ABSTRACT

Metals are ubiquitous to man’s environment. With the process of evolution man has developed immunity towards their natural concentration. But with industrialization the use of metals are increased many folds, as a consequence of which they are now being found in the environment in objectionable concentrations. Heavy metals like lead, chromium, copper, nickel and zinc discharged in wastewaters can be toxic to aquatic life and cause natural waters to be unsuitable as potable water sources. Therefore, treatment of effluents is necessary to bring the concentration of toxic metals to permissible limits before they are discharged. The most commonly used techniques for removing metal ions from wastewaters include chemical precipitation, ion exchange, reverse osmosis and solvent extraction. However, these techniques have certain disadvantages viz; high capital and operational cost, disposal of material sludges, expensive equipment, monitoring system etc. Hence cost effective treatment designs are required to mitigate metal pollutants within the economic constraint of developing regions.

Adsorption is a physicochemical process which offers great potential for treating effluents containing undesirable components specially the metals. The advantages of adsorption process includes: low investment in terms of cost, simple design, easy operation etc. Activated carbon has been the standard adsorbent for reclamation of municipal and industrial wastewaters for potable use for almost more than four decades because of its high surface area. But it is expensive and suffers losses during regeneration. Therefore, the research is on to look for economic, abundant and ecofriendly adsorbents. In an increasing search for low cost adsorbents various substances such as fly ash, Bagasse, Portal sand, Rice husk, Rice brawn, Sawdust ,Coconut fiber, Coconut husk etc. have been reported.

The scrutiny of literature revealed that, the researchers tried to evaluate the metals adsorption potential of low cost adsorbents by batch techniques, only in few cases by batch downflow column studies. Further, the investigations have not been carried out to assess the performance of upflow column in treating wastewaters containing metals using low cost adsorbents. Thus, it was thought off to carry out research in this area and hence the topic of present research work titled “Upflow Column Studies on Adsorption Kinetics of Low Cost Adsorbents for the
Removal of Heavy Metals from Aqueous Solutions" was defined and bench scale studies were carried out.

In the present research work, the attempts have been made to assess the removal efficiencies of low cost adsorbents namely Sawdust, Wheat brawn, Sugar cane leaves and Coconut husk in removing metals namely Lead, Nickel, Copper and Zinc under varied experimental conditions.

For the convenience and clarity, as well as to sequentially relate the planned activities with the outcome of research work, this research report consisting of following chapters is prepared.

Chapter I : Introduction
Chapter II : Literature Review
Chapter III : Materials and Methodology
Chapter IV : Results and Discussions
Chapter V : Conclusions ,Limitations and scope for further study

In Chapter- I, an attempt has been made to throw light on necessity of treatment of wastewaters to remove metals from them, techniques practiced to treat the wastewaters containing metals. Also, the problem identification and thereby the objectives of the study are documented in this chapter.

In chapter –II, an attempt has been made to collect and collate the research carried out by researchers across the globe on metals removal from wastewaters by various techniques. Issues like sources of metals, problems associated with metals pollution, adsorption techniques, disposal standards are discussed in this chapter. This chapter also throws light on basic adsorption isotherms.

Chapter –III, describes materials and methods used in the present research work. This chapter throws light on absorbents used for research work and their preparation, procedure for preparation of synthetic wastewater samples, experimental variables considered for study, methods adopted for analysis of sample and details of experimental setups used.
The results obtained from the present research study have been presented in Chapter-IV. Based on the results, the discussions made and inferences drawn are also documented in this chapter.

Wheat Brawn, Coconut husk were found to remove 100 % of lead from synthetic wastewaters. On the other hand studies revealed that maximum of 86 % of zinc removal can be achieved by using sawdust and sugar cane leaves. While 85 to 86 % removal of copper by sawdust and sugar cane leaves was observed. Coconut husk was found to remove 92 % of nickel from aqueous solutions. The removal efficiency as a function of pH, initial metal concentration and particle size of the adsorbent has been observed.

Chapter -V, lists the major conclusions drawn based on the experimental studies. It also includes limitations and recommendations for further research work.

The relevant and latest research papers, articles and technical reports collected, collated, discussed and referred to in the text of this thesis are listed under references.