SUMMARY

SUMMARY

The search for clean water is a problem for every body. Without water there is no life, no agriculture, and no industry. In many fresh waters, metal ions concentrations is elevated by domestic and industrial sewage or other sources. Some metal ions are essential for organisms in low concentration, but they are toxic in high concentration. The presence of trace elements and heavy metal ions in drinking water is of concern from a health-related aspect, since these ions have been linked to the occurrence of human cancer in many instances, in addition to the probable toxicity. The search of methods for decontamination of water is of great concern. The effective removal of heavy metal (HM) ions from aqueous wastes is the most important issue for many industrialized countries. Therefore, the aim of this thesis is to investigate the possibility of the utilization of Cement Kiln Dust (CKD) as a low cost adsorbent and industrial waste, for decontamination of water from heavy and toxic metallic ions such as Cd(II), Al(III), Co(II) and Zn(II).

This study is to cover the following items:

- Study of physical and chemical properties of the two materials using "XRF and surface area measurement."
- Different parameters affecting the adsorption of the metal ions from aqueous solution were studied. These parameters include the shaking time, hydrogen ion concentration in the aqueous phase, metal ion concentration, anions concentration and variation of temperature.
- The thermodynamic studies which are represented by plotting the adsorption isotherms for each metal ion at three different temperatures, Langmuir and Fruendlich isotherm equation and calculating their parameters were applied to determine the type of the adsorption process.
- The kinetic studies, are represented by studying the effect of contact time on the removal percentage of the four heavy metal ions with the cement kiln dust.

It was found that pH of the solution has a significant impact on the percentage removal of heavy metal ions. Between pH 5.5 and 8, where the influence of precipitation is negligible, the percent removal was 80% - 99% for zinc, 85% - 99% for Aluminum, 90% - 99% for cadmium and 50% - 90% for cobalt. The percent

removal of the heavy metal ions increased as the pH increased. Most of the metal ions had a 99% removal when the pH was 8 except cobalt had a 90% at this pH.

Time-dependent experiments for the removal efficiency of heavy metal ions showed that Al(III) required a shortest contact time, for Zn(II) and Cd(II), binding to the CKD was rapid and occurred within 20 to 40 min and completed for Co(II) within 4 hrs.

High sorption capacities were observed for the four heavy metal ions. The binding capacity experiments revealed the following amounts of heavy metal ions bound per gram of CKD: 165.994 mg/g, 75.389 mg/g, 64.296 mg/g and 108.875 mg/g for Zn(II), Al(III), Co(II) and Cd(II), respectively.

The experiment was conducted at temperatures from 30 to 60 ^{o}C and throughout the batch period for individual metal solution experiments without showing any significant variation. This may be attributed to the stability of CKD on these temperatures since this material has been burnet at high temperature.

The adsorption isotherm studies clearly indicated that the adsorptive behavior of heavy metal ions on CKD satisfies not only the Langmuir assumptions but also the Freundlich assumptions, i.e. multilayer formation on the surface of the adsorbent with an exponential distribution of site energy.

The results from this study indicated that CKD industrial waste could be employed for industrial wastewater decontamination, neutralization of acidic wastewaters (the alkalinity 9-10) and for removal of HM ions such as Cd(II), Zn(II), Al(III) and Co(II) from industrial effluents.