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3. ZORH SUSRET

28. I 29. TRAVNJA 2022., SPLIT

Knjiga sažetaka



Fakulta materiálov,
metalurgie a recyklácie





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FACULTY OF CHEMISTRY AND
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3RD ZORH CONFERENCE

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Fakulta materiálov,
metalurgie a recyklácie



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PREDGOVOR

Susret znanstvenika, stručnih djelatnika i studenata na temu zaštite okoliša u Republici Hrvatskoj (3. ZORH susret) projekt je kojeg organiziraju studenti Kemijsko-tehnološkog fakulteta u Splitu zajedno s Fakultetom materijala, metalurgije i recikliranja u Košicama, SEA-EU Alijansom Europskog sveučilišta mora te studentskom sekcijom Hrvatskog društva kemijskih inženjera i tehnologa.

Prvi ZORH susret održan je 5. ožujka 2018. godine. Ovogodišnji 3. ZORH susret izlazi iz regionalnih okvira te postaje mjesto za susrete, razmjenu mišljenja i iskustva te uspostavu suradnje među sudionicima s visokih učilišta, instituta i gospodarstva iz raznih europskih zemalja. Uz širenje znanja i vidika te usvajanje novih ideja i tehnologija, susret je omogućio povezivanje velikog broja ljudi s različitih institucija kao i pokretanje novih projekata. Promatranjem zapadnih država, uviđamo sve veću potrebu za povezivanjem akademske zajednice s privredom, te želimo potaknuti studente da kritički i odgovorno pristupaju poslovima koji uvelike utječu na okoliš.

Kroz usmena i posterska izlaganja vrsnih stručnjaka i znanstvenika te studenata proširit će se informacije i doprinijeti razvoju svijesti o zaštiti okoliša. Ove godine najbolji radovi bit će objavljeni u časopisima Kemija u industriji, The Holistic Approach to Environment i Journal of Sustainable Technologies and Materials.

Hvala svima koji su doprinijeli organizaciji 3. ZORH susreta, a osobito Organizacijskom i Znanstveno-programskom odboru bez kojih ovaj susret ne bi bilo moguće realizirati. Cijenim svaku pruženu pomoć u nastojanju da se uspješno organizira ovako veliki projekt. Svim sudionicima i sponzorima želim zahvaliti što su se odazvali našem susretu i prepoznali njegovu važnost!

Predsjednica Organizacijskog odbora



Klara Magaš, univ. bacc. ing. cheming

PREFACE

The 3rd International Convention of Scientists, Specialist Employees and Students on the Topic of Environmental Protection in the Republic of Croatia (3rd ZORH convention) is a project organized by students of the Faculty of Chemical Technology of Split in cooperation with the Faculty of Materials, Metallurgy and Recycling in Košice, SEA-EU European University of the Seas and the student section of the Croatian Society of Chemical Engineers and Technologists.

The first ZORH meeting was held on March the 5th, 2018. This year's 3rd ZORH convention is expanding from the original regional framework and is aiming to become a place for gathering, exchanging viewpoints/experiences and for establishing cooperation between participants from higher education institutions, institutes and industry from various European countries. In addition to spreading knowledge and perspectives and adopting new ideas and technologies, the meeting enabled the connection of a large number of people from different institutions, as well as the launch of new projects. By observing the countries from the West we notice a growing need to connect the academic community with the industry and we want to encourage students to take a critical and responsible approach to jobs that greatly affect the environment.

The exchange of experience through oral and poster presentations by top experts, scientists and students is the best way to spread information and contribute to the development of environmental awareness. This year, the best papers will be published in the journals Chemistry in Industry, The Holistic Approach to Environment, and Journal of Sustainable Technologies and Materials.

I would like to thank everyone who contributed to the organization of the 3rd ZORH meeting, and especially to the Organizing and Scientific-Programme Committee, without which this convention would not have been possible. I appreciate all the help provided in the effort to successfully organize such a large project. I would like to thank all the participants and sponsors for responding to our meeting and recognizing its importance!

President of Organizing Board



Klara Magaš, univ. bacc. ing. cheming

OD OTPADA DO EKOLOŠKIH MATERIJALA – PRIMJENA SORBENATA NA BAZI KOŠTICE VIŠNJE U UKLANJANJU TEŠKIH METALA

FROM WASTE TO ECO MATERIALS – THE APPLICATION OF SOUR CHERRY STONE SORBENTS IN HEAVY METAL REMOVAL

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Serious environmental problem worldwide are effluent waters from many industries, such as mining, refining ores, pesticide, batteries, paper industries, etc., containing toxic components, mostly heavy metals, which are not treated properly in many cases. These pollutants pose serious threat to environment and human health because of their toxicity, persistence and bioaccumulation tendency. There are plenty of conventional methods for heavy metal removal, but in most cases, they are too expensive for removing low, but still toxic present concentrations, with high operational cost/energy demand, or they create large quantities of toxic sludge which request further processing. The application of low cost, mostly waste materials as a heavy metal sorbent are a potential alternative to the existing conventional technologies for the removal/recovery of metal ions from aqueous solutions. The major advantages of sorption by renewable biomass over conventional treatment methods include low cost and abundance of biomaterials, high efficiency with minimum sorbent treatments, minimization of sludge generation and feasible regeneration with possibility of metal recovery. At the same time, application of renewable waste materials contributes to carbon sequestering and climate change mitigations, avoiding land usage and negative impact of landfilled material onto environment. The revalorization of this kind of sorbents also contributes to resource conservation and circular economy in its broadest sense. In this research, lignocellulosic waste material from food industry (sour cherry stones) has been applied as a sorbent for treatment of polluted water with various heavy metals. The sour cherry stones are widespread, locally available waste with considerable potential for sorbents development. This lignocellulosic material was grinded into particle size of approximately 0.5 mm, marked as CSP, and investigated for removal of heavy metal content in contaminated water containing highly toxic metals: Cd²⁺, Cu²⁺, Ni²⁺, Zn²⁺, and Pb²⁺. Sorption experiments were performed in an isothermal batch system with stirring under specified operational conditions, avoiding metal precipitation. The removal efficiency of investigated metals reduced in order Pb²⁺ > Cd²⁺ > Cu²⁺ > Zn²⁺ > Ni²⁺ using CSP as a sorbent. The CSP characterisation included: contact pH (pH_{sus}), point of zero charge (pH_{pzc}), Scanning Electron Microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX). Structural characterization of the CSP surface was performed using Fourier transform infrared spectroscopy (FTIR), which disclosed the presence of specific functional groups (hydroxyl, carbonyl and carboxyl) responsible for the removal of heavy metals ions. The obtained results suggest that the application of the raw CSP is an economic and environment feasible strategy for removing heavy metals from water polluted streams.

Key words: waste biomass, sour cherry stone, sorption, heavy metals, circular economy

3rd International convention of scientists, specialist employees and students on the topic of Environmental protection in the Republic of Croatia (3rd ZORH convention) on 28th-29th of April 2022