Chapter 5

Conclusion and Scope of Future Work

The objective of the thesis is to develop high efficient materials, with high adsorption efficiency for the removal of heavy metal ions towards environmental remediation. The work has been divided into three parts in this thesis. The first part of the work deals with the preparation of carbon nanotubes using different catalyst by CVD technique and their efficiency on the removal of heavy metal ions.

The second part of the work deals with the synthesis of graphene materials and their efficiency on removal of heavy metal ions. The adsorption of Pb(II) and Cd(II) ions onto graphene materials using adsorption process with different adsorption parameters, their kinetic and thermodynamic studies have been presented in detail. Optimization parameters in this process were viz., initial concentration, pH, contact time and adsorbent dosage. The efficiency with which the catalyst could be recycled was determined.

The third part of the work deals with the synthesis of graphene based magnetic nanocomposite materials and their efficiency on the removal of heavy metal ions. The adsorption of Pb(II) and Cd(II) ions onto graphene based magnetic nanocomposite materials using adsorption process with different adsorption parameters, their kinetic and thermodynamic studies have been investigated in detail. Optimization parameters in this process were viz., initial concentration, pH, contact time and adsorbent dosage. The efficiency with which the catalyst can be recycled was determined.

Overall, different adsorbents have been prepared and tested for the effective removal of Pb and Cd ions. Results showed that all the adsorbents were showing appreciable activities with CoFe₂O₄-G being the best adsorbent which was showing highest activity of 142.8 mg/g for lead and 111.1 mg/g for cadmium ions respectively (Table 4.14). Thus, overall results show that the developed adsorbents could be used in adsorbent technology for heavy metal adsorption.
As an extension of such developed adsorbents, these materials could be integrated in water filters with magnetic cartridges for filtering heavy metal contaminated water samples. A novel and a simple water filter could be designed, integrated with the developed adsorbents for effective water filtration.