TOWARDS A SAFER ENVIRONMENT: A NEW MODIFIED CLAY FOR REMOVING HEAVY METALS FROM LOW QUALITY WATER

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The principal objective of wastewater treatment is generally to allow human and industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment. Irrigation with wastewater is both disposal and utilization and indeed is an effective form of wastewater disposal (as in slow-rate land treatment). However, some degree of treatment must normally be provided to raw municipal wastewater before it can be used for agricultural or landscape irrigation or for aquaculture. The quality of treated effluent used in agriculture has a great influence on the operation and performance of the wastewater-soil-plant or aquaculture system.

Clay sediments represent excellent natural barriers due to their small grain size, their specific surface area and their diagenetic processes (which cause high natural density). Besides, their ability to close fissures and cracks (which may form paths for leachates). In addition, their chemical reactivity permits them to immobilize important contaminants from wastewater.

To produce a new modified clay as a sorbent for removing heavy metals and other toxicants from low quality water, two Egyptian natural clay sediments dominated mainly by kaolinite were selected. Unusual treatments depend on thermal transformation and acid activation to increase the exchangeability properties of kaolinite were used. This was proved by different methods, among them XRD analysis, I.R spectroscopy Scanning Electron Micorscope and C.E.C measurements. The explanation was focused on release of some octahedral Al-ions without disturbing the structure itself. This helps in sucking the pollutants out of low quality water.

Key words: Heavy metals removal, I.R ,Modified kaolinite,S.E.M, Wastewater treatment .

As the world population continues to increase accompanied by growth in food needs, urbanization and industrialization; limited available easily and clean surface and ground water resources are being not only limited but also exhausted. Currently, there is a general agreement by the global community on the seven challenges facing World Water Resources and their management. The third one is deterioration of water quality,(1).

In the field of wastewater treatment, many techniques are used to remove the contaminants and eliminate or reduce the hazardous nature of the effluent and prepare the water for release into the environment. Most of these techniques are multi-step and require time as well as extensive handling to accomplish the task of removing solids, oils and metal ions from the water

Many materials used to adsorb wastewater contaminants ions; among them, clays which have remarkable affinity for metals particularly heavy ones. These metals become bound up in the clay through the process of ion exchange which is driven by electrostatic

attractive forces between the metal ion in solution and the anionic surfaces on the clay particles.

Although kaolinite exhibits the least exchangeability among clay minerals, several studies have confirmed the potential of natural kaolinite for the adsorption of metal ions from solution (2) and (3).

A modified kaolinite amorphous derivative (metakaolinite $Al_2(OH)_4Si_2O_5$) which produced from calcining the kaolinite at 600oC, (4) and (5), absorbs heavy metals and could be used in the treatment of toxic metal pollution in water. Definitely, (2) and (6) reported that the porous of collapsed crystalline structure of this modified kaolinite can adsorb a large amount of metallic ions such as Pb, Cd and Cu from wastewater.

The present work reports the development of some local clay sediments in Egypt to produce modified clay mineral by thermal and chemical treatments which could improve the removeability of Cu and Zn from industrial wastewater.

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Industrial non-treated wastewater was collected from Helwan Iron and Steel factory, Cairo, Egypt and treated with the sediment before and after modification.

Obtained results reported that the porous of collapsed crystalline structure of this modified kaolinite can adsorb a large amount of pollutants metallic ions such as Zn and Cu from wastewater.

Observed increase of metal ions removed by modified clays are due to the increasing of exchange sites produced by the acid leaching on a collapsed kaolinite framework.

A comparison of relative removing values revealed that the removing kinetics of Cu is more favored under identical molar concentrations
than Zn.

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