through the cylindric pipe must be determined, lasting no longer than 24h, to lower the temperature inside the reactor and at the same time keep the active oxygen that creates aerobic conditions. This paper describes a trial construction system of the cylindrical reactor for the self-purification of indigenous microorganisms. These results serve as support for the promotion and application of this technology.

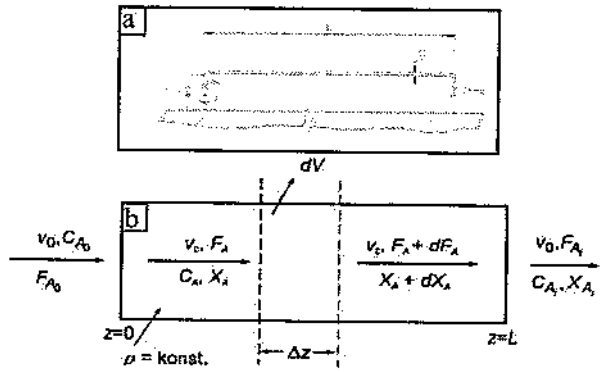

Figure 1. a) An example of the "cylindrical reactor for the purpose of self-purification by indigenous microorganisms" SP-1 water sampling site before entering the reactor; MF flow meter; P-pump; L-length of hose-cylindrical reactor; Di-section / diameter of the reactor hose; SP-2 designation for the point at the outlet of the hose / reactor where a water sample is taken; b) cylindrical reactor for enhancing self-purification capacity by indigenous microorganisms: v_0-volume flow (flow rate at the beginning), C_{A0}-concentration of reactant (in our case the number of indigenous microorganisms at the beginning); F_{A0}-molar flow rate of indigenous microorganisms at the beginning; FA-molar flow rate for indigenous microorganisms in the cylinder; CA-concentration of reactant (in our case indigenous microorganisms in the cylinder); XA-conversion of reactant reaction in our case of indigenous microorganisms; dV-differential volume element; z-axial direction; ρ-density; dFA-differential element of molar velocity for indigenous microorganisms; dX_A-differential element of conversion of the reactant reaction, in our case of indigenous microorganisms; L-length of reactor; F_{Az}-molar flow of indigenous microorganisms at the outlet; C_{Az}-concentration of indigenous microorganisms at the outlet; X_{Az}-conversion of reactant reactions at the outlet (in our case of indigenous microorganisms).

EXPERIMENTAL

Model design

The model design of the cylindrical reactor for the self-purification of indigenous microorganisms is shown in Figure 1b. It consists of a built-in pump (P), flow meter (MF), rotameter, specifically with the ability to regulate the rate of the flow, and a long pipe (L) that represents a cylindrical reactor. Hypothetically, we have different flow rates in the pipe. The highest velocity, both theoretically and practically, is during laminar flow in the middle of the pipe's (*Di*) axis, which is parabolically arranged so that its outermost radius amounts to zero.

Average velocity is calculated by a continuity equation, flow Q = const, the maximum velocity of 0.005 m/s is adopted (*Di*), considering that in the worst case, the pipe can reach laminar flow that, compared to the turbulent velocity, has a higher velocity in the axis. Based on that, we can calculate the length of the cylindrical reactor:

$$L = Vmax \times 3600s \times 24h = 0.005\ E \times 3600s \times 24 = 432m$$

Samples were taken from localities SP1 and SP2. The water sample taken from locality SP1 was taken before the water entered the cylindrical reactor, and it is a so-called "native sample". The sample from locality SP2 was taken from the cylindrical reactor's faucet (water sample is taken from the kinetic reactor of indigenous microorganisms after a reaction lasting 24 h). The objective of the experiment has been to prove that under these conditions, facultative oligotrophs can increase their number and can affect modifications in the concentration of certain pharmaceuticals in water; accordingly, it would provide the grounds for the assumption that the same applies to other microorganisms.

Study area

The river Morača has its source at the topographic point of 975 m above the springs which flow down the Javorje and Zebalci slopes, with the largest of them being Javor and Rzav creeks. Morača is 113 km long, which makes it the longest river in Montenegro. We tested the locality Vukovci, situated at an altitude of 49 m.

The coordinates of the research location are 42°20'02" N, 19°11'60" E. The average yearly temperature at the locality Vukovci is 23.25 °C, and the average annual precipitation is 116.92 mm. The highest temperature recorded during the summer was 42.0 °C, and the lowest temperature recorded during the winter was -2.1 °C.

Additionally, this is the most densely populated area in Montenegro and is part of the central region. In 1948, the population of this region reached 128,872 which was equal to 34.2% of the total population, while in 2011, the central region accounted for 47.3% of the total population.

The river flows into the Skadar lake, the largest still body of freshwater in Montenegro. The main hydrological parameters of the river Morača are Q abs-

olute minimum: 5.5 m^3/s; Q average: 140 m^3/s; Q absolute maximum: 900 m^3/s. The annual average flow of the river Morača on locality Vukovci is 104,125 m^3/s.

Data collection and analysis

The quality of the water samples was monitored over a one-year period from September 2017, to December 2018. Samples were taken monthly, on the 5th day of each month, in the morning.

Samples taken for chemical analysis were collected using glass bottles with a capacity of 1 liter. To determine the concentrations of dissolved oxygen in water, Winkler's bottles with coded stoppers were used, with oxygen being immediately fixed by adding 1 ml KI and 1 mL $MgCl_2$ [26].

Sampling for microbiological analysis was performed in pre-sterilized glass bottles. Sampling bottles were washed and dried, then sterilized for one hour at 190 °C in a dry sterilizer. The sampling included the following procedures: the sampling for microbiological analysis was done by quickly submerging prepared bottles, to avoid contamination of the bottle. Samples were transported to the laboratory in a portable fridge. Microbiological analysis of the samples was performed at the Hydrobiological Institute of Montenegro, Department of Biology [27].

Samples intended for saprobiological analysis were taken using a 25 μm mesh plankton net, and they were analyzed without being fixated, or fixated using 96% alcohol.

Community-level physiological profiling of the microbial community (CLPP) is based on the BIOLOG microbial identification system in the Microbiological lab at Hemomont d.o.o, Podgorica, Montenegro. The BIOLOG system functions by identifying microorganisms on the phenotype level. It is especially important because every living community can react with 95 different sources of carbon on a microtiter plate. Prokaryote communities represent functional units that have the metabolic characteristics of bacteria, hence CLPP is used as a sensitive and fast method to identify the potential diversity of microbial communities. By degrading the sources of carbon, we reduce one out of 95 microbial mediums found in cupolas (not the one in the position (1,1) as it represents negative control), and we notice changes in the shades of orange. Those color changes manifest through the optical distance measurements (OD), and the change of the shade itself can identify the microbial community through the average metabolic response (AMR).

Average metabolic response (*AMR*) is by definition the average respiration of carbon sources used by microbial communities, and is predictable, measurable, and can be compared between communities

$$AMR = \Sigma(O.D.well - O.D.neg)/95$$

where (*O.D.well-O.D.neg*) is the relation between measured values of optical density and negative control [28].

Analysis of PhACs (NSAID) in water samples

River water (100 mL) was collected to determine the presence of PhACs (NSAIDs) in the aqueous phase. River samples were filtered through 1 μm glass fiber filters followed by 0.45 μm nylon membrane filters and kept at -20 °C until analysis. Water samples were analyzed for PhACs according to [29]. Ultrapure water (100 mL) was spiked with a mixture of the target analytes and subsequently subjected to the extraction method. Briefly, 3mL of EDTA 1M (4 vol.%) was added to the water samples. A Baker vacuum system (J. T. Baker, The Netherlands) was used to pre-concentrate the samples in Oasis HLB cartridges (60 mg, 3 mL). They were loaded with 100 mL of water samples and eluted with 6 mL of methanol. The extracts were evaporated under a gentle nitrogen stream and reconstituted with 1 mL of the methanol-water mixture (volume ratio for PhACs), and 10 mL of IS mixture (1 mg/L) was added to the final extract. Method detection limits (*MDL*) and method quantification limits (*MQL*) were set as the minimum detectable amount of analyte with a signal-to-noise of 3 and 10, respectively. *MDL* and *MQL*s have been calculated as the average of those estimated in real samples and in the spiked samples. Chromatographic separations were carried out with a Waters Acquity Ultra-Performance™ liquid chromatography system, equipped with two binary pumps systems (Milford, MA, USA) using an Acquity HSS T_3 column (50 mm×2.1 mm i.d., 1.8 μm particle size) for the compounds analyzed under positive electrospray ionization (PI) and an Acquity BEH C18 column (50 mm×2.1 mm i.d., 1.7 μm particle size) for the ones analyzed under negative electrospray ionization (NI), both purchased from Waters Corporation. For the analysis in PI mode, the optimized separation conditions were as follows: solvent (A) methanol, solvent (B) 10 mM formic acid/ammonium formate (pH 3.2) at a flow rate of 0.5 mL/min. The gradient elution was: initial conditions 5% A; 0-4.5 min, 5-95% A; 4.5-4.6 min, 100% A; 4.6-6.0 min, 100% A; from 6.0 to 6.1 return to initial conditions; 6.1-6.7, equilibration of the

column. The analysis in NI mode was performed by using acetonitrile (A) and 5 mM ammonium acetate/ammonia (pH=8) (B) at a flow rate of 0.6 mL/min. The gradient elution was: 0-1.5 min, 0-60% A; 1.5-2.0 min, 100% A; 2.0-3.0 min, 100% A; 3.20 min return to initial conditions; 3.20-3.70 min, equilibration of the column. The sample volume injected was 5 µL, and sample analysis was repeated three times. UPLC instrument was coupled to a 5500 QTRAP hybrid triple quadrupole-linear ion trap mass spectrometer (Applied Biosystems, Foster City, CA, USA) with a turbo ion spray source. Compound-dependent MS parameters (declustering potential (DP), collision energy (CE) and collision cell exit potential (CXP)) were optimized by direct infusion of individual standard solutions of each compound at 20 µg/L.

All data were obtained and processed using Analyst 1.5.1 software, and the end value was obtained by adding the repeated values and dividing them by three.

Saprobity index (*SI*)

Samples intended for saprobiological analysis were taken by using a 25 µm mesh plankton net, and they were immediately analyzed without being fixated, or fixated using 96% alcohol.

The saprobity index was calculated according to Pantle-Buck method. This system involves the application of the standard sampling techniques (Grginčević and Pujin, 1986).

Phytoplankton analysis with the application of the saprobity system, as noted in [30], determination of phytoplankton in the tested water sample, along with specifying the relative frequency (u) of each type, by using the numbers 1,3,5, whereas in this study, in addition to listed numbers 1, 3 and 5, the abundance was also reported by numbers 2, 4 and 10, depending on the frequency of microalgae, which is rather common in research of this kind.

Saprobity index (*SI*) is determined by using a method explained in [30] by applying a species value index as described in [31].

Preparation for SEM:

- Freshly collected diatom material can simply be air dried onto a small coverslip (Ø 12 mm) or filtered through a 2.5 µm Millipore® filter.
- Cleaned material can be prepared in a similar manner.
- After air drying, the sample should be placed in a desiccator containing silica gel for 24 h to make sure that it is completely dehydrated before continuing with further preparation.
- When dry, the coverslip or filter should be mounted on an aluminum microscope stub with carbon tape and sputter-coated with gold-palladium.
- The samples are now ready for examination.
- 10-15 kV is usually an adequate voltage for examining diatoms.
- Image analysis is the most advanced technology for a broad range of functions such as digital image acquisition, image processing, sample analysis, database archiving, and results/report documentation [32]. A recommended software package is "analySIS" which has several expansion versions and configurations. Version 3.1 provides live overlay, 3-D surfaces, automatic scale bar, and many other functions. It is relatively user-friendly, however, expert advice is required for the most benefit.

RESULTS AND DISCUSSION

The system of the kinetic model of the reactor was operating from 05/09/2017 to 05/09/2018. Over this time, the system proved sustainable, micropollutant (NSAIDs) removal efficiency slowly stabilized, and the indicators, *i.e.*, saprobity index, auto-purification level, and the concentration of dissolved oxygen in water (DO) showed that water quality was improving. Oligotrophic microorganism phenotype monitoring showed that native samples differ from those taken 24 h after the samples passed through the kinetic reactor.

Following an empirically determined incubation period, color patterns in the 96-well matrix and intensity (O.D.) of color formation can be used to determine AMR to describe the microbial community. According to that, native sample AMR (Figure 2) ranged from 0.8 to 1.94. Initially, the values of the native sample AMR, *i.e.*, of the sample before entering into the cylinder collector, were almost identical, except for the 0.8 minimum in September 2018. In December 2018, the native sample AMR value was 1.71. The AMR values of the kinetic cylindrical reactor sample were higher and ranged from 1.3 to 2.17.

