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REMOVAL OF LEAD IONS IN WASTEWATER USING THERMALLY REGENERATED DIATOMACEOUS EARTH FROM SPENT DIATOMACEOUS EARTH

M.W.E.H. Wimalarathna[1], C.A. Gunathilake[2*] and A.N. Navaratne[3]

[1]Department of Environmental and Industrial Sciences, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka
[2]Department of Chemical and Process Engineering, Faculty of Engineering, University of Peradeniya, Peradeniya, Sri Lanka
[3]Department of Chemistry, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka
[*]chamilag@pdn.ac.lk

This study describes a method of removal of lead ions in wastewater using a thermally regenerated diatomaceous earth (DE) formed from spent diatomaceous earth (SDE) under 400 °C (SDE-400 °C) and 800 °C (SDE-800 °C). SDE is mainly generated from food processing and brewery industries as industrial waste. This work also reports the effectiveness and efficiency of lead (Pb^{2+}) ions removal from aqueous solution by the adsorbent of SDE. The surface morphology of SDE dry form was obtained by Field Emission Scanning Electron Microscopy (FE-SEM) and indicated a well-arranged porous structure with some particles on the surface. Nitrogen adsorption-desorption analysis was performed at -196 °C for the dry form of SDE and found that it contains 2.22 $m^2 g^{-1}$ of specific surface area and 0.015 $cm^3 g^{-1}$ of the total pore volume. The favourable conditions for Pb^{2+} adsorption onto SDE were determined. The maximum lead adsorption was obtained when the adsorbent dosage of 50 mg and contact time of 180 min at pH of 4.8, maintained for 50 mL of lead solution at 25 °C. The Langmuir and Freundlich adsorption isotherm models were used to interpret the equilibrium data of the investigated systems. The Langmuir model best described the adsorption characteristics of Pb^{2+} on SDE, SDE-400 °C and SDE-800 °C with maximum adsorption capacities of 163.93, 208.33, 322.58 mg g^{-1}. Moreover, the present study suggests the favourable application of SDE-800 °C as an effective material for removing Pb^{2+} from aqueous solutions for industrial wastewater treatment than the other two adsorbents due to the presence of chemisorption and physisorption.

Keywords: Adsorption, Isotherm, Lead(II), Spent diatomaceous earth, Thermal regeneration