Study of Applicability of Kaolin to Remove Heavy Metals (Cr, Mn, Cu, Fe and Cd) from Textile Sludge

I. Hewage[1], D.T. Jayawardana[2] and D.T. Udagedara[1]

[1]*Department of Science and Technology, Uva Wellassa University, Badulla, Sri Lanka*
[2]*Department of Forestry and Environmental Science, University of Sri Jayewardenepura Nugegoda, Sri Lanka*

Synthetic dyes (metal complex, direct, azo, vat etc.) heavily used in the dyeing process in textile industry are toxic as they contain a wide variety of poisonous chemical compounds including carcinogenic heavy metals that cause adverse effects on all forms of life. In textile wastewater treatment process, most of these chemicals get settled out, ending up in sludge making it hazardous, thus making its management a critical environmental issue. Studying the effective utilization of compost and kaolin mixtures with 0, 10, 20, 30 and 40 wt% kaolin to compost mass ratios on textile sludge (in the form of a slurry) treatment and to analyzing their efficiencies at specified heavy metal(s) removal under ion exchange and absorption processes is the primary objective of this research. In the study adsorption characteristics were provide by adding kaolin and compost for boosting Cation Exchange Capacity (CEC) of filter media(s). Major physical changes were observed in the media after 50 days at which filtering process was terminated. Higher average values for all analyzed parameters; Cr, Mn, Cu and Cd in textile sludge used for the experiment was reported. Wide ranges of removal efficiencies in all heavy metals: Cr (9-67%), Mn (2-100%), Cu (6-98%), Fe (1-100%) and Cd (16-95%) was observed where heterogeneous sorption processes were involved. In addition, the statistical analysis revealed that a significant improvement in removal efficiencies of all specified heavy metals can be achieved by adding organic matter to kaolin except for Mn. It was concluded that the filter with 30 wt% kaolin/compost has the best conditions. Furthermore, X-ray diffraction (XRD) analyses indicated that secondary mineral kaolinite as the major mineral responsible for the sorption process. Fourier-transform infrared (FT-IR) analysis of filter media(s) evident active functional groups for sorption.

Keywords: Kaolin, Organic matter, CEC, Sorption processes