The average mean result AMR for the sample before entering into the cylinder amounted to 1.42, while the average mean result AMR after the samples passed through the kinetic reactor amounted to 1.96 (Figure 2). Standard deviation is a significant statistical element that shows us how close the values in a data set are to the mean. For the native sample AMR, the standard deviation was 0.38, and for the kinetic cylindrical reactor sample, the standard deviation was higher by 0.05. The standard deviation value being

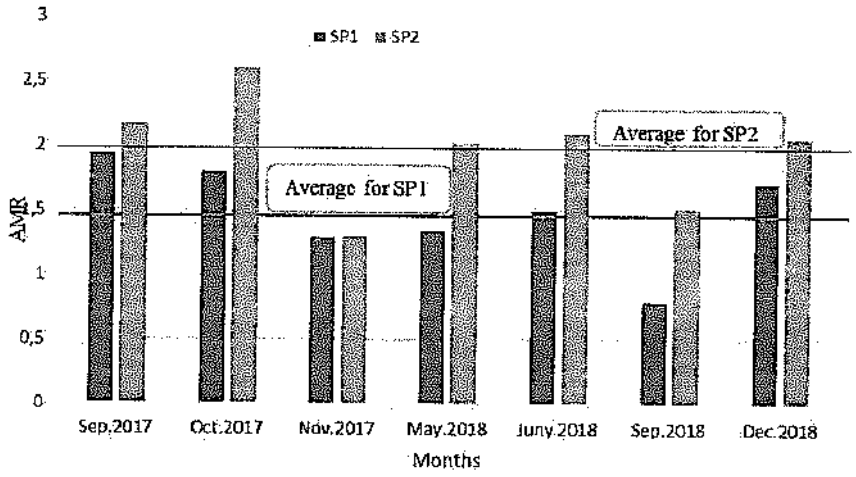

Figure 2. AMR average for research locations SP1 and SP2 for oligotrophic microorganisms.

this low only leads us to conclude that the results are mostly the closest to the average mean result.

The water contains 8.3 mg/L of dissolved oxygen at the temperature of 25 °C and it is of huge importance for many microorganisms in the water. During the operation of the model of the kinetic reactor, we established that the *DO* values in the analyzed samples were significantly higher and ranged from 9.5 to 16.9 mg/L. The average *SP*1 value was 12.64 mg/L, while the average *SP*2 value was 12.52 mg/L (Figure 3).

The average native sample value mg/L of dissolved O_2 is negligibly higher (0.12) compared to the value of dissolved O_2 in the water samples for the indigenous microorganisms of the kinetic cylindrical reactor sample. We assume that the sustainability of the system is based on the presence of the microorganisms that are capable of auto-purification, hence breaking down the micropollutants.

Based on the water self-purification categories, depending on the FO/H index, during the operating of the model (Figure 4), both *SP*1 and *SP*2 show good self-purification ability. The average FO/H mean index for *SP*1 amounted to 1.88, while the average FO/H mean index for *SP*2 amounted to 2.62 (Figure 4). FO/H range value for *SP*1 was 1.17, while the same *SP*2 value amounted to 1.98. The FO/H index values for *SP*2 were 28.05% higher compared to *SP*1 samples. Such auto-purification values are followed by the values of the NSAIDs in water samples *SP*1 and *SP*2 at the Vukovci location. During the study, we examined acetaminophen (paracetamol) which is used for reducing fever and treating pain in people of all ages [33], salicylic acid, as one of the most important components in the pharmaceutical industry [34], carbamazepine, which is used to prevent and control seizures, known as an anticonvulsant or antiepileptic drug [35], and ketoprofen class of nonsteroidal anti-inflammatory drugs (NSAID) with analgesic and antipyretic effects [36] in micropollutant concentrations at the research sites (Figure 5). With the model of the cylindric reactor for self-purification by

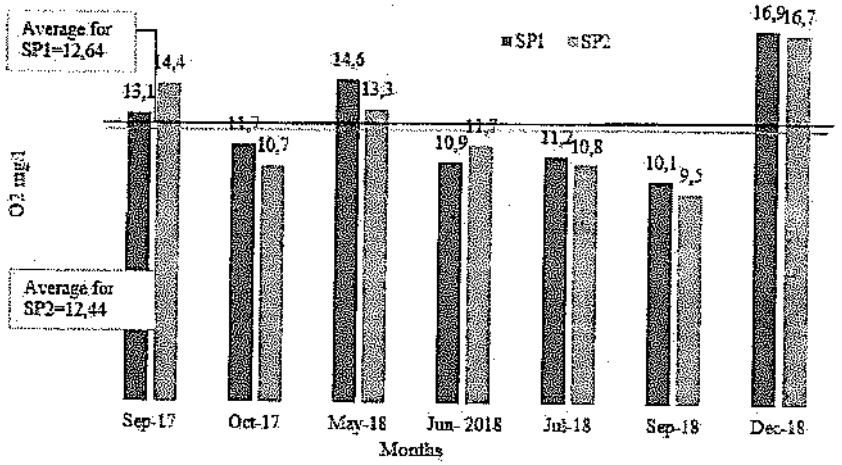

Figure 3. Dissolved oxygen concentration in the water (DO) values for locations SP1 and SP2, Vukovci locality.

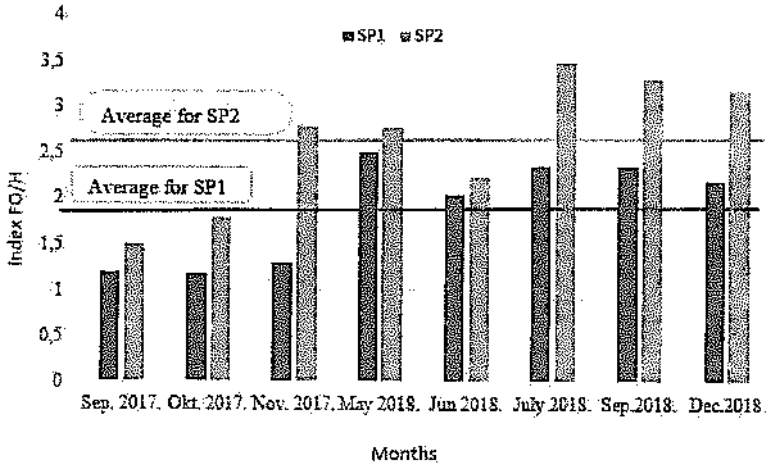

Figure 4. Index FO/H at the Vukovci locality for locations SP1 and SP2.

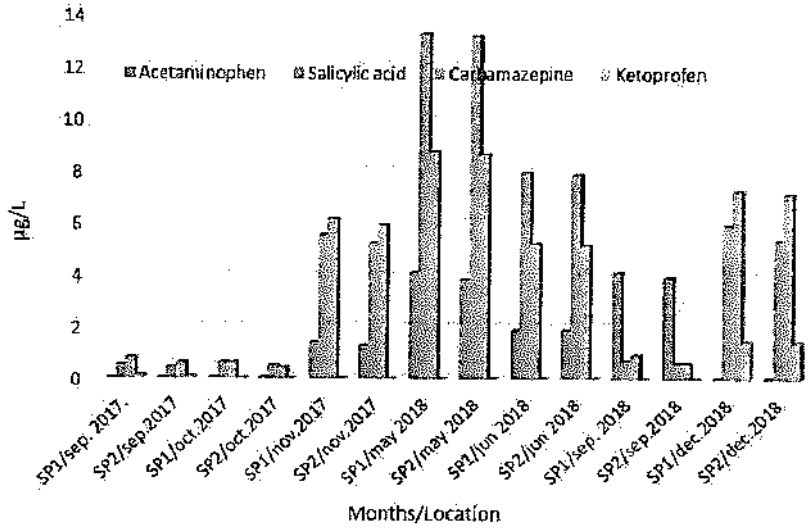

Figure 5. NSAID presence on Vukovci locality for locations SP1 and SP2.

indigenous microorganisms, we proved a 4.19% decrease in micropollutant (NSAIDs) in *SP*2 samples. When observing the pharmaceuticals individually, we noticed that the average value for the acetaminophen *SP*1 was 1.65, and 1.56 for *SP*2, with the standard deviation difference of 0.12 in favor of the *SP*1 (1.83). SP1 range value was 4.09, while that value amounted to 3.89 for *SP*2. Statistical values of the salicylic acid showed that the results for *SP*1 and *SP*2 do not differ significantly, with the averages for *SP*1 and *SP*2 being 4.9 and 4.7, respectively. Standard deviation was even for both samples, 4.73 for *SP*1, and 4.72 for *SP*2. The average mean for carbamazepine *SP*1 value was 4.21, and the average mean for *SP*2 was 4.04. The standard deviation for *SP*1 was 3.39, and 4.04 for *SP*2. *SP*1 ketoprofen range value was 1.32, and 1.35 for *SP*2, with the maximal value for *SP*1 and *SP*2 being 1.43. Minimal *SP*1 and *SP*2 values were 0.11 and 0.08, respectively. During researching, ketoprofen values for October and November of 2017, as well as May, June, and September of 2018, were under the method detection limits (*MDL*).

During the experiment, it was especially important to prove that the system does not significantly affect the composition of the microalgae/saprobity index (*SI*).

SI value for the Vukovci locality, as well as locations *SP*1 and *SP*2 (Figure 6), was increasing in *SP*1 up until May 2018. By monitoring the system operation in May 2018, we noted that the value of *SP*2 saprobity index was higher than the value in *SP*1. Then, the *SP*1 saprobity index went up during June and July 2018, until September and December of 2018, when the *SP*1 saprobity index significantly surpassed the *SP*2 value. The average saprobity index value for *SP*1 was higher than the average *SP*2 value by 0.38 (Figure 6). Standard deviation of the "sum sample" amounted to 0.39 which clearly indi-

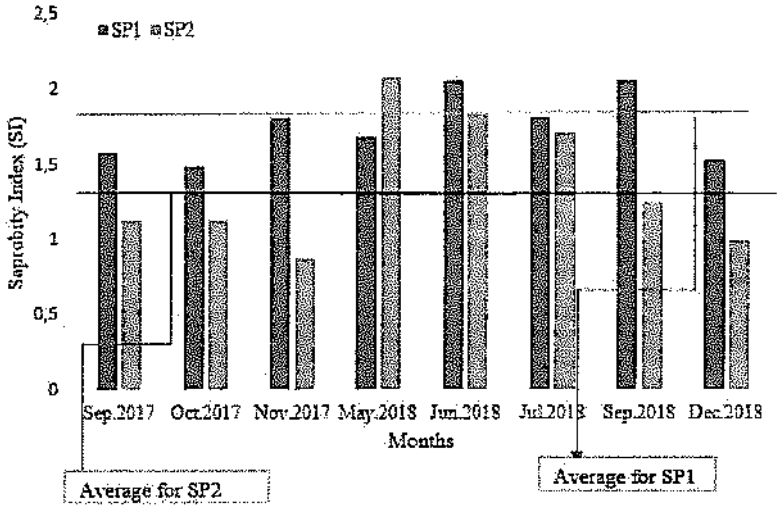

Figure 6. Saprobity index for Vukovci locality at locations SP1 and SP2.

cates that the results are grouped mostly around the average mean value, as well as low dispersion compared to the overall sample. The most prevalent division was *Bacillariophyta*, while the most prevalent species were *Cymbella lanceolata*, *Fragilaria crotonensis* and *Cymbella ehrenbergii*, captured using SEM microscope.

During the summer months, the water level at Vukovci site fell below the zero point. During that period (August-October), operating the kinetic cylindrical reactor was very difficult and saprobity index values (Figure 6) were at their highest. When the system normalized, heavy rainfall was recorded from November to June, which played a key role in the improvement of the system results.

