



Tropentag, October 6-8, 2009, Hamburg

“Biophysical and Socio-economic Frame Conditions
for the Sustainable Management
of Natural Resources”

Removal of Cadmium and Lead by Organo-clay Complexes from Contaminated Waste Water

DALIA MUBARAK¹, RUDOLF SCHULZ¹, REINER RUSER¹, JÖRN BREUER², MOHAMED MOSTAFA³,
FIKRI AWAD⁴, TORSTEN MÜLLER¹

¹University of Hohenheim, Department of Plant Nutrition, Germany

²University of Hohenheim, State Institute of Agricultural Chemistry, Germany

³Ain Shams University, Department of Soil Science, Egypt

⁴National Research Centre, Soils and Water Use Department, Egypt

Abstract

Organically modified clay complexes (OMC) were prepared from naturally occurring clay sediment modified by organic cations [L-Cystine dimethylester (cystin), L-Carnitine (carnitin), Thiamine (Thiamin) methyltriphenylphosphonium (MTP), and hexadecyltrimethylammonium (HDTM)] and humic acid (HA), to adsorb heavy metals from contaminated wastewater. Cadmium and Lead were chosen as examples of common heavy metals in wastewater to investigate the adsorption characteristics of the OMC. The most efficient OMC shall later on be selected for wastewater cleaning in Egypt.

The effect of different organic modifiers on the characteristics of the clay sediments was studied by XRD, MIR and total organic carbon (TOC) analysis.

Generally, the total organic carbon (TOC) content in the prepared OMC increased with increasing modifiers concentrations in the following order: HDTM- > MTP- > Thiamin- > Carnitin- > Cystin- > HA-OMC. The Cd adsorption by MTP-, and HDTM-OMC was higher than the adsorption by the un-treated sediment. Carnitin- and HA-OMC showed a lower Cd adsorption than the untreated sediment. Carnitin- and MTP-OMC had the highest adsorption of Pb. HA-OMC showed a similar Pb adsorption as the untreated sediment. Cd and Pb adsorptions on the OMC were pH dependent. Carnitin-OMC had the highest Cd adsorption efficiency (94% of the initial amount of Cd) at pH 4 to 8. HA-OMC showed a Cd adsorption efficiency of 84–86% at pH 6 to 8. Carnitin- and HA-OMC achieved Pb adsorption efficiencies between 99.8–99% at pH 4 to 6. Effect of the equilibrium time and the electrolyte ionic strength on the adsorption process were also investigated.

Keywords: Cadmium, lead, organically modified clay, wastewater