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Title of the Thesis : Studies on Synthesis, Characterization and Analytical Applications of New Synthetic Ion Exchangers

Abstract

Now day's organic- inorganic hybrid ion exchange materials have emerged as a more suitable class of ion exchanger. The hybrid material enables the integration of useful organic and inorganic characteristics within a single molecular scale composite. Unique ion exchange properties of these materials have been observed. Tetravalent metal acids salt (TMA) has emerged as promising advancing materials as they posses robust properties. The revived interest in the compound is due to their good properties and resistance towards higher temperature and ionizing radiations. Tin (IV) based ion exchangers have received attention because of their excellent ion exchange behavior.

The **first chapter** gives the general introduction of the earlier work related to the ion exchanger. A critical review of synthetic organic ion exchangers and inorganic ion exchangers with their applications in different fields are mentioned.

The **second chapter** describes the synthesis, characterization and analytical application of a new and novel "organic-inorganic" hybrid cation-exchanger: Benzamide tin (IV) phosphate. Unique ion exchange properties of these types of hybrid material have been observed. The physico-chemical properties of this hybrid material were determined. Ion exchange capacity, thermal stability and distribution behavior etc. were also carried out to understand the cation exchange behavior of the hybrid material. On the basis of distribution studies, the

material was found to be highly selective for Hg(II), a highly toxic environmental pollutant. The separation capacity of the material has been demonstrated by achieving some important binary separation such as Hg(II)-Mg(II), Hg(II)-Cd(II), Hg(II)-Pb(II), Hg(II)-Ba(II), etc.

The **third chapter** describes the synthesis, characterization and ion exchange properties of a new and novel organic-inorganic hybrid cation-exchanger: Benzamide tin (IV) tungstophosphate. The adsorption efficiency towards heavy metal ions was determined by distribution studies and material was found highly selective for Hg^{2+}, a heavy toxic metal ion present in waste stream. The analytical utility of the material has been explored by achieving some binary separations of metal ions on its column.Hg^{2+} has been selectively removed synthetic mixtures containing Mn^{2+}, Zn^{2+}, Cd^{2+}, Pb^{2+}, Sr^{2+}, Ba^{2+}, etc.

The **fourth chapter** describes the synthesis of a new hybrid organic-inorganic cation exchanger Acrylonitrile tin (IV) tungstophosphate has been synthesized and its analytical application explored. The effect of experimental parameter such as reagent mixing ratio, temperature effect on ion exchange properties of material has been studied. Distribution studies reveal the exchanger to be highly for Pb^{2+}. As a consequence, some binary separations of metal ions have been achieved on a column of this material, demonstrating its analytical potential.

The **fifth** chapter is divided in two parts. Part A deals with the selective removal of mercury from Industrial waste water and some synthetic sample on Benzamide tin(IV) phosphate. As a conservative technology, ion exchange allows the removal and recycling of metals from liquid effluents.

Part B includes a process applied for the removal of lead from waste water by ion exchange. This process is based on Acrylonitrile tin (IV) tungstophosphate cation exchanger capable of removing lead (II) from effluent followed by selective separation.