As Figures 4 and 5 show, there is a significant connection between FO/H index, self-purification, and NSAID concentration in water samples at the Vukovci locality. By correlating these two variables using the Pearson correlation coefficient, we are able to support our results mathematically. The calculated *r*-value is 0.484, which allows us to establish a moderately positive ratio between those two variables [37]. The coefficient of determination amounts to 23%, therefore we can claim that 23% of one variable in water (FO/H index) was caused by the concentration value of the second variable in the water (NSAID concentration). Integrated effect: self-purification index, dissolved oxygen in water, removal of NSAIDs from water samples, saprobity index, complied with the

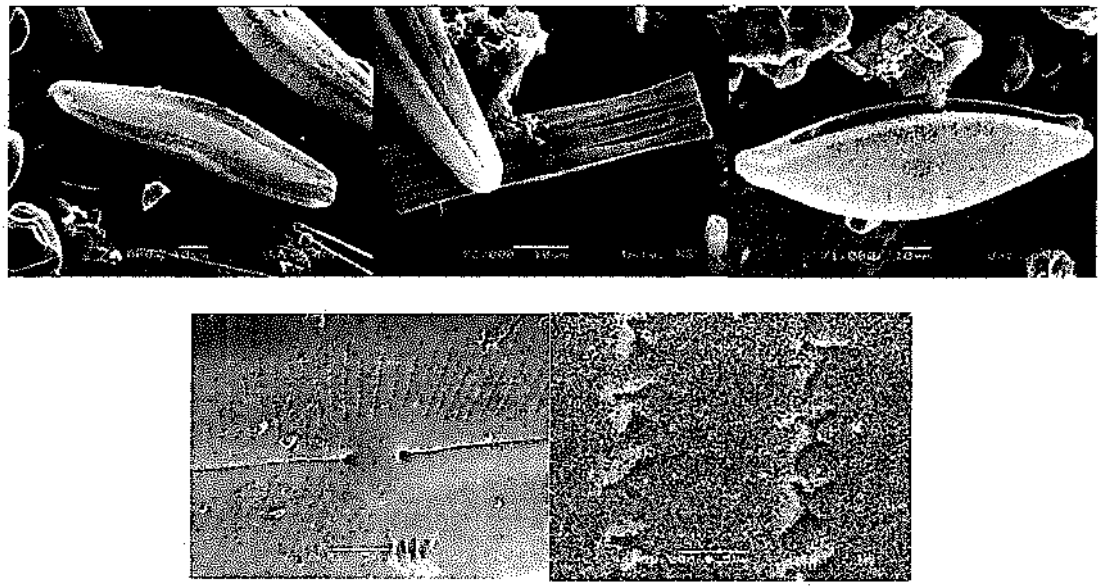

Figure 7. SEM micrographs of diatoms collected from Morača river; from left to right, first row: Cymbella lanceolata, Fragilaria crotonensis, Cymbella ehrenbergii; second row: Cymbella ehrenbergii, both.

development and change in the phenotype of the indigenous facultative oligotrophic microorganisms in the water.

During September 2017, optimal conditions regarding air and water temperature enabled our system to function optimally, and therefore the difference in the adaptation of the phenotype of indigenous oligotrophic microorganisms shown as the *AMR* value was higher by 10.6% at the *SP*2 location compared to the *SP*1, and also the value of the auto-purification index in *SP*2 was higher by 20% than the value in *SP*1.

Regarding the saprobity index, the value in location *SP*1 was 28.5% higher than the value in *SP*2. The *SP*2 values were noticeably higher until November 2017, when the difference in the phenotype of indigenous facultative oligotrophic microorganisms amounted to only 0.08%.

The CLPP approach has sufficient sensitivity to detect acute contaminant impact on the physiological processes of the indigenous microbial community while providing data for the evaluation of chronic stress-induced adaptations in microbial community structure. By examining the AMR relation for *SP*2 and *SP*1, the most significant difference in their results was noted during October 2017, when the difference amounted to 0.8, and then during the September sampling, when it amounted to 0.68. Of course, microbial communities have great potential for temporal or spatial change, and thus represent a powerful tool for understanding community dynamics in both, basic and applied ecological contexts [5]. This proves that the system has satisfactory self-purification ability. Water quality is directly correlated to its chemistry at numerous locations along the course of rivers, but also is the result of geomorphological conditions, as well as anthropological influence.

The dissolved oxygen content of water ranged from 9.5 to 16.9 mg/L during the operating of the system; therefore, the system was supersaturated with oxygen. The saprobity index was highly oligotrophic [38] during 57.15% of our analysis for *SP*1, and 85.22% of our analysis for *SP*2; for the rest of the analysis it was β-mesosaprobic. This proves that our system is sustainable.

CONCLUSION

One-year observation of the system of "cylindrical reactor for self-purification by indigenous microorganisms" showed that the system has sufficient auto-purification capacity and therefore actively improves the water quality. It was mature and stable throughout the entire year. The FO/H index values were 28.05% higher in the *SP*2 samples than the values in *SP*1. This model showed a total decrease of 4.19% of the selected pharmaceuticals and micropollutants in samples taken at location *SP*2, *i.e.*, post-reactor samples, compared to the same NSAID concentration in the *SP*1 or native sample. Indigenous microorganisms actively affected NSAID degradation.

The *AMR* for *SP*2 was 24.62% higher than for *SP*1, which proves the phenotypic adaptivity of facultative oligotrophic microorganisms. Saprobity level was highly oligotrophic for over 50% of the samples, the highest being *Bacillariophyta*.

The system integrates water purification and ecological restoration. Based on the "close to nature, multi-functional and sustainable" concept of ecological restoration, the study provides an excellent theory and practice to promote a healthy river environment and the sustainable ecological, economic, and social development of the region.

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NAUČNI RAD

PRIMJENA MODELA CILINDRIČNOG REAKTORA U CILJU SAMOPREČIŠĆAVANJU KORIŠTENJEM AUTOHTONIH MIKROORGANIZAMA

Farmaceutski aktivne komponente (PhACs), a posebno nesteroidni antiinflamatorni lekovi (NSAID) su u sve široj upotrebi i kao takvi su sve češće deo organske materije recipijentnih reka, posebno u njihovom donjem toku. Da bismo ukazali na njihov značaj kao zagađivača, kao i na značajnu ulogu koju prisustvo, autohtone mikroflore igra u rešavanju ovog pitanja, preduzeli smo da izvedemo ovaj eksperiment. Eksperiment pod nazivom „Primjena modela cilindričnog reaktora u cilju samoprečišćavanju korištenjem autohtonih mikroorganizama" sproveden je u periodu od godinu dana na lokalitetu Vukovci, u donjem toku rijeke Morače. Pod pretpostavkom da se koncentracija NSAID i PhACs u vodi može smanjiti samoprečišćavanjem, dokazano je da takvi procesi rezultiraju modifikacijom fenotipa u autohtonoj mikrobiološkoj populaciji. Imajući u vidu navedenu predpostavku, konstruisan je eksperimentalni model, koji podrazumeva da se voda kreće. Pri tome je definisana zapreminska brzina protoka po jedinici vremena i ona je iznosila 0,005 m/s; dužina cilindričnog reakora je iznosila 432 m. Za godinu dana primene modela cilindričnog reaktora za povećanje kapaciteta samoprečišćavanja od strane autohtonih mikroorganizama, autoprečišćavanje je povećano za 28,05%, fenotip autohtonih mikroorganizama se promenio za 24,62%, dok je ukupna koncentracija pojedinih PhACs, mikrozagađivača i NSAID smanjena za 4,19.

Ključne reči: farmaceutski aktivne komponente (PhACs), nesteroidni antiinflamatorni lekovi (NSAID), samoprečišćavanje, kretanje vode, fenotip autohtonih mikroorganizama.

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REPUBLIKA HRVATSKA
NACIONALNO VIJEĆE ZA ZNANOST

Matični odbor za područje prirodnih znanosti - polje kemije

KLASA: UP/I-640-03/14-01/0074
URBROJ: 355-06-04-14-0002
Zagreb, 12. ožujka 2014.

Na temelju članka 33. i 35. Zakona o znanstvenoj djelatnosti i visokom obrazovanju (NN 123/03, 198/03, 105/04, 174/04, 46/07, 45/09, 63/11, 94/13 i 139/13) Matični odbor za područje prirodnih znanosti – polje kemije, na 4. sjednici održanoj 12. ožujka 2014. donosi

O D L U K U
o izboru u znanstveno zvanje

Dr.sc. MIRA PETROVIĆ, izabire se u znanstveno zvanje znanstvenog savjetnika u znanstvenom području prirodnih znanosti – polje kemija.

O b r a z l o ž e n j e

Sukladno članku 33. i 35. Zakona o znanstvenoj djelatnosti i visokom obrazovanju pristupnica dr.sc. Mira Petrović, podnijela je Fakultetu kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu, zahtjev za izbor u znanstveno zvanje.

Na prijedlog Stručnog povjerenstva imenovanog na sjednici Fakultetskog vijeća Fakulteta kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu dana 02. prosinca 2013., koje je za pristupnicu dalo svoje mišljenje o ispunjenju uvjeta iz Pravilnika o uvjetima za izbor u znanstvena zvanja – čl.1.tč.1. prirodne znanosti (NN 84/05, 138/06), Fakultetsko vijeće Fakulteta kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu na sjednici održanoj 20. siječnja 2014. utvrdilo je da pristupnica ispunjava sve uvjete za izbor u znanstveno zvanje znanstvenog savjetnika u znanstvenom području prirodnih znanosti – polje kemija.

Matični odbor prihvatio je prijedlog Fakultetskog vijeća Fakulteta kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu na 4. sjednici održanoj 12. ožujka 2014. te izabrao pristupnicu u znanstveno zvanje znanstvenog savjetnika.

UPUTA O PRAVNOM LIJEKU: Protiv Odluke o izboru u znanstveno zvanje pristupnik nema pravo žalbe, ali može pokrenuti upravni spor pred Upravnim sudom u Zagrebu u roku od 30 dana od dana dostave pristupniku. Tužba se predaje Upravnom sudu u Zagrebu neposredno u pisanom obliku, usmeno na zapisnik ili se šalje poštom odnosno dostavlja elektronički.

Predsjednica Matičnog odbora

dr. sc. Kata Majerski, znanstvena savjetnica

Odluka se dostavlja:
1. dr.sc. Mira Petrović
2. Fakultet kemijskog inženjerstva i tehnologije u Zagrebu
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Dr.sc. Mira Petrovic

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Matični broj iz Upisnika znanstvenika: 158983
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ŠKOLOVANJE

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1996-1999.	visa asistentica, Zavod za analitičku kemiju Fakulteta kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu
1991.-1995.	asistentica, Zavod za analitičku kemiju Fakulteta kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu
1989.-1991.	znanstvena novakinja, Zavod za analitičku kemiju Fakulteta kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu

ZNANSTVENI RAD

Područje znanstvenog interesa

- Analitička kemija, kemija okoliša
- Razvoj i optimizacija naprednih analitickih metoda (LC-MS/MS)
- Razvoj metoda priprave uzorka za LC-MS/MS određivanje
- Određivanje tragova organskih zagađivala u uzorcima iz okoliša (voda, tlo, sediment) i ispitivanje prijenosa i sudbina zagađivale u okolišu

Sudjelovanje u znanstvenim projektima

Voditeljica je jednog medjunarodnog projekta (ERA-NET), bilateralnog Spanjolska-Cipar, voditeljica spanjolske grupe u FP7 MC ITN projektu.
Sudjelovala je u radu 13 međunarodnih projekta (FP5, FP6 and FP7). Sudjelovala u radu 13 domacih projekata.

Objavljeni znanstveni radovi

Autorica je 141 SCI znanstvenih radova. Urednica 7 knjiga. Autorica je 33 poglavlja u knjigama. Citiranost radova iznosi 4883 (Web of Science), *h*-indeks je 43.

