Removal of Heavy-Metals from Wastewater Using a Hydrous Alumino-Silicate Mineral from Kenya

Enos W. Wambu[1], Stephen Attahiru[2], **Paul M. Shiundu[3*]** and John Wabomba[2]

, [1], University of Eldoret, [2] University of Nairobi [3*] **Department of Chemistry, Technical University of Kenya,**

Abstract

Heavy metals' discharge into the environment continues to pose grave concerns around the world. The efficacy of a hydrous alumino-silicate clay (AlSiM) coming obtained from some regions of Kenya to sorb heavy-metal ions from water has been evaluated in batch tests taking into account changes in adsorbent dose, pH, contact time, and temperature. Complete metal removals, from water containing up to 66 mg/L of Pb(II) was achieved using this material at pH value of 5 over a temperature range of 289–333 K. The adsorption data fitted both the Langmuir and the Dubinin-Radushkevich isotherms with $R^2 > 0.99$. The D-R adsorption energy (−11.7 kJ/mol) indicated that chemisorption was the primary reaction in the adsorption process and the derived ΔG^0 value (−7.45 kJ/mol) was consistent with the spontaneity of the adsorption process. The kinetic analyses indicated a film-diffusion and surface-chemisorption controlled process. Verification of the initial results on heavy metals-containing wastewaters obtained from a tannery and a leather processing industries revealed excellent adsorption efficacies of AlSiM for Cr^{3+}(99–100%), Fe^{3+} (96–98%), Mn^{2+} (85–97%) and Zn^{2+} (78–86%). The use of AlSiM as a plausible low-cost adsorbent for heavy-metal decontamination of industrial effluents has therefore been demonstrated.

KEY WORDS: Adsorption, Clays, Dubinin-Radushkevich, Heavy metals, Isotherms, Kinetics, Langmuir, Wastewater

Chemical Society of Ethiopia Vol.32 (1) pp.39-51 (2018).
See more at: https://www.ajol.info/index.php/bcse/article/view/169507/158956