Langmuir, Freundlich and Dubinin-Radushkevich Isotherms as Models for the Adsorption of Fungicide (Na-Dimethyldithiocarbamate) on Synthesized Zeolite X

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Pesticides have often been found in polluted ground and surface water near agricultural sites, and have therefore been detected from time to time in the food chain, drinking water and air [1]. Adsorption of some pesticides onto solid substances, such as clay minerals or activated carbon, has been rather wide-studied [2]. But only a few studies are devoted to pesticides sorption by zeolites [3]. Zeolites form a large family of aluminosilicates which have been studied by mineralogists for more than 200 years. Zeolites are microporous crystalline solids with well-defined structure, consisting of a three-dimensional network of SiO₄ and AlO₄ tetrahedral linked together by common oxygen atoms. For their chemical, physical and structural characteristics, zeolites are suitable for a number of applications in various fields such as adsorption of cations, separation, ion exchange and catalysis [4]. The aim of this study is investigation of adsorption of Na-dimethyldithiocarbamate from aqueous solution on the synthesized zeolite type X using Langmuir, Freundlich and Dubinin-Rudushkevich isotherms.

Zeolite NaX was synthesized by hydrothermal method [5]. The XRD pattern, FT-IR and SEM have been used for characterizing of synthetic zeolite. The test for sorption of Na-dimethyldithiocarbamate was conducted by using a batch equilibration technique. The concentration of CS₂ which is formed from heating Na-dimethyldithiocarbamate in presence of SnCl₂ is measured by spectrophotometry at λₘₐₓ=302 in potassium methanolic solution [6]. The experimental results were analyzed in terms of three two-parameter adsorption isotherm equations - the Langmuir, Freundlich and Dubinin-Radushkevich isotherms.

According to the evaluation using Freundlich, Langmuir and Dubinin-Radushkevich equation, the sorption capacities obtained were 0.674 mg/g, 0.675 mg/g and 0.332 mg/g, respectively, for Na-dimethyldithiocarbamate. The results showed that, the Freundlich and Langmuir isotherms described the data appropriate than Dubinin-Radushkevich.

In conclusion, the results showed that zeolite type X could be useful for removal of Na-dimethyldithiocarbamate from aqueous solutions.

REFERENCES