Urednistvo

Glavna je urednica casopisa TrEAC – Trends in Environmental Analaytical Chemsitry (Elsevier)
Clan je uredjivackog odbora STOTEN – The Science of Total Environment (Elsevier)

JEZICI

- Engleski
- Spanjolski
- Katalonski

IZVJEŠĆE O ZNANSTVENOJ, NASTAVNOJ I STRUČNOJ DJELATNOSTI

Dr. Mira Petrovic

A. ZNANSTVENA DJELATNOST

1. ZNANSTVENI RADOVI

Citiranost prema SCI

Scopus: citiranost 5822
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h-indeks: **43**

Web of Science: citiranost: 5470
citiranost bez samocitata: 5057
h-indeks: **43**

1.1. Urednistvo knjige

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1.1.2. Mira Petrovic and Damia Barcelo (Urednici): Analysis, Fate and Removal of Pharmaceuticals in the Water Cycle, Elsevier (series: Comprehensive Analytical Chemistry), 2007

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1.1.4. Damia Barcelo and Mira Petrovic (Urednici): The Handbook of Environmental Chemistry. Emerging Contaminants from Industrial and Municipal Waste: Removal Technologies (Volume 5 Water Pollution Part S/2), Springer-Verlag Berlin Heidelberg, 2008

1.1.5. Damia Barcelo and Mira Petrovic (Urednici): The Ebro river Basin (The Handbook of Environmental Chemistry. Volume 13), Springer-Verlag Berlin Heidelberg, 2011

1.1.6. Damia Barcelo and Mira Petrovic (Urednici): Waste Water Treatment and Reuse in the Mediterranean Region (The Handbook of Environmental Chemistry. Volume 14), Springer-Verlag Berlin Heidelberg, 2011

1.1.7. Marija Kastelan Macan i Mira Petrovic (Urednici): Analitika okolisa, *HINUS* i Fakultet kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu, 2013

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TITULO: Sources, occurrence and environmental risk assessment of pharmaceuticals in the Ebro river basin u: The Ebro river Basin (The Handbook of Environmental Chemistry. Volume 13) (Ur. Damia Barcelo and Mira Petrovic), Springer-Verlag Berlin Heidelberg, 2011, str. 209-238

1.2.30.
Sandra Perez, Marianne Köck, Lei Tong, Antoni Ginebreda, Rebeca Lopez-Serna, Cristina Postigo, Rikke Brix, Miren Lopez de Alda, Mira Petrovic, Yasnxin Wang, Damia Barcelo Wastewater reuse in the Mediterranean area of Catalonia, Spain: Case study of reuse of tertiary effluent form a wastewater treatment plant at el Prat de Llobregat (Barcelona) U: Waste Water Treatment and Reuse in the Mediterranean Region (The Handbook of Environmental Chemistry. Volume 14) (Ur. Damia Barcelo and Mira Petrovic), Springer-Verlag Berlin Heidelberg, 2011, str. 229-248

1.2.31.
Damia Barcelo, Mira Petrovic, Jaume Alemany, Problems and needs of sustainable water management in the Mediterranean area: conclusions and recommendations
Waste Water Treatment and Reuse in the Mediterranean Region (The Handbook of Environmental Chemistry. Volume 14) (Ur. Damia Barcelo and Mira Petrovic), Springer-Verlag Berlin Heidelberg, 2011, str. 295-305

1.2.32.
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UHPLC-MS for multi-residue screening of pharmaceuticals in environmental samples
Ion RSC Chromatography monographs, No 16, UHPLC in Life Science (Ur. Davy Guillarme, Jean-Luc Veuthey), RSC Publishing, UK, 2012, str. 337-353

1.2.33.
M. Petrović, V. Tomašić, J. Macan, Zagadjenje okolisa u: *Analitika okoliša* (ur. M. Kaštelan-Macan i M. Petrović), HINUS i Fakultet kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu, Zagreb 2013., str. 37-96

1.2.34.
M. Petrović, D. Mutavdžić Pavlović, S. Babić, A.J.M. Horvat, D. Ašperger, *Analiza tragova i ultratragova* u: Analitika okoliša (ur. M. Kaštelan-Macan i M. Petrović), HINUS i Fakultet kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu, Zagreb 2013., str. 250-304.

1.2.35.
M. Petrović, S. Babić, A. Ginebreda, R.M. Darbra, *Procjena rizika* u: Analitika okoliša (ur. M. Kaštelan-Macan i M. Petrović), HINUS i Fakultet kemijskog inženjerstva i tehnologije Sveučilišta u Zagrebu, Zagreb 2013., str. 375-398.

1.3. **Znanstveni rad objavljen u časopisu citiranom u *Current Contents* bazi**

1.3.1.
M.Kastelan-Macan, S.Cerjan-Stefanovic, M.Petrovic
Phenol Adsorption of Active Carbon by Means of Thin Layer Chromatography
Chromatographia 27 (7/8), 297-300 (1989)
If:1.336

1.3.2.
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I.f: 5.528 (2014)

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Ponsati Lídia, Corcoll Natàlia, Petrović Mira, Picó Yolanda, Ginebreda Antoni, Tornés Elisabet, Guasch Helena, Barceló Damià and Sabater Sergi, Multiple stressor effects on river biofilms under different hydrological conditions, Freshwater Biology (in press)
If: 2.738 (2014)

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Yuli Ekowati, Gianluigi Buttiglieri, Giuliana Ferrero, Jennifer Valle-Sistac, M. Silvia Diaz-Cruz, Damià Barceló, Mira Petrovic, Marta Villagrasa, Maria D. Kennedy, Ignasi Rodríguez-Roda, Occurrence of pharmaceuticals and UV filters in swimming pools and spas. Environmental Science and Pollution Research (in press)
If: 2,828 (2014)

1.4. Znanstveni rad objavljen u časopisu citiranom u sekundarnim publikacijama

1.4.1.
Mira Petrović, Marija Kaštelan-Macan, A.Dürrigl
Separation of structural isomers of some phenol compounds by thin layer chromatography (in croatian)
Prehrambeno-tehnol.bioteh. rev. 27, 141 (1989)

1.4.2.
D.Skansi, Z.Nuber, A.Vrdoljak, M.Petrović
Operation of extraction column with pulsation plates (in croatian)
Kem. Ind. 30 (11), 523 (1990)

1.4.3.
Mira Petrović, Marija Kaštelan-Macan
Separation of substituted phenolic compounds by interaction thin-layer chromatography (in croatian)
Prehrambeno-tehnol.bioteh. rev. 29, 91 (1991)

1.4.4.
S.Babić, M.Petrović, M.Kaštelan-Macan
Optimization of chromatographic separation of pesticides (in croatian)
Kem. Ind. 47(7-8), 275-279 (1998)

1.4.5.
P. Eichhorn, M. Petrovic, D. Barceló, T. P. Knepper
Fate of Surfactants and their Metabolites in Waste Water Treatment Plants
Vom Wasser, 95, 245-268 (2000)

1.4.6.
Mira Petrovic, Damiá Barceló
Sample preparation and liquid chromatography-mass spectrometry analysis of endocrine disrupting compounds in sewage sludges and sediments
The Scientific World 2, 1610-1616 (2002)

1.4.7.
M.J. López de Alda, M. Petrovic and D. Barceló
Waste Water Cluster o Grupo de las Aguas Residuales. Estudio de la presencia e impacto de contaminantes orgánicos en el medio acuático
Retema, 88 (2002), 16

1.4.8.
Kosutić, K., Kunst, B., Petrović, M.
Organic matter removal from potable water by RO and NF membranes | [Membransko uklanjanje organskih tvari iz voda za piće] (in croatian)
Hrvatske Vode 10(40) (2002) 291-298

1.4.9.
M.J. López de Alda, M. Petrovic and D. Barceló
Nuevos contaminantes orgánicos (emergentes) en Cataluña
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1.4.10.
Petrovic M., Radjenovic J., Barcelo D.
Analysis of pharmaceuticals as environmental contaminants
Chemistry Today, 28, (6) (2010) 14-16

1.5. Znanstveni rad, recenziran, objavljen u zborniku radova s međunarodnog znanstvenog skupa

1.5.1.
M.Kaštelan-Macan, M.Petrović
Competitive Sorption of Humic Substances and Phosphates on Suspended Particulate Matter,
Proceedings - International Symposium on Pollution of the Mediterranean Sea, Nicosia, Cyprus, 1994, pp. 649-657

1.5.2.
F.Briški, M.Petrović, M.Kaštelan-Macan, L.Sipos
Removal of Heavy Metals by Biosorption of Fungal Pellets Coated With Organic Substances,
Proceedings - 2nd Specialized Conference on Pretreatment of Industrial Wastewaters, Athens, Greece, 1996, pp. 179-185

1.5.3.
S.Andrašić, M.Kaštelan-Macan, M.Petrović
Determination of Agrochemicals in Soil by Reverse Phase TLC-Densitometry

Proceedings - 1st International Conference on Environmental Restoration, Ljubljana, Slovenia, 1997, p.369-375

1.5.4.
M.Petrović, M.Kaštelan-Macan, S.Babić
Quantitative Evaluation of 2D-Chromatograms with CCD Camera.
Proceedings - 10th International Symposium on Instrumental Planar Chromatography, Visegrad, Hungary, 1998. pp. 117-125

1.5.5.
M. Petrovic, D. Barceló
Advanced sample preparation strategies in determining complex mixtures of organic pollutants in contaminated soil, sediment and sludges
Proceedings of 1st International Workshop on Groundwater Risk Assessment, Tuebinge, Germany, May 2002, published Tübinger Geowissenschaftliche Arbeiten (TGA): Reihe C; 61

1.5.6.
D. Barcelo, M. Petrovic, D. Raldua, B. Pipña, S. Lacorte, M.J. Lopez de Alda, R. Céspedes, M. Sole
Endocrine disruptors in sewage treatment plants, receiving waters and sediments. Integration of chemical analysis and effect studies on carps and yeasts.
Proceedings of the 2nd European Conference on Pesticides and Related Organic Micropollutants in the Environment. (Corfu, Grecia, Septiembre 2002) T.A. Albanis (Ed.) (ISBN:960-91399-0-6)

2. PROJEKTI

2.4. Voditeljica međunarodnog projekta

2.4.1. IX-Aqua - Fate, effect and removal potenital of xenobiotics present in aquaous matrices, Research Promotion Foundation, European regional development fond and Republic of Cyprus, bilateral project Cipar-Spanjolska, 01/01/2009 - 31/12/2012, M. Petrovic, voditeljica spanjolske grupe

2.4.2. CSI-Environment – Isotope forensics meets biogeochemistry linking sources and sinks of organic contaminants by compound specific isotope investigation, Marie Curie Initial Training Network (ITN)-FP7, 11/2010-05/2014, Mira Petrovic spanjolska voditeljica (do 2012)

2.4.3. REPHAD - Reduction of environmental risks posed by pharmaceuticals and their degradation products in process wastewaters, through RO/NF membrane treatment, projekt Fonda „Jedinstvo uz pomoć znanja",2007-2011, Mira Petrovic, su-voditeljica projekta.

2.1.4. GREEN-TECH - From grey to green. How to improve the sustainability of wastewater and drinking water treatment, ERA-NET New Indigo programme, 01/2013 – 12/2014, Mira Petovic coordinator projekta

2.5. Voditeljica domaćeg projekta

-

2.3. Aktivno sudjelovanje u realizaciji znanstvenih projekata

Sudjelovanje u domaćim projektima

2.3.1. Kemometrijska procjena i optimizacija separacijskih parametara, projekt MZOŠ, voditeljica: Marija Kaštelan-Macan, red. prof., 2002 - 2006.

2.3.2. Organske tvari u vodi za piće, projekt MZOŠ, voditelj: Branko Kunst, red. prof., 1996 - 2002.

2.3.3. Urban and Industrial Pollution in Coastal Zones (Harbours and Waste Water): An Integrated Study, Spanjolski Ministerio de Educación y Ciencia- MEC, 09/98 - 09/01, voditelj: Damià Barceló Cullerès

2.3.4. Traceability of new organic pollutants in wate and sludge from waste water treatment plants and their environmental impact in rivers, coasts and harbours, Spanjolski Ministerio de Educación y Ciencia- MEC, 12/01 – 12/04, voditelj: Damià Barceló Cullerès

2.3.5. EVITA - Estudio integrado de Eliminación, Vigilancia avanzada e ImpacTo Ambiental de contaminantes emergentes en la depuración de Aguas residuales urbanas e industriales (CTM2004-06265-C03-01), Ministerio de Educación y Ciencia- MEC, 12/04 - 12/07, voditelj: Damià Barceló Cullerès

2.3.6. CEMAGUA - Estudio de la presencia y destino de contaminantes emergentes en aguas subterráneas y superficiales y desarrollo de herramientas para su control medioambiental (CGL2007-64551), Ministerio de Educación y Ciencia- MEC, 01/10/2007- 30/09/2012, viditelj: Damià Barceló Cullerès

2.3.7. Presencia de contaminantes orgánicos prioritarios y emergentes en lodos de EDAR y su biodegradación por hongos, Ministerio de Medio Ambiente, Medio Rural y Medio Marino, 01/01/2007- 31/12/2010, voditelj: Damià Barceló Cullerès

2.3.8. Desarrollo y validación de plataformas integradas de vigilancia biológica y química optimizadas económicamente (VIECO), Ministerio de Medio Ambiente, Medio Rural y Medio Marino, 01/01/2007- 31/12/2010, voditelj: Damià Barceló Cullerès

2.3.9. SCARCE - Assessing and predicting effects on water quantity and quality in Iberian rivers caused by global change (Consolider-Ingenio CSD2009-00065), Ministerio de Ciencia e Inovacion, 17/12/2009- 16/12/2014, voditelj: Damià Barceló Cullerès

Sudjelovanje u međunarodnim projektima:

2.3.10. PRISTINE - Priority surfactants and their toxic metabolites in waste effluent discharges: An integrated study, EU FP5 (Environment and Climate Program), 02/98 - 01/01, voditelj: Damià Barceló Cullerès

2.3.11. SANDRINE - Biosensor tracing of endocrine disrupting compounds in surface water, waste water and sludge for water quality assessment, EU FP5 (Environment and Climate Program), 02/99 – 01/02, voditelj: Damià Barceló Cullerès.

