

EMEC21

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

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Serbian Chemical Society



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BOOK OF ABSTRACTS





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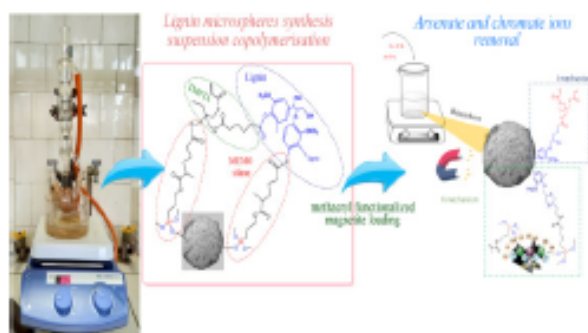
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Removing of Chromium(VI) and Arsenic(V) from Water Solution Using Modified Lignin Microspheres

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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 methacryloyl 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 methacryloyl 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^\ominus), enthalpy (ΔH^\ominus) and entropy (ΔS^\ominus), proved that adsorption is viable, spontaneous and endothermic process (LMS-1) and exothermic process (LMS-2) at temperatures between 25 and 45 °C.

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