Investigating the Possibility of Using a Cheap Adsorbent Based on Fly Ash to Remove Neonicotinoid Insecticides from Water

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This research aims to solve several problems in the environment imposed on us by modern society. The first is the removal of the systematic insecticide imidacloprid from the group of neonicotinoids, whose mass use in agriculture leads to elevated concentrations in water, which manifests negative effects on the environment. Also, huge amounts of waste products in the form of fly ash and boiler ash are generated in thermal power plants for the purpose of obtaining electricity. Its disposal uses large areas of land and a huge amount of water and energy and presents a major health, ecological and economic problem.

In this paper, the possibilities of fly ash as a cheap adsorbent for removing the insecticide imidacloprid from water were examined. This study recognizes that fly ash (FA) is a promising adsorbent for the removal of various pollutants. Fly ash from the Morava thermal power plant was simply chemically treated with CaO and water to give modified fly ash (MFA), which proved to be an effective adsorbent for the removal of imidacloprid from water. The content of lime (CaO and water) in the fly ash in relation to the adsorption capacity of imidacloprid and the adsorption conditions (pH value of the system, mass of adsorbent, temperature and time) were optimized by applying D Optimal design of the response surface method (RSM). For this purpose, the commercial software "Design expert 9" was used. The results showed that the pseudo-first-order rate equation effectively describes the adsorption kinetics, and that the adsorption equilibrium was established after 90 minutes. The Langmuir model exhibited a better fit to the adsorption isotherm than the Freundlich model. The maximum Langmuir adsorbent capacity for imidacloprid was 73.25 mg g^{-1} at 25 °C at a solution pH of 7.

Keywords: fly ash, adsorbent, imidacloprid, water, adsorption capacity, optimization.