2.3.12. EXPRESS-IMUNOTECH - Development of new express enzyme immunotechniques for pesticides and surfactants monitoring in water, EU FP5 (Program Copernicus), 07/01 – 06/04, *Voditelj:* Damià Barceló Cullerès

2.3.13. SEDNET – Demand driven, European Sediment Research Network, EU FP5 (Environment and Climate Program), 01/02 – 02/05, *Voditelj:* Damià Barceló Cullerès

2.3.14. P-THREE - Removal of Persistent Polar Pollutants Through Improved Treatment of Wastewater Effluents [EVK1-CT2002-00116], EU FP5 (Environment and Climate Program), 10/02 – 11/05, *Voditelj:* Damià Barceló Cullerès

2.3.15. SOWA - Integrated Soil and grounwater protection [EVK1-CT2002-80022], EU FP5 (Environment and Climate Program), 02/03 – 02/05, *Voditelj:* Damià Barceló Cullerès

2.3.16. AQUATERRA - Integrated modelling of the river-sediment-soil-groundwater system; Advanced tools for the management of catchment areas and river basins in the context of global change [CT-505428-2004], EU FP6 - Global Change and Ecosystems (FP6), 06/04– 06/09, *Voditelj:* Damià Barceló Cullerès (Mira Petrovic voditelj pod-projekta MONITOR)

2.3.17. EMCO - Reduction of environmental risks, posed by emerging contaminants, through advanced treatment of municipal and industrial wastes, 6th Framework Programme EU, INCO CT 2004-509188, 2004-2007, voditelj projekta: Damia Barcelo

2.3.18. NORMAN - Network of reference laboratories and related organisations for monitoring and bio-monitoring of emerging environmental pollutants (018486), EU - Global Change and Ecosystems (FP6), 09/05 – 09/08, *Voditelj:* Damià Barceló Cullerès

2.3.19. INNOVA-MED - Innovative processes and practices for wastewater treatment and re-use in the Mediterranean region (INCO-CT-2006-517728), CEE- INCO-Mediterranean Partner Countries (FP6), 01/07 – 12/2010 voditelj: Damià Barceló Cullerès (Mira Petrovic Project manager)

3. ZNANSTVENA PREDAVANJA

3.1. Usmena priopćenja na međunarodnim skupovima (kao predavac)

3.1.1.
Mira Petrovic, Marija Kaštelan-Macan, Štefica Cerjan-Stefanović, Phenols Isolation and Preconcentration from Waste Wateŕs Using XAD Resins, 1st Symposium on Measurement of Water Quality, Balatonvilagos, Hungary, 1991

3.1.2.
Mira Petrovic, Marija Kastelan-Macan, Thin-layer chormatography on modified layers, International Conference "New achievements in chromatography", Opatija, Croatia, 1992

3.1.3.
Felicita Briški, **Mira Petrovic**, Marija Kaštelan-Macan, Laszlo Sipos
Removal of Heavy Metals by Biosorption of Fungal Pellets Coated With Organic Substances, 2nd Specialized Conference on Pretreatment of Industrial Wastewaters , Athens, Greece, 1996

3.1.4.
Mira Petrovic, M.Kaštelan-Macan, Validation of Video-Densitometric Quantitative TLC Determination, 5th International Symposium on Chromatography & Hyphenated Techniques, Bled, Slovenia, 1998

3.1.5.
Mira Petrovic, Damià Barcelo, The stability of nonionic surfactants and linear alkylbenzene sulfonates in a water matrix and on SPE cartridges, 10th Symposium on Handling of Environmental and Biological Samples in Chromatography, Wiesbaden-Mainz, Germany, 2001

3.1.6.
Mira Petrovic, Alfredo Diaz, Francesc Ventura, Damià Barceló
Simultaneous determination of halogenated derivatives of alkylphenol ethoxylates and their5 metabolites in sludges, river sediments, surface, drinking and wastewaters by LC-MS, ExTech 2001-Advances in Extraction Technologies, Barcelona, Spain, 2001

3.1.7.
Mira Petrovic, Damià Barceló, Sample preparation and LC-MS analysis of endocrine disrupting compounds in sewage sludge and sediment, Workshop "Analysis, toxicity and biodegradation of organic pollutants in groundwater from contaminated land, landfills and sediments", Barcelona, Spain, 2001

3.1.8.
Mira Petrovic, Damià Barceló, Fate of non-ionic surfactants and their degradation products in wastewater treatment plants and surface waters, International Conference on Small Wastewater Technologies and Management for the Mediterranean Area, Sevilla, 2002

3.1.9.
Mira Petrovic, Damià Barceló, Analysis of alkylphenol ethoxylates and their metabolites by LC-MS and LC-MS/MS, I Reunion Nacional de Espectrometria de Masas, Madrid, 2002

3.1.10.
Mira Petrovic, Damià Barceló , LC-MS and LC-MS-MS analysis and monitoring of endocrine disrupting compounds in freshwater sediments in Spain and Portugal, Sednet Workshop "Analysis and risk assessment of emerging contaminants in sediments and dredged material", Barcelona, Spain, 2002

3.1.11.
Mira Petrovic, Damià Barceló, LC-MS and LC-MS-MS analysis of selected emerging pollutants in the aquatic environment, 16th IMSC, Edinburgh, UK, 2003

3.1.12.
Mira Petrovic, Peter Gehringer, Helmut Eschweiler, Damià Barceló, LC-MS-(MS) determination of oxidative degradation products of nonylphenol ethoxylates,

carboxylates and nonylphenols in water, 4th specialized conference on assessment and control of hazardous substances in water- Ecohazard 2003, Aachen, Germany, 2003

3.1.13.
Mira Petrovic, D. Barcelo, LC-MS-MS Analysis Of Pharmaceuticals In Wastewaters, 10th International Symposium New Achievements in Chromatography, New Achievements in Chromatography, Opatija, Croatia, 2004

3.1.14.
Mira Petrovic, D. Barcelo, Fate of non-regulated (emerging) contaminants in wastewater treatment and re-use processes, Enviromin 2004, Kasane, Botswana, 2004

3.1.15.
Mira Petrovic, S. Gonzalez, P. Gehringer, H. Eschweiler, D. Barcelo, Removal of alkylphenol ethoxylates and their metabolites by advanced oxidation processes (AOP) and membrane bioreactor (MBR), SETAC Europe 15 th Annual Meeting, Lille, France, 2005

3.1.16.
Mira Petrovic, M. Gros, D. Barcelo, Multi-residue analysis of pharmaceuticals in wastewater by UPLC-Q-TOF and LC-MS/MS (QqQ), 1st international workshop on Liquid chromatography-tandem mass spectrometry for screening and trace level quantitation in environmental and food samples, Barcelona, Spain, 2005

3.1.17.
Mira Petrovic, Susana Gonzalez, Jelena Radjenovic Damià Barceló, Removal of selected emerging contaminants (pharmaceuticals and alkylphenol ethoxylate surfactants) by membrane bioreactor (MBR), SETAC 26th Annual Meeting in Baltimore, Maryland, USA, 2005

3.1.18.
Mira Petrovic, Damià Barceló, LC-Q-TOF-MS in environmental analysis, III Meeting of the Spanish Society of Mass Spectrometry, *Oviedo, Spain*, 2006

3.1.19.
Mira Petrovic, M. Gros, D. Barcelo, Challenges and Opportunities of UPLC coupled to LC-tandem MS and LC-Q ToF MS for the analysis of pharmaceuticals in water, 2nd international workshop on Liquid chromatography-tandem mass spectrometry for screening and trace level quantitation in environmental and food samples, Barcelona, Spain, 2006

3.1.20.
Mira Petrovic, M. Gros, D. Barcelo, Liquid chromatography-tandem mass spectrometry as a powerful tool for the determination of pharmacuetical residues in the aquatic environment, VII Scientific Meeting of the Spanish Society of Chromatography and Related Techniques, Granada, Spain, 2007

3.1.21.
Mira Petrovic, Meritxell Gros, Damia Barcelo, Challenges and achievements of tandem and hybrid LC-MS in environmental analytical chemistry, 14th International Symposium on Separation Sciences, Primosten, Croatia, 2008

3.1.22.
Mira Petrovic, El tratamiento y reciclaje de las aguas en el siglo XXI, EXPOQUIMIA; Barcelona, Spain, 2008

3.1.23.

Mira Petrovic, Pharmacueticals as emerging environmental contaminants: Sources, environmental levels, toxic effect, general environmental problems (Invited plenary lecture), REPHAD workshop, Pharmaceuticals and their degradation products in the environment, Varazdin, Croatia , 2009

3.1.24.
Mira Petrovic, Meritxell Gros, Damia Barcelo, Advantages and pitfalls of tandem and hybrid LC-MS analysis of emerging contaminants in environmental samples (Invited plenary lecture), NATO workshop, Characterisation of hazardous chemical contamination – from environmental chemistry and toxicology to risk assessment, Dubrovnik, Croatia , 2010

3.1.25.
Mira Petrovic, Alícia Navarro-Ortega, Alain Hildebrandt, Meritxell Gros, Ethel Eljarrat And Damià Barceló, The AquaTerra Project: Occurrence and Fate of Priority and Emerging Contaminants in the Ebro River Basin (Invited plenary lecture), SCARCE 1st annual Conference: Understanding effects of global change on water quantity and quality in river basins, Girona, Spain, 2010

3.1.26.
Mira Petrovic, Meritxell Gros, Damià Barceló, Pharmaceuticals in the Ebro River basin: Occurrence, distribution and elimination in wastewater treatment plants (Invited plenary lecture), Symposium on emerging pollutants, watr treatment and remediation, Barcelona Spain, 2011

3.1.26.
Mira Petrovic, Marina Gorga, Victoria Osorio , Sandra Perez, Damia Barcelo, Levels and spatial distribution of emerging contaminants in the iberian rivers, SCARCE 2nd annual conference "Integrated modelling and monitoring at different river basin scales, Madrid, Spain, 2011

3.1.27.
Mira Petrovic, Advanced mass spectrometric methods applied to the study of fate and removal of pharmaceuticals in wastewater treatment, 2nd CEFSER Workshop "Persistent organic pollutants in food and environment, Novi Sad, Serbia, 2011

3.1.27.
Mira Petrovic, What data are available and how use it (to assess exposure)?. Invited talk / Invited section talk. International Symposium Emerging Pollutants: Bridging Science to Decision Making and Public Demand. Montpelier. France, 2012

3.1.28.
Mira Petrovic, Emerging Environmental Contaminants: Analysis, Fate and Effects. XXIII Croatian meeting of chemists and chemical engineers, Osijek, Croatia, 2013.

3.1.29.
Mira Petrovic, Recent advances in on-line sample preparation methods coupled to LC-tandem MS for the analysis of emerging contaminants in environmental samples 19th International Symposium on Separation Sciences - New Achievements In Chromatography, Poreč, Croatia, 2013

4. ZNANSTVENA DRUŠTVA

4.1. Sociedad Española de Espectrometría de Masas, član
4.2. IWA – International Water Association, član

6. ČLAN UREDNIČKOG ODBORA ZNANSTVENOG ČASOPISA

6.1. Glavni urednik TrEAC - Trends in Environmental Analytical Cheimistry, Elsevier
6.2. Clan urednickog odbora – STOTEN – The Science of the Total Environment, Elsevier
6.3. Clan urednickog odbora Journal of Chromatography A, Elsevier, 2006 - 2007

7. ČLAN ZNANSTVENOG ILI PROGRAMSKOG ODBORA ZNANSTVENOG SKUPA

1. Član znanstvenog i organizacijskog odbora GPoll Workshop Barcelona 2001
2. Clan znanstvenog i predsjednica organizacijskog odbora 4 Sednet Workshops organized in Barcelona 2002, Berlin 2003, Lisbon 2004 and San Sebastian 2004, respectively
3. Član znanstvenog i predsjednica organizacijskog odbora 2nd MTBE Conference Barcelona November 2004.
4. Član znanstvenog i organizacijskog odbora EMCO workshops Dubrovnik, Croatia 2005 and Belgrade, Serbia 2007
5. Član znanstvenog i predsjednica organizacijskog odbora 1st Thematic workshop of the EU project NORMAN on Chemical Analysis of Emerging Pollutants, Maó, Menorca (Balearic Island) 2006
6. Član znanstvenog i predsjednica organizacijskog odbora INNOVA-MED Final Conference , Girona, Spain October 2009
7. Član znanstvenog i predsjednica organizacijskog odbora of five International Workshop on Liquid Chromatography-Tandem Mass Spectrometry for Screening and Trace Level Quantitation in Environmental and Food Samples. Barcelona 2005, 2006, 2008, 2010, 2012

8. OSTALO

Evaluacija istrazivackih projekata za:

EU Commission 5th, 6th and 7th Framework Programme (since November 2001)

ANEP (Spanish National agency for the evaluation of projects)

AGAUR (Agència de Gestió d'Ajuts Universitaris i de Recerca de Catalunya)

Portugese FCT Fundação para a Ciência e Tecnologia, Ministério da educação e ciencia

ARRS - Slovenian Research Agency

Czech Science Foundation

B. NASTAVNA DJELATNOST

1. MENTORSTVO I PODIZANJE ZNANSTVENOG PODMLATKA

Mentorstvo doktorskog rada:

1.1.
Susana Gonzalez Blanco, Analisis, distribución y eliminación de contaminantes emergentes en aguas residuales, Universidad de Barcelona, Facultad de Química 28 November 2008

1.2.
Meritxell Gros, Análisis, destino y transformación de fármacos en aguas naturales y residuales, Universidad de Barcelona, Facultad de Química, 28 May 2009

1.3.
Jelena Radjenovic, Compartimento de fármacos durante tratamientos de aguas residuales y potables, Universidad de Barcelona, Facultad de Química, 22 July 2009

1.4.
Aleksandra Jelic, Occurrence and fate of pharmaceuticals in wastewater treatment processes, Universidad de Barcelona, Facultad de Química, 21 December 2012

1.5.
Rebeca Lopez-Serna, Análisis y destino de residuos farmacéuticos en aguas subterráneas, superficiales y residuales, Universidad de Barcelona, Facultad de Química, 17 September 2013

2. DODIPLOMSKA NASTAVA (predavanja, vježbe, seminari...)

Stari programi:

2.1. *Analitička kemija I*, vježbe, 1990.-1999., seminari ak. god. 1996./1999.
2.2. *Analitička kemija II*, vježbe, 1990.-1999.
2.3. *Ispitivanje kvalitete*, vježbe, 1995.-1999., seminari 1997.-1999.

