EMEC21

21st European Meeting on Environmental Chemistry
November 30 – December 3, 2021, Novi Sad, Serbia

Association of Chemistry and the Environment

Serbian Chemical Society

Matica Srpska

www.emec21.rs

Scientific Committee
Jan Schwarzbauer, president

Organisational Committee
Branimir Jovančićević, president

Executive Committee
Vladimir Beškoski, president

BOOK OF ABSTRACTS

ASSOCIATION OF CHEMISTRY AND THE ENVIRONMENT

21st European Meeting on Environmental Chemistry

BOOK OF ABSTRACTS

EMEC 21

November 30 – December 3, 2021

Novi Sad, Serbia

Book of Abstracts

21st European Meeting on Environmental Chemistry

Publisher

Serbian Chemical Society

Karnegijeva 4/III, Belgrade, Republic of Serbia

For the publisher

Dušan Sladić

President of the Serbian Chemical Society

Editors

Ivana Ivančev-Tumbas

Vladimir P. Beškoski

Aleksandra Šajnović

Cover page photo

Branko Lučić

Design and prepress

Beoživković, Belgrade

Printed by

RIS Studio, Belgrade

Circulation

150

ISBN

978-86-7132-078-8

Year

2021

Scientific Committee

Jan Schwarzbauer, Germany, president
Ivana Ivančev-Tumbas, Serbia, vice president

Marijana Ačanski, Serbia
Vladimir P. Beškoski, Serbia
Jelena Bošković, Serbia
Anne-Marie Delort, France
Stuart Gibb, UK
Branimir Jovančićević, Serbia
Đorđe Jovanović, Serbia
Albert T. Lebedev, Russia
Milan Matavulj, Serbia
Milica Balaban, Bosnia and Herzegovina
Polonca Trebše, Slovenia

Organisational Committee

Branimir Jovančićević, president
Maja Turk Sekulić, vice president

Mira Aničić-Urošević
Mališa Antić
Jelena Avdalović
Tanja Brdarić
Aleksandar Đorđević
Rada Đurović Pejčev
Gordana Gajica
Ljubiša Ignjatović
Marko Ilić
Konstantin Ilijević
Ivana Ivančev-Tumbas
Kristina Joksimović
Vladan Joldžić
Milica Kašanin-Grubin
Branka Lončarević
Nikoleta Lugonja
Marija Lješević
Snežana Maletić
Aleksandra J. Mihajlidi-Zelić
Maja Milanović
Srđan Miletić
Tijana Milićević
Dubravka Milovanović
Miloš Momčilović
Jovana Orlić
Kristijan Pastor
Ivana Perović
Petar Pfendt
Srđan Pokorni
Bojan Radak
Dubravka Relić
Goran Roglić
Sanja Sakan
Slađana Savić
Jelena Savović
Slavka Stanković
Vesna Stanković
Sanja Stojadinović
Aleksadra Šajnović
Tatjana Šolević Knudsen
Anđelka Tomašević
Aleksandra Tubić
Gorica Veselinović
Nenad Zarić
Vesna Zlatanović Tomašević
Aleksandra Žerađanin
Sanja Živković

Executive Committee

Vladimir P. Beškoski, president
Jelena Radonić, vice president

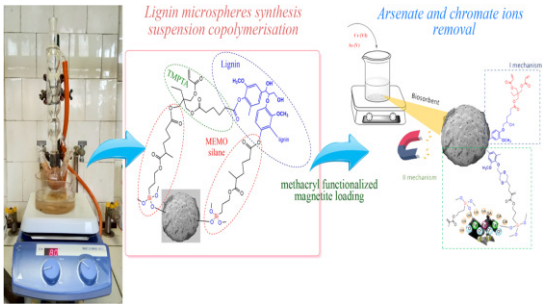
Gordana Gajica
Kristina Joksimović
Milica Kašanin-Grubin
Srđan Miletić
Gorica Veselinović

EMEC21 Secretariat

Aleksandra Šajnović
Aleksandra Tubić
Nevena Antić

Removing of Chromium(VI) and Arsenic(V) from Water Solution Using Modified Lignin Microspheres

