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Recovery of Heavy Metals from Sludges and Wastewaters

**A Thesis Presented
To**

**Chemistry Department
Faculty of Science
Cairo University**

By


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For

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Doctor of Philosophy in Science**



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ABSTRACT

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Recovery of metals from industrial wastewater, after ion exchange treatment, is strong economic driving force even in cases when discharge limitations can be met by precipitation. The main objective of this study to use bench scale column runs to assess the effectiveness of ion exchange resin for metal recovery at different operating conditions. The results indicate that strongly basic anion exchange resin is highly efficient for chromate removal and the selectivity of chelating cation exchange resins for metals removal increases in the following order: $\text{Cu} > \text{Ni} > \text{Cd}$. This evaluation address the product quality, pollution prevention potential, and the factors involved in the use of ion exchange to recover Cd, Cu, Cr (VI), Ni from industrial wastewater.

The quantity of sludge produced by the Greater Cairo wastewater treatment plants is large and will increase to about 360,000 tons dry solids / year by 2020. Land application of sewage is widely used in Egypt; however, the principal environmental concern is due to the inevitable presence of heavy metals. The objective of this study is to assess the effective methods for metals removal from sludge to reduce health risks during land application. The results showed that acid leaching was more efficient for metals removal from sludge except for lead and copper EDTA leaching was more efficient. The optimum treatment efficiencies of metals extraction from sludge are related to the nature of metals in sludge, dosage of extractants, pH, sludge solid content, and reaction time. Stringent industrial effluent control, coupled with improved industrial technology should be effective in reducing the heavy metal contents of sludge in Egypt.

Key words: Recovery; Removal; Heavy Metals; Wastewater; Anion Exchange Resin; Chelating Cation Exchange Resin; Sludge; leaching.

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**To THE SOUL OF
"MY MOTHER"**

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