3. POSLIJEDIPLOMSKA NASTAVA

3.1. *Kromatografske metode u zastiti okolisa*, ak. god. 1999-2000

Универзитет у Београду
БИОЛОШКИ ФАКУЛТЕТ
Бр. 506/92 –23.06.2018.

На основу члана 159. став 2. Закона о запосленима у јавним службама („Службени гласник РС", број 113/17) и члана 45. став 2. тачка 27. Статута Факултета доносим,

Р Е Ш Е Њ Е

1. **СЛАВИШИ СТАНКОВИЋУ**, доктору биолошких наука, утврђује се назив радног места **НАСТАВНИК НА АКАДЕМСКИМ СТУДИЈАМА-РЕДОВНИ ПРОФЕСОР**, члан 16. Правилника о организацији и систематизацији послова на Универзитету у Београду-Биолошком факултету.
2. Овим решењем не врши се премештај запосленог на друге послове.
3. Ово решење ступа на снагу даном доношења.

О б р а з л о ж е њ е

Чланом 159. став 1. Закона о запосленима у јавним службама прописана је обавеза да се у року од 90 дана од дана ступања на снагу овог закона донесе правилник о организацији и систематизацији послова који је усклађен са Уредбом о каталогу радних места у јавним службама и другим организацијама у јавном сектору („Службени гласник РС", број: 81/17 и 6/18), одредбама закона којим се уређује систем плата у јавном сектору и овим законом. Ставом 2. истог члана утврђена је обавеза да се у року од 30 дана од дана ступања на снагу Правилника о организацији и систематизацији послова донесу решења којима се утврђују називи радних места чије послове запослени обављају у складу са називима из наведеног правилника. Овим решењима се по сили закона мењају одредбе уговора о раду које се односе на називе послова које запослени обављају.

На основу претходне сагласности коју је дао Савет Факултета на седници одржаној дана 23.03.2018. године, декан је донео Правилник о организацији и систематизацији послова на факултету, који је ступио на снагу 23.06. 2018. године .

На основу наведеног проф.др Славиши Станковићу је утврђен назив радног места као у изреци овог решења.

Поука о правном леку: Против овог решења запослени може изјавити жалбу Савету Факултетау року од 15 дана од дана достављања решења.

ДЕКАН БИОЛОШКОГ ФАКУЛТЕТА
Проф.др. Жељко Томановић

Доставити:
-Именованом
-Стручној служби - за Материјално- финансијске послове и
- за Правне послове
-Архиви факултета

Curriculum Vitae

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SAOPŠTENJA NA SKUPOVIMA ŠTAMPANA U CELINI

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Na osnovu člana 72 stav 2 Zakona o visokom obrazovanju („Službeni list Crne Gore" br. 44/14, 47/15,40/16,42/17,71/17 55/18 i 3/19) i člana 32 stav 1 tačka 9 Statuta Univerziteta Crne Gore, Senat Univerziteta Crne Gore, na sjednici održanoj 04. juna 2019.godine, donio je

O D L U K U
O IZBORU U ZVANJE

Dr **SVETLANA PEROVIĆ** bira se u akademsko zvanje **redovni profesor Univerziteta Crne Gore za oblast Opšta grupa bioloških predmeta na Prirodno matematičkom fakultetu i nematičnim fakultetima** (Mikrobiologija, Studijski program Biologija, Mikrobiologija, Studijski program Zaštita životne sredine), Industrijska mikrobiologija, Studijski program Hemijska tehnologija **i za oblast Ekologija na Prirodno matematičkom fakultetu** (Zaštita životne sredine-biološki dio), na neodređeno vrijeme.

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Rođena sam 24. juna, 1973. godine u Podgorici. Osnovnu i srednju školu (gimnazija, prirodno-matematički smjer) završila sam u Podgorici. Diplomirala sam 1996. godine na Prirodno matematičkom fakultetu, Odsjeku za biologiju, Univerziteta Crne Gore s prosječnom ocjenom 9.3. Magistarski rad pod nazivom " Mikrobiološki testovi za detekciju inhibitora genotoksičnog efekta zagađivača životne sredine" uradila sam na Katedri za Biologiju mikroorganizama Biološkog fakulteta u Beogradu. Magistarski rad sam odbranila 2002. godine i time stekla zvanje magistra bioloških nauka. Tema magistarske teze je iz oblasti antimutageneze/antikancerogeneze. U magistarskom radu naročita pažnja se poklanja supstancama biljnog porijekla sa inhibitornim ili modulatornim efektom na genotoksične agense i njihovoj primjeni u primarnoj prevenciji maligniteta i drugih bolesti uzrokovanih mutacijama. Za detekciju supstanci sa antimutagenim potencijalom u etarskom ulju bosiljka i pelina koristili su se mikrobiološki testovi na kulturama Salmonella typhimurium TA100 i TA98 i Saccharomyces cerevisiae D7.

U periodu od 2002. do 2005. godine boravila sam u više navrata, u Institutu za Zoologiju, Univerziteta u Hajdelbergu, Njemačka, u Labaratoriji za akvatičnu ekologiju i toksikologiju i u Laboratoriji za hemiju i mikrobiologiju, Univerzitetske klinike u Hajdelbergu. U toku boravka u navedenim laboratorijama radila sam na istraživanjima ekološkog i ekotoksikološkog stanja akvatičnih ekosistema Skadarskog jezera, pri čemu su primjenjivane baterije mikrobioloških testova i bio-testova na kulturama ćelija i višim organizmima za detekciju genotoksičnog, mutagenog, citotoksičnog efekta komponenti koje se nalaze u vodama i sedimentima Skadarskog jezera. Ova istraživanja su bila osnova za početak eksperimentalnog dijela doktorske disertacije. U periodu od 2004-2005 godine, takođe, u više navrata boravila sam na Biotehničkom fakultetu u Ljubljani, u Laboratoriji za molekularnu genetiku mikroorganizama, gdje sam ispitivala genetički biodiverzitet i filogeniju mikrobnih zajednica u vodama i sedimentima Skadarskog jezera. Doktorsku disertaciju pod naslovom "Primjena integralnog pristupa i analiza diverziteta bakterijskih zajednica u procjeni ekotoksikološkog stanja Skadarskog jezera" odbranila sam 2006. godine na Katedri za Biologiju mikroorganizama, Biološkog fakulteta u Beogradu i time stekla zvanje doktora bioloških nauka. U okviru istraživanja doktorske disertacije vršene su analize ekološkog i ekotoksikološkog stanja akvatičnih ekosistema korišćenjem baterije mikrobioloških testova i bio-testova na višim

organizmima (Comet assay, Citotoksični test na ćelijskim linijama RTG-2 i RTL-W1, EROD test i dr) i komparativna analiza genetske raznolikosti mikroorganizama u vodi i sedimentima akvatičnog ekosistema Skadarskog jezera, primjenom klasičnih metoda i molekularno-genetičkih: izolacija DNK iz prirodnih uzoraka, sedimenata i vode, PCR tehnika, elektroforeza TTGE (Temporal Temperature Gel Electrophoresis), RFLP (Restriction Fragment Lenght Polymorphism), izolacija rezistentnih bakterija na živu.

Kroz međunarodne naučno-istraživačke projekte usavršavala sam se na više univerziteta i instituta, kroz kraće studijske boravke. Izdvojila bih: Institut za Zoologiju, Univerzitet u Hajdelbergu, Njemačka, Labaratorija za akvatičnu ekologiju i toksikologiju; Univerzitetska klinika u Hajdelbergu, Laboratorija za hemiju i mikrobiologiju; Biotehnički fakultet u Ljubljani, Slovenija, Laboratorija za molekularnu genetiku mikroorganizama; Institut Bioforsk, Norveška.

Do sada sam objavila više od 60 naučnih publikacija u vidu naučnih radova, saopštenja na nacionalnim i internacionalnim kongresima, simpozijima i konferencijama. Učestvovala na mnogim internacionalnim i nacionalnim projektima. Po važnosti izdvojila bih NEWEN (Netherlands and Western Balkans Environmental Network); EUREKA: "Sveobuhvatna proizvodnja biljnih ekstrakata za visoko kvalitetne proizvode sa dodatnom vrijednošću" i bilateralni projekat: „Filogenetska analiza diverziteta bakterijskih zajednica u sedimentu u Bokokotorskom zalivu- FILOSED".

Služim se ruskim i engleskim jezikom. Majka sam dvoje djece.

Radni odnos sam zasnovala u decembru, 1996. godine na Prirodno matematičkom fakultetu Univerziteta Crne Gore, kao asistent-pripravnik na Studijskom programu Biologija. Taj angažman je trajao do sticanja titule magistra bioloških nauka, kada sam izabrana za asistenta sve do kraja 2006. godine. Za docenta na PMF-u za oblast mikrobiologija izabrana sam 2007. godine (Bilten br. 224. Odluka br. 01-2776, 26.10.2007. godine). Od tada izvodim nastavu na predmetu Mikrobiologija na PMF-u i na MTF-u na predmetima Industrijska mikrobilogija i Ekološka mikrobiologija; Godine 2013. izabrana sam za vanrednog profesora Univerziteta Crne Gore (Bilten br. 316. Odluka br. 08-2693, 19.12.2013. godine) za predmete: Mikrobiologija i Zaštita životne sredine II, na osnovnom akademskom studijskom programu Biologija na PMF-u i Industrijska mikrobiologija, na specijalističkom akademskom studijskom programu Hemijska tehnologija, na MTF-u.

Dio nastave iz predmeta Humana genetika izvodim na Medicinskom fakultetu, na studijskom programu Medicina i Stomatologija. Na studijskom programu Zaštita životne sredine, na MTF-u izvodim nastavu iz predmeta Mikrobiologija.

Na postdiplomskim studijama PMF-a izvodim nastavu na predmetima Ekološka mikrobiologija, na programu Zaštita životne sredine i Odabrana poglavlja iz mikrobiologije na programu Eksperimentalna biologija i biotehnologija. Na doktorskim studijama držim kurs iz Ekološke mikrobiologije i Metode u ekotoksikologiji,

Godine 2019 izabrana sam za redovnog profesora iz oblasti mikrobiologija i ekologija (zaštita životne sredine) na Univerzitetu Crne Gore.

Naučne monografije izdate od strane međunarodnog izdavača

B. Damjanović Vratnica, S. Perović, Ž. Lepojević (2016): Supercritical fluid extraction of fennel (Foeniculum vulgare mill.) seed from Montenegro: antimicrobial activity. In: Edward Roj (ed.) Supercritical fluid applications, Publisher: New Chemical Syntheses Institute, Pulawy. pp. 61-75. ISBN 978-83-935354-1-5.