A. Tomašević[1,], A. Jovanović[2], J. Bošnjaković[3], M. Stevanović[1], J. Rusmirović[4], A.Marinković[2]. (1) Institute of Pesticides and Environmental Protection, Banatska 31b, Belgrade-Zemun, Serbia, (2) Faculty of Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia, (3) Research and Development Institute Lola L. T. D., Kneza Višeslava 70a, Belgrade, Serbia (4) Military Technical Institute, Ratka Resanovića 1, Belgrade, Serbia; *andjelka.tomasevic@pesting.org.rs.*



With the development of the industry and growth of the population, there is an increasing amount of waste, which, due to inadequate treatment, pollutes water. The group of the most dangerous pollutants present in water includes heavy metals, such as As, Cd, Pb, Ni, Hg, Cr, etc. [1]. Heavy metal ions are highly toxic and not biodegradable, but are prone to accumulation in the body in certain tissues and organs [2].

In recent years, natural materials, originating from waste or renewable sources, have been increasingly used as adsorbents in the removal of heavy metal ions from water, due to their low cost, high prevalence and beneficial impact on the environment [3]. Lignin, cellulose and hemicellulose are the main polymers of wood biomass [4]. Lignin is represented as a by-product in the paper and pulp industry [5]. Chemical modification of lignin was performed using acrylate derivatives (L-AC). Modified lignin microspheres (LMS) were synthesized by inverse suspension copolymerization using L-AC, trimethylolpropane triacrylate (TMPTA) and methacryl functionalized magnetite modified with MEMO silane or with methacryloyl chloride (MACM1 or MACM2). The procedure of inverse emulsion-suspension copolymerization developed by Popović et al. [6] was used. In a summary, disodium laureth sulfosuccinate (surfactant) was stirred in water solution for 30 min at 80 °C. Afterwards, TMPTA, L-MAC, MACM1 or MACM2 and the initiator AIBN (1 wt. %) were added, followed by the mixture of pore-forming solvents (tetradecanol and toluene), stirred for 18 h at the same elevated temperature.

LMS microspheres were characterized by zero charge point determination, FT-IR and SEM. The efficiency of pollutants (chromium(VI) and arsenic(V) ions) removal was analysed in terms of varying the experimental conditions: the mass of adsorbent, the pH of solution, the temperature of reaction and the contact time. The best sorption was observed for the pH between 5.0 and 7.0. Synthesized bio-adsorbents showed high efficiency, with capacities of 35.5 and 54.0 mg g^{-1} for the LMS adsorbents loaded with magnetite modified using methacyl functionalized silane (LMS-1) or methacryloyl chloride (LMS-2), respectively, obtained according to Freundlich isothermal model. Adsorption kinetics are described according to a pseudo-second order model. Based on the obtained results, both adsorbents showed excellent adsorption abilities.

Thermodynamic parameters, including the Gibbs free energy (ΔG^{Θ}), enthalpy (ΔH^{Θ}) and entropy (ΔS^{Θ}), proved that adsorption is viable, spontaneous and endothermic process (LMS-1) and exothermic process (LMS-2) at temperatures between 25 and 45 °C.

Acknowledgements

This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract Nos. 451-03-9/2021-14/200066; 451-03-9/2021-14/200023; 451-03-9/2021-14/200135; 213-1/21-08-03-2021; 451-03-9/2021-14/200325 and 451-03-9/2021-14/200214).

References

[1] Y. Ge, L. Qin, Z. Li, *Materials and Design* 95 (2016) 141–147.

[2] A.E. Burakov, E. V. Galunin, I. V. Burakova, A.E. Kucherova, S. Agarwal, A.G. Tkachev, V.K. Gupta, *Ecotoxicology and Environmental Safety* 148 (2018) 702–712.

[3] Y. Ge, Z. Li, *ACS Sustainable Chemistry Engineering* 6 (2018) 7181–7192.

[4] G. Gellerstedt, *Industrial Crops and Products* 77 (2015) 845–854.

[5] A. Duval, M. Lawoko, *Reactive and Functional Polymers* 85 (2014) 78–96.

[6] A. Popovic, J. Rusmirovic, Z. Velickovic, Z. Radovanovic, M. Ristic, V. Pavlovic, A. Marinkovic, *International Journal of Biological Macromolecules,* 156 (2020) 1160-1173.