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Prediction of equilibrium parameters of adsorption of lead (II) ions onto diatomite

Taylan Salman, Yüksel Ardalı, and N. Gamze Turan

Ondokuz Mayıs University, Engineering Faculty, Dept. of Environmental Engineering, Kurupelit, Samsun, Turkey; Tel: +90 362 3121919/1217; Fax: +90 362 4576094; E-mail: yardali@omu.edu.tr

Heavy metals from industrial wastewaters are one of the most important environmental issues to be solved today. Due to their toxicity and nonbiodegradable nature, heavy metals cause environmental and public health problems. Various techniques have been developed to remove heavy metals from aqueous solutions. These include chemical precipitation, reverse osmosis, ion Exchange and adsorption. Among them, adsorption is considered to be a particularly competitive and effective process for the removal of heavy metals from aqueous solutions. There is growing interest in using low cost, commercially available materials for the adsorption of heavy metals. Diatomite is a siliceous sedimentary rock having an amorphous form of silica (SiO_2. nH_2O) containing a small amount of microcrystalline material. It has unique combination of physical and chemical properties such as high porosity, high permeability, small particle size, large surface area, and low thermal conductivity. In addition, it is available in Turkey and in various locations around the world. Therefore, diatomite has been successfully used as adsorbent for the removal of heavy metals. The aim of the study is to investigate the adsorption properties of diatomite. The equilibrium adsorption data were applied to the Langmuir, Freundlich and Dubinin-Radushkevic (D-R) isotherm models. Adsorption experiments were performed under batch process, using Pb (II) initial concentration, pH of solution and contact time as variables. The results demonstrated that the adsorption of Pb (II) was strongly dependent on pH of solution. The effect of pH on adsorption of Pb(II) on diatomite was conducted by varying pH from 2 to 12 at 20 oC. In the pH range of 2.0-4.0, the adsorption percentage increases slightly as the pH increasing. At pH>4, the adsorption percentage decreases with increasing pH because hydrolysis product and the precipitation begin to play an important role in the sorption of Pb (II). At pH4, the maximum adsorption capacity of diatomite was found as 26.158 mg/g. The adsorption isotherms of Pb (II) on diatomite can be described well by the Freundlich model. The high adsorption capacity of diatomite makes it suitable low-cost material in the removal of Pb (II) from aqueous solutions.