Summary and Conclusion

5.0 SUMMARY AND CONCLUSION

Due to recent industrial revolution and developments in the field of science and technology, a large number of chemical compounds have been introduced into the environment. There is increased occurrence of water pollution problems many folds, because of the ultimate disposal of untreated or partially treated effluents and industrial waste into the aquatic ecosystem.

Water used in industries creates a wastewater that has a potential hazard for our environment because of introducing various contaminants such as heavy metals into soil and water resources. Mainly, Electroplating industries are using highly toxic and hazardous chemicals in the process like lead, tin, copper, cadmium, zinc, nickel and chromium.

The major source of nickel into water bodies is from electroplating industry, where nickel is used to improve the values of treated metals by providing improvement such as corrosion resistance, durability, electrical properties etc. Mostly nickel is used in mining, stainless steel, battery, pigments and ceramics industries. Nickel sulphate is used in pesticides and fungicides. Chromium is used on a large scale in many different industries, including metallurgical, electroplating, production of paints and pigments, tanning, wood preservation, chromium chemicals production and pulp and paper production.

The presence of nickel and chromium in wastewater when exceeds a limit affects the taste and appearance of potable water and also has adverse effect on domestic use and water structures. Beyond the permissible limit, they are toxic.

Globally, in developed countries, pollution of the aquatic system is controlled by the union under the framework 'Dangerous Substances Directive' which has led to certain environmental protection acts and regulations enforced by environmental agencies. Consequently, all effluents need to be finally discharge.

Looking into the increased environmental awareness, even in developing countries like India, wastewater treatment is of utmost importance. The increasing concern with environmental pollution significantly motivates the investigation and development of safe technologies.

Various techniques have been employed for the treatment of heavy metals, such as chemical precipitation, ion exchange, electrolysis and reverse osmosis. But the disadvantage of these methods includes high operating costs and the production of sludge. As a result, an aquatic problem is changed into solid disposal problem. To overcome these problems, adsorption process is widely used. Activated carbon is used for the removal of heavy metals by adsorption process from the industrial wastes is a common practice. However, the high cost and the difficulty of procuring commercial activated carbon proved the way to use indigenous agricultural wastes.

Hence, the present study was undertaken with human hair as adsorbent for the removal of nickel(II) and chromium(VI) from the respective synthetic metal solutions and from synthetic binary metal solutions consisting of both nickel(II) and chromium(VI).

The objective of the present study was to investigate the adsorption behavior of nickel and chromium from synthetic solutions on human hair at different operating conditions and to determine the optimum conditions of the sorbent and also to study the kinetics of adsorption of the two metals, nickel(II) and chromium(VI). Bicomponent aqueous solutions of nickel(II) and chromium(VI) ions have been used to investigate the sorption of metal ions onto human hair, in presence of one another to assess their interference behaviour.

Adsorption experiments were carried out at pH 4, 5, 6, 7 and 8, temperature 20°C, 25°C, 30°C, 35°C and 40°C, adsorbent dosage 1g, 2g, 3g, 4g and 5g, initial metal concentration of 10, 6.67, 5, 13.33 and 15 mg/100ml, contact time 15, 30, 45, 60 and 75 minutes respectively.

The salient findings of the study were as follows:

Powdered human hair had greater adsorption capacity at pH 6 for nickel(II) and pH 4 for chromium(VI) and pH 4 for both nickel(II) and chromium(VI) sorption from synthetic metal solution; temperature 30°C for nickel(II), 30°C for chromium(VI) and 30°C for both nickel(II) and chromium(VI) from synthetic solution; 1g adsorbent dosage for nickel(II), chromium(VI) and 1g for both together; dilution 1:1 for nickel(II), chromium(VI) and also both nickel(II) and chromium(VI) together from synthetic metal solution and contact time 75 minutes for nickel(II), chromium(VI) and competitive sorption from synthetic metal solution.

Using Freundlich and Langmuir isotherm adsorption models were performed using human hair as adsorbent. The value of 1/n, indicate the relationship between the sorbent and the adsorbate. The value of 1/n for the selected sorbent (human hair) was less than 1 for both metal sorptions indicating the suitability of the adsorbent for nickel(II) and chromium(VI) removal. The equilibrium data described both the Langmuir and the Freundlich isotherm models satisfactorily.

The present study has shown that the powdered human hair can be successfully used for the removal of Ni(II) and Cr(VI) ions. Adsorption has been found to be spontaneous and rapid.