Radovi objavljeni u časopisima koji se nalaze u međunarodnim bazama podataka

M. Bigovic, M. Roganovic, I. Milasevic, D. Djurovic, V. Slavic, M. Kosovic, M. Vlahovic, S. Perovic, A. Perovic, V. Kastratovic, Z. Potpara, M. Martinovic, S. Pantovic (2020): PHYSICO-CHEMICAL CHARACTERIZATION OF IGALO BAY PELOID (MONTENEGRO) AND ASSESSMENT OF THE POLLUTION OF POTENTIALLY TOXIC ELEMENTS IN THE SAMPLING AREA. Farmacia Vol 68 (3), pp. 560-571

S.Perovic, S.Pantovic, V. Scepanovic, A.Perovic, V. Zivkovic, B. Damjanovic-Vratnica (2019): Evaluation of antimicrobial activity and activity on the autonomic nervous system of the lavender essential oils from Montenegro. Progress in Nutrition (Journal of nutrition and internal medicine) Vol 21, No 3. pp: 584-590

S. Perovic, B. Sljukic, M. Šrut, A. Perovic, G. I. V. Klobučar (2019): Evaluation of DNA damage in haemolymph of freshwater mussels Unio pictorum from Lake Skadar. Biologia DOI https://doi.org/10.2478/s11756-019-00308-w

I. Bošković, D. Đukić, P. Mašković, L. Mandić, S. Perović (2018): Phytochemical composition and antimicrobial, antioxidant and cytotoxic activities of Anchusa officinalis L. extracts. Biologia, Vol. 73 (11), pp. 1035-1041. doi 10. 2478/s11756-018-0124-4. Springer ISSN: 0006-3088 (Print); 1336-9563 (electronic version); vodeći autor

S. Perović, G. Veinović, J. Antić Stanković (2018): A A Review on Antibiotic Resistance: Origin and mechanisms of bacterial resistance as biological phenomenon. Genetika, Vol. 50 (3), pp. 1124-1135. https://doi.org/10.2298/GENSR1801209S. ISSN 0534-0012.

B. Damjanović-Vratnica, S. Perović, T. Lu, R. Santos (2016): Effects of matrix pretreatmant on the supercritical CO2 extraction of Saturaja montana. Chemical Industry and Chemical Engineering Quarterly. Vol. 22 (2), pp. 201-209. doi: 10.2298/CICEQ150504034D. ISSN 1451-9372.

A. Perović, S.Perović, T. Benjamin Seiler and H. Hollert (2013): In vitro cytotoxic and teratogenic potential of sediment extracts from Skadar Lake using fish cell line RTL-W1 and Danio rerio embryos. Archive of Biological Sciences, Vol. 65, Issue 4, pp. 1539-1546. doi: 10.2298/ABS1304539P. ISSN 1821- 4339.

S. Perovic, A. Perovic, L. Erdinger and H. Hollert (2013): Assessment of the mutagenic potential of sediments Skadar Lake using Salmonella/microsomal assay. Arch. Biol. Sc. Vol. 65 Issue 3; ISSN 1821- 4339. JCR IF 2010=0.356.

A.Perovic, S.Perovic, L. Erdinger and H.Hollert (2012): "Assessment of genotoxic potential of the Lake Skadar sediments extracts using the comet assay with fish cell line RTL-W1 and Ames test", Archive of Biological Sciences, Vol. 64, Issue 1, pp. 249-256 ISSN 1821- 4339. JCR IF 2010=0.356.

B.Damjanovic-Vratnica, A.Perović, D.Šuković and S. Perović (2011): "Effect of vegetation cycle on chemical composition and antimicrobial activity of Wild-growing winter savory (Satureja montana L.) Essential oil". Archive of Biological Sciences, Vol. 63, Issue 4, pp. 1173-1181. ISSN 1821- 4339. JCR IF 2010=0.356.

B. Vuković Gačić, S. Nikčević, T. Berić-Bjedov, J. Knežević-Vukčević and D. Simić (2006): Antimutagenic effect of essential oil of sage (Salvia officinalis L.) and its monoterpenes against UV-induced mutations in Escherichia coli and Saccharomyces cerevisiae. Food and Chemical Toxicology 44, pp. 1730-1738.

R.Kostanjšek, A.Lapanje, D.Drobne, S.Perovic, A.Perović et.al., (2005): Bacterial Community Structure Analyses to Assess Pollution of Water and Sediments in the Lake Shkodra/Skadar, Balkan Peninsula. Environ. Science and Pollution Research Vol.12 No.6, pp. 361-368; ISSN 0944-1344; ISSN Internet: 1614-7499.

A.Rastall, A.Neziri, Z.Vuković, S.Mijović, H.Hollert, S.Nikčević, L.Erdinger (2004):The identification of Readily Bioavailable Pollutans In Lake Skadar using Semipermeable Membrane Devices (SPMD-s), Bioassays and Chemical Analysis. ESPR-Environ Sci & Pollution Research, 11(4) 7A, pp. 240-253. ISSN 0944-1344; ISSN Internet: 1614-7499.

Radovi u međunarodnim časopisima koji se ne nalaze u bazama podataka, a imaju redovnu međunarodnu distribuciju

B. Damjanović Vratnica, D. Šuković, S. Perović (2016): Essential oils components and antimicrobial activity of Pepermint (Mentha piperita) from Montenegro. Agricult. Forest. Vol. 62 (1), pp. 259-268. DOI: 10.17707/AgricultForest.62.1.29. ISSN 0554-5579.

B. Damjanović Vratnica, D. Caković, S. Perović (2015): Composition and antimicrobial studies of essential oil of Thymus vulgaris from Montenegro. Biologica Nyssana, 6 (2): 67-73. ISSN: 2217-4606.

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S.Perovic, S. Stankovic and A. Perovic, (2007): Using Arthrobacter globiformis Bioassay for Assessment Bioavailibity and Toxicity Soil and Sediments. Acta Agriculturae Serbica, pp.1-6. YU ISSN: 0354-9542;

Međunarodni kongresi, simpozijumi, seminari

A. Perović, D. Šuković, J. Vukić, B. Damjanović -Vratnica, P. Trebše, S. Perović (2013): "Quality Evaluation of Soils and Sediments in Zeta Plane Using Danio rerio Embrio Toxicity Test". 14th European Meeting on Environmental Chemistry, Budva, Montenegro, December 4th to 7th 2013. C103. pp.73. ISBN: 978-9940-9059-1-0.

A. Perović, S. Perović, Z. Leka (2015): "Testing teratogenic effect of synthesized dithiocarbamate, K-daap, on zebra fish (Danio rerio)". 52. savjetovanje Srpskog hemijskog društva. Novi Sad, Srbija, 29 -30. Maj 2015. P-9,pp74. ISBN:978-86-7132-056-6.

A. Perović, B. Šljukić, S. Perović, M. Šrut, G. Klobučar (2015): "Pollution Biomonitoring of the River Moraca and Lake Skadar Using Caged Mussles Unio sp". 12th Croatian Biological Congress with International Participation, Sveti Martin na Muri, 18.– 23. September 2015. P117. pp. 254. ISSN: 1848-5553

S. Perović, S. Pantović, V. Šćepanović, A. Perović and B. Damjanović-Vratnica (2017): "Chemical Composition and Bioactive Effect of Lavender Essential Oil From Montenegro".

The 10th Joint Meeting on Medicinal Chemistry 2017. Dubrovnik, Croatia 25-28 Jun. P-120, pp.196. ISBN:978-953-55232-8-4

S. Krivokapić, S. Perović, D. Stešević, D. Caković, A. Perović, B. Damjanović-Vratnica (2017): "Antioxidative potential of summer asphodel (Asphodelus aestivus) extracts". 54th Meeting of the Serbian Chemical Society and 5 th Conference of Young Chemists of Serbia, Belgrade, Serbia, September 29 and 30, 2017. BT-02. pp.57 ISBN:978-86-7132-067-2

S. Perović, S. Krivokapić, S. Pantović, A. Perović, B. Damjanović-Vratnica (2017): "Bioactive potential of grape pomace (Vranac variety)". 54th Meeting of the Serbian Chemical Society and 5 th Conference of Young Chemists of Serbia, Belgrade, Serbia, September 29 and 30, 2017. BT-03. pp.58 ISBN:978-86-7132-067-2

S. Perović, S. Krivokapić, B. Damjanović-Vratnica, A. Perović, G. Veinović, J. Stanković (2018): "Antimicrobial Activities and Composition of the Essential Oils Salvia officinalis from Montenegro" Balkan Congres of Microbiology. Sofia. Bulgaria, november 16-10. pp. 144.

B. Damjanović-Vratnica, S. Krivokapić, S. Pantović, S. Perović (2017): "Biological activities of extracts from thyme (Thymus vulgaris) leaves" 10th Joint Meeting on Medicinal Chemistry, June 25–28, 2017. Dubrovnik, Croatia. ISBN:978-953-55232-8-4

M. Bigović, M. Roganović, I. Milašević, D. Đurović, V. Kastratović, V. Slavić, M. Kosović, M. Vlahović, S. Perović, A. Perović, Z. Potpara, M. Martinović, S. Pantović (2018): Physico-chemical characterization of Igalo Bay Peloid (Montenegro) and assessment of the Pollution in the sampling area. Bulletin of the Chemists and Technologists of Bosnia and Herzegovina. Special Issue 2018. pp. 91. ISSN 0367- 4444.

S. Perović, S. Krivokapić, S. Pantović, Z. Potpara, A. Perović, B. Damjanović Vratnica (2018): Chemical Composition and antimicrobial activity of the esential oils from Montenegro. Green Room Sessions 2018 International GEA (Geo Eco-Eco Agro) Conference, 1-3 November, 2018. Book of Abstracts pp. 98.

A. Perović, S. Perović, J. Vukić, D. Šuković, H. A. Leslie (2018): Toxicity evaluation of soils sampled in the vicinity of an Aluminum smelter in Montenegro using the Ames, Bioluminescence and DR-LUC bioassays. SETAC Europe 28th Annual Meeting, 13-17 May 2018 Rome. Abstract book pp. 257. ISSN 2309-8031 (print), Online ISSN 2310-3043.

Učešće u realizaciji naučno-istraživačkog projekta:

EUREKA Σ!: Phyto-preparations - natural materials with supercritical extracts for controlled release of active components; SCIMPLANT

COST Action CA16110: (HUPLANT control): Control of Human Pathogenic Micro-organisms in Plant Production Systems

EUREKA: " Comprehensive processing of plant extracts for high value added products. COMPLANT. Aktivni učesnik u projektu i koordinator ispred PMF-a.

Inovativni projekat: Balneološki efekti peloida, mineralne vode, ljekovitog i aromatičnog bilja na inflamatorni odgovor kod reumatoidnih i kardiovaskularnih oboljenja.

Bilateralni projekat (Crna Gora i Srbija): Ispitivanje hemipreventivnog potencijala ljekovitih i aromatičnih biljaka iz ruralnih regiona Crne Gore

EU CBRN CoE Project 67: Strengthening CBRN Waste Management Capabilities in South-East and Eastern European Countries

Program monitoringa morskog ekosistema: Pogram praćenja bioloških indikatora i biomarkera na zagađenje

Bilateralni projekat (Crna Gora i Hrvatska): „Filogenetska analiza diverziteta bakterijskih zajednica u sedimentu u Bokokotorskom zalivu- FILOSED"

ECOTOX: Korišćenje bioloških testova za procjenu toksičnosti zemljišta u regionu Skadarskog jezera

Bilateralni projekat (Crna Gora-Slovenija): Procjena uticaja na okolinu u Goriškom regionu i regionu Skadarskog jezera kao posljedica poljoprivrednih aktivnosti

Bilateralni projekat (Crna Gora-Austrija): Identity and basic characterization of potential lactic acid bacteria starter cultures isolated from traditionally fermented milk products in Montenegro

Elaborat procjene uticaja na životnu sredinu br. 35-10-17: Novo gradsko groblje u Danilovgradu

LMOCP (Labor Market Oriented Curriculum) Experimental Biology and Biotechnology. WUS-Austria Project.

Bilatera project Montenegro-Croation: Phylogenetic analysis of the diversity of bacterial communities in sediments of Kotor Bay

Član stručnog tima za državno takmičenje iz biologije; član stručnog tima za eksternu maturu iz biologije; član stručnog tima za pripremu srednjoškolaca za svjetsko takmičenje iz biologije IBO

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Broj / Ref 03-2630

Datum / Date 16.10.2017

Na osnovu člana 72 stav 2 Zakona o visokom obrazovanju („Službeni list Crne Gore" br. 44/14, 47/15,40/16,42/17) i člana 32 stav 1 tačka 9 Statuta Univerziteta Crne Gore, Senat Univerziteta Crne Gore na sjednici održanoj 16.oktobra 2017.godine, donio je

O D L U K U
O IZBORU U ZVANJE

Dr Slađana Krivokapić bira se u akademsko zvanje **vanredna profesorica za oblast Anatomija, fiziologija i morfologija biljaka na Prirodno-matematičkom fakultetu,** na period od pet godina.

