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BOOK OF ABSTRACTS

9. simpozijum
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EnviroChem2023
sa međunarodnim učešćem



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Influence of the solution pH value on the adsorption of carbamate pesticide methomyl onto synthesized Cobalt-Beta Zeolite

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Environmental pollution is a reality of modern human society, so in many countries around the world, constant efforts are being made to reduce the negative impact of this phenomenon on the health and quality of life of the human population, as well as the environment [1]. It has been proven that exposure of the organism to pesticides and their decomposition products can have carcinogenic and mutagenic effects, and the toxicity of pesticides certainly causes cell damage and the creation of metabolites harmful to the organism [2].

According to the broad spectra of the possibility of environmental and human contamination by pesticides from water and soil worldwide, extensive research and development of safe technologies for its effective removal was initiated. Adsorption is one of the most commonly used and most suitable considered methods as a simple, efficient, and highly effective method for pesticide removal from aqueous solutions [3]. The application of modern technologies in the production of materials in the field of water purification has enabled the development of various modified and functionalized high-capacity adsorbents, which should be thermostable, highly porous, with a good balance between micropores and macropores, and with the possibility of multiple applications, minimal environmental impact and financially viable in terms of exploitation [4]. Zeolites are crystalline microporous aluminosilicate minerals that are framework silicates built by SiO₄ and AlO₄ tetrahedrons. Beta zeolite can be defined as a zeolite with high silicon content and a three-dimensional structure built by perpendicular 12-ring channel systems characteristic of the three polymorphs [5]. Modifying zeolite structure is essential to improve the characteristics of zeolite in some industrial processes. Modification of zeolite by metal is possible using isomorphic substitution and metal impregnation [6]. In this study, the influence of solution pH value on methomyl adsorption onto Co-Beta zeolite synthesized by the wet ion-exchange method and sintered at 500 °C was investigated.

The carbamate pesticide methomyl was obtained from DuPont (USA). The zeolite material used for modification was H-Beta zeolite (CP811E-150, Si/Al=68) purchased from Zeolyst International (USA). CoCl₂ × 6 H₂O and HCl were obtained by Centrohem (Serbia). The adjustment of an aqueous solution pH value was done by the addition of sulfuric acid and ammonium hydroxide (30% w/w) (Fisher Scientific (USA)). The Arium® Pro Ultrapure Water System (Sartorius, Germany) provided deionized water (18 MΩ). Mettler Toledo pH Meter Seven Compact S220 (Switzerland) was used for the pH measurements. A UV/Vis Shimadzu 3600 spectrophotometer (Japan) was used for investigation of kinetics of removal. All adsorption experiments were carried out in a thermostatic water bath using glass reactor with the volume of 100 mL at 25 °C.

The influence of pH value on the system is manifested through surface tension, surface properties, degree of ionization of groups present on the surface of the adsorbent, and the speciation of ions in an aqueous solution at a specific pH value. The effect of pH on methomyl removal is presented in Figure 1. As mentioned above, methomyl retention depends on the nature of the pesticide and adsorbent. The examined pesticide efficiently hydrolyzes in basic solution ($\text{pH} > 8$), which negatively affects adsorption. The adsorption onto the zeolite surface of unhydrolyzed methomyl molecules is quicker due to its higher hydrophobicity than the hydrolyzed molecule. Also, in an acidic and basic aqueous environment, this pesticide efficiently hydrolyzes to more toxic metabolites, which is another reason why sorption experiments are performed at pH 7 [7]. The pesticide molecule could be more positively charged at a neutral state, with a cationic character, which can also explain this more significant adsorption. In an acidic solution, H_3O^+ ions attract surface oxygenated adsorbent groups, which could lead to the formation of a bond between H_3O^+ and adsorbent [8].

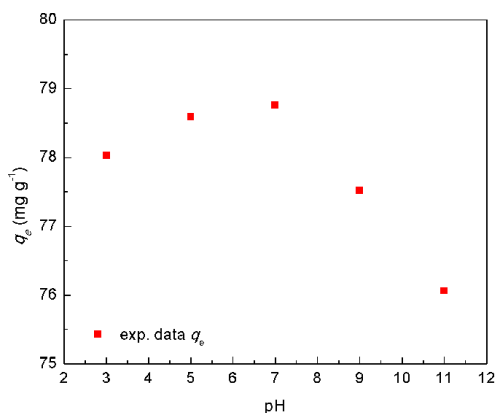


Figure 1. Influence of the initial solution pH value on methomyl removal: ($C_{\text{methomyl}} = 81.105 \text{ mg L}^{-1}$, $m/V = 1000 \text{ mg L}^{-1}$, $T = 25 \text{ }^\circ\text{C}$).

References

1. Stupar S. Lj., Vuksanović M. M., Totovski L. M., Jančić Heinemann R. M., Mijin D. Ž. *Sci. Sinter.* 53 (2021) 91.
2. Tarique M., Kumar M., Malik A. *Biotechnol. Rep.* 24 (2019) e00389.
3. Hokkanen S., Repo E., Sillanpää M. *Chem. Eng. J.* 223(2013) 40.
4. Gao L., Yin H., Mao X., Zhu H., Xiao W., Wang D. *Environ. Sci. Pollut. Res.* 22(2015) 14201.
5. Lu T., Yan W., Xu R. *Inorg. Chem. Front.* 6 (2019) 1938.
6. Tielens F., Dzwigaj S. *Chem. Phys. Lett.* 501 (2010) 59.
7. Yang G.P., Zhao Y.H., Lu X.L., Gao X.C. *Colloids Surf. A Physicochem. Eng. Asp.* 264 (2005) 179.
8. Cox L., Hermosín M.C., Cornejo J. *Chemosphere* 27 (1993) 837.

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