Senat Univerziteta Crne Gore
Predsjedavajući

Prof.dr Danilo Nikolić,v.f.rektora

BIOGRAFIJA

Ime i prezime: Slađana Krivokapić
Datum i mjesto rođenja: 11. 02. 1969., Kotor, Crna Gora
Nacionalnost: Crnogorska
Adresa: Studijski program Biologija, Prirodno-matematički fakultet, Univerzitet Crne Gore Cetinjski put bb, 81 000 Podgorica, Crna Gora
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NAUČNA OBLAST ISTRAŽIVANJA

Fiziološka ekologija -eutrofikacija obalnih voda; teški metali i antioksidativna zaštita biljaka; biološki aktivne materije vaskularnih biljaka i marinskih algi

OBRAZOVANJE

1992 - diplomirala na Odsjeku za biologiju (istraživačko-primjenjeni smjer), Prirodno-matematičkog fakulteta, Univerziteta u Novom Sadu

1998 - magistarski rad pod nazivom »*Genetička varijabilnost rezervnih i funkcionalnih proteina tetraploidne pšenice*« odbranila na smjeru »Genetika i oplemenjivanje biljaka« Poljoprivrednog fakulteta u Novom Sadu

2006 - doktorsku disertaciju pod nazivom »*Dinamika biomase fitoplankona kao indikatora stepena trofičnosti u unutrašnjem dijelu Bokokotorskog zaliva*« odbranila na Prirodno-matematičkom fakultetu Univerziteta u Novom Sadu

PROFESIONALNO ANGAŽOVANJE I USAVRŠAVANJA

1992-1993 - saradnik ne predmetu Genetika, Odsjek za biologiju, Prirodno-matematički Fakultet, Novi Sad

1994-1999 - Prirodno-matematički fakultetu u Podgorici (angažovana zaizvodenje vježbi na predmetima Anatomija biljaka, Fiziologija biljaka i Marinska biologija)

1999 - izabrana u zvanje asistenta na Katedri za Botaniku, predmet Fiziologija biljaka

2005 -3 sedmice u Laboratorio Nazionale di Riferimento per le Biotossine Marine,Cesenatico, Italy

2006 –izabrana u zvanje docenta za predmete Anatomija biljaka i Fiziologija biljaka.

2008 – 2 sedmice, Department of Chemistry, University of Oslo (hromatografske tehnike u biološkim istraživanjima)

2012 – izabrana u zvanje vanredni profesor za predmete Anatomija i morfologija biljaka i Fiziologija biljaka

2017- izabrana u zvanje vanredni profesor za predmete Anatomija i morfologija biljaka i Fiziologija biljaka (Držim nastavu i iz sledećih predmeta: na modulu Eksperimentalna biologija: Instrumentalne metode u biologiji;- na specijalističkim studijama biologije – eksperimentala biologija i biotehnologija: Kurs laboratorijskih tehnika; specijalističkim studijama biologije – nastava biologije: Laboratorijski praktikum; na doktorskim studijama biologije: dio ispita Biodiverzitet vodenih ekosistema; izborni predmet na specijalističkim studijama biologije-eksperimntalna biologija i biotehnologija: Biološki aktivne materije biljaka; izborni predmet na magistarskim studijama biologije ekologija: Fotosinteze i primarna produkcija, Sekundarni metaboliti marinskih algi, Teški metali i antioksidativna zaštita biljaka, a na doktorskim studijama biologije: Biološki aktivne materije algi, Toksini marinskih algi, Teški metali u životnoj sredini)

U toku dosadanjeg rada bila sam koordinator jednog medjunarodnog i dva bilateralnog projekta, kao i učesnik u realizaciji više međunarodnih i nacionalnih naučno- istraživačkih projekata.
Bila sam mentor dva doktoranda, čije su doktorske disertacije odbranjenje na Studijskom programu Biologija, Prirodno-matematičkog fakulteta, UCG-a.

Autor sam skripte "Biološki akrivne materije biljaka" i koautor poglavlja "Phytoplankton Community and Trophic State in Boka Kotorska Bay" i "Phytobenthos in the Boka KotorskaBay: State of Knowledge and Threats" u "The Boka Kotorska Bay Environment", Hdb Env Chem.

Posjedujem aktivno znanje engleskog jezika.

Spisak izabranih referenci:

Krivokapić, S., Bosak, S., Viličić, D., Kušpilić, G., Drakulović, D., Pestorić, B. **(2018):** Algal pigments distribution and phytoplankton group assemblages in coastal transitional environment – Boka Kotorska Bay (South eastern Adriatic Sea). Acta Adriatica 59(1):35-50.	**SCI**
Krivokapić, S., Petrović, D., **(2018):** Trace metals in vegetables plants (*Allium cepa* L., *Capsicum annum* L., *Lycopersicon esculentum* Mill and *Beta vulgaris* L.). Fressenius Environmental Bulletin 27 (5): 2690-2696	**SCI**
Kastratović, V., Bigović, M., Jaćimović, Ž., Kosović, M., Đurović, D., **Krivokapić, S. (2018):** Levels and distribution of cobalt and nickel in the aquatic macrophytes found in Skadar Lake, Montenegro. Environmental Science and Pollution Research. 25(27):26823-26830	**SCI**
Kastratović, V., Jaćimović, Ž., Bigović, M., Kosović, M., Đurović, D., **Krivokapić, S. (2017):**Seasonal patterns of Cu in a system of sediment-water-macrophytes. Fressenius Environmental Bulletin 26 (2):1247-1253. ISSN1018-4619.	**SCI**
Pejatović, T., Samardžić, D., **Krivokapić, S.** (2017): Antioxidative properities of a traditional tincture and several leaf extracts of Alliumursinum L. (collected in Montenegro and Bosnia and Herzegovina). Journal of Materials and Environmental Sciences 8(6): 1929-1934. ISSN:2028-2508.	
Krivokapić, S., Pestorić, B., Krivokapić, M. **(2017):** Application of the TRIX for water quality assessment along Montenegrin coast. Studia marina. 29(1): 47-62.	
Kastratović, V., Jaćimović, Ž., Bigović, M., Đurović, D., **Krivokapić, S. (2016):** Environmental status and geochemical assessment sediments of Lake Skadar, Montenegro. Environ Monit Assess 188:449 DOI 10.1007/S10661-016-5459.	**SCI**
Petrović, D., Jančić D., Furdek, M., Mikac, N., **Krivokapić, S. (2016):** Aquatic plant *Trapa natans* L. as bioindicator of trace metal contamination in freshwater lake (Skadar lake, Montenegro). Acta Botanica Croatica. 75 (2): 236-243. DOI 10151/botcro- 2016-031	**SCI**
Anđić, B., Dragićević, S., Stešević, D., Jančić D., **Krivokapić, S. (2015):** Comparative analysis of trace elements in the mosses – *Bryumargenteum* Hedw. And *Hypnum cupressiforme* Hedw. In Podgorica (Montenegro). J. Mater. Environ. Sci. 6 (2) 333-342. ISSN: 2028-2508.	
Kastratović, V., Jaćimović, Ž., Bigović, M., Đurović, D. **Krivokapić, S. (2016):** The distribution and accumulation of chromium in the water, sediment and macrophytes of Skadar Lake, Kragujevac J. Sci. 38: 125-134.	
Kastratović, V., Jaćimović, Ž., Đurović, D., Bigović, M., **Krivokapić, S. (2015):** *Lemna minor* L. as bioindicator of heavy metal pollution in Skadar Lake (Montenegro), Kragujevac J. Sci. 37: 123-134.	
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Na osnovu člana 72 stav 2 Zakona o visokom obrazovanju („Službeni list Crne Gore" br. 44/14, 47/15,40/16,42/17,71/17) i člana 32 stav 1 tačka 9 Statuta Univerziteta Crne Gore, Senat Univerziteta Crne Gore, na sjednici održanoj 03.07.2018.godine, donio je

O D L U K U
O IZBORU U ZVANJE

Dr DANILO MRDAK bira se u akademsko zvanje vanredni profesor Univerziteta Crne Gore za oblast Ihtiologija i Konzervaciona biologija **na Prirodno-matematičkom fakultetu**, na period od 5 godina.

SENAT UNIVERZITETA CRNE GORE
PREDSJEDNIK

Prof.dr Danilo Nikolić, rektor

BIOGRAFIJA I BIBLIOGRAFIJA DANILO MRDAK

Rođen sam 01.07.1976. godine u tadašnjem Titogradu (Podgorica), gdje sam završio osnovnu (»Sutjestka«) i srednju školu (gimnazija »Slobodan Škerović«).

Školske 1995/96 godine upisao sam studije Biologije (Opšta Biologija, 9 semestara) na Biološkom fakultetu, Univerziteta u Beogradu gdje sam u septembru 2000. Godin diplomirao sa diplomskim radom „Ekološko upoređivanje zajednica riba u Sutomoru i u Ljutoj" sa prosječnom ocjenom studiranja 9,27 i tako steako zvanje diplomiranog biologa.

Poslijediplomske studije upisao sam školske 2000/2001. godine na Biološkom fakultetu Univerziteta u Beogradu (smjer: Biologija izabranog taksona –*pisces*, 6 semestara) i 2003. godine završio ih sa prosječnom ocjenom 10. Magistarsku tezu pod nazivom: "*Taksonomska i ekološka karakterizacija ihtiofaune infralitorala južnog Jadrana*" odbranio sam 15. 12. 2003. godine i stekao zvanje magistra bioloških nauka.

Doktorsku disertaciju pod nazivom: "Pastrmke (*Salmo* L., 1758) rijeka Crne Gore – diverzitet, taksonomski status i filogenetski odnosi ", odbranio sam 01. 07. 2011. godine, na Biološkom fakultetu Univerziteta u Beogradu i stekao zvanje doktora bioloških nauka. Rješenje o priznavanju Uvjerenja o stečenom naučnom stepenu Doktora bioloških nauka izdato mi je od strane Ministarstvo prosvjete i sporta, Vlade Crne Gore, 14. septembra 2011. godine.

Studisjki boravci

Jun 2004 – Biotehnički fakultet, Laboratorija za Genetiku, Univerztet u Ljubljani
April - Maj 2005 – Biotehnički fakultet, Laboratorija za Genetiku, Univerztet u Ljubljani
Novembar 2005 – Biotehnički fakultet, Laboratorija za Genetiku, Univerztet u Ljubljani
Jun- Jul 2006 – Hellenic Insititute for Marine Research
Novembar 2006 - Hellenic Institute for Marine Research
April 2008 – Institute of Zoology, Karl – Franzens University of Graz
Oktober 2009 - Institute of Zoology, Karl – Franzens University of Graz
April 2016 – Institute for fishery – Potsdam, Germany

Podaci o radnim mjestima i izborima u zvanja

- Od okotbra 2000. godine zasnovao sam radni odnos na Prirodno-matematičkom fakultetu u Podgorici (Studijski program Biologija), gdje sam marta 2001. godine izabran u zvanje saradnika u nastavi. U toku svog desetogodišnjeg staža asistirao sam u laboratorijskim vježbama i izvodio praktičnu nastavu na predmetima: *Biologija Mora, Ekologija životinja, Zoologija Invertebrata, Ekologija životinja I i II, Sistematika algi, gljiva i lišajeva, Krenobiologija, Ekologija populacija* i *Biocenologija* a sve na akademskom i specijalističkom studijeskom programu Biologija.
- U vremenskom intervalu 2006 – 2009 bio sam predstavnik saradnika u nastavi u sazivu Senata Univerziteta Crne Gore.
- 2012 godine u julu biram sa u zvanje Docneta za predmete: Konzervaciona biologija, Genetika populacija i Principi održivog razvoja

- 2013 – 2016 obavljao sam dužnost prodekana za međunarodnu saradnju i nauku na Prirodno-matematičkom fakultetu
- 2016 obavljao sam dužnost VD rukovodioca Studijskog Programa Biologija na Prirodno-matematičkom fakultetu
- Od 2014 godine držim nastavu iz predmeta Osnovi prirodnih nauka I (Biologija sa ekologijom na studijskom programu Obrazovanje učitelja – Filozofski fakultet kao i predmet Osnovi humane genetike na studijskom programu Psihologija – Filozofski fakultet.
- 2015-2016 obavljao sam dužnost V.D. rukovodioca studijskog programa Biologija na Prirodno-matematičkom fakultetu.
- 2018 godine biram se u zvanje Venrednog profesora za predmete: Konzervaciona biologija, Genetika populacija i Principi održivog razvoja

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