ANALYTICAL APPLICATIONS OF CHELATING ION EXCHANGERS

by

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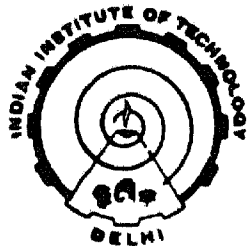

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CERTIFICATE

This is to certify that the thesis entitled "ANALYTICAL APPLICATIONS OF CHELATING ION EXCHANGERS" by Sandeep Srivastava is a record of original bonafide research carried out under my supervision and has not been submitted elsewhere for a degree.

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ABSTRACT

In the first chapter a comprehensive review of the chelating resins has been described. A review on the solid membrane sensors using such resins as electroactive phase has also been included in this chapter. Scope of the present work has been indicated at the end of this chapter. Synthesis of three novel chelating ion exchange resins, viz. salicylaldoxime- formaldehyde (SOF), 2-salicylaldene aminothiophenol-formaldehyde (STF), and 2-hydroxynaphthaldoxime -formaldehyde (HOF), has been described in the second chapter. These resins have been characterised by different techniques such as infrared spectroscopy, elemental analysis etc.

In the third chapter the adsorption patterns of some transition and inner transition metals using SOF, STF and HOF resins have been discussed. Detailed studies of the adsorption of Cu(II), Zn(II), Ni(II), Pd(II), Co(II), Cd(II), Mn(II), Pb(II), Fe(II) on SOF resin have been carried out. The resin showed good selectivity for the following metal ions, the order of adsorption being :

Pb(II) ~ Zn(II) ~ Ni(II) > Cu(II) > Cd(II) > Pd(II) > Mn(II) > Fe(II) > Co(II) .

The adsorption of Ni(II), Fe(II), Pd(II), Co(II), Pb(II), Mn(II), Zn(II), Cd(II), Cu(II) and some inner

transition metals on STF resin has been investigated. The order of adsorption is :

Pd(II) ~ Fe(II) > Pb(II) > Cu(II) > Cd(II) > Ni(II) > Mn(II) > Co(II) > Zn(II).

The chelating resin HOF has been tested to study the adsorption pattern of Pb(II), Co(II), Fe(II), Pd(II), Ni(II), Zn(II) and Cu(II). The order of adsorption on this resin, which exhibits good selectivity for some metals is :

Fe(II) ~ Co(II) > Pb(II) > Zn(II) > Cu(II) > Ni(II) > Pd(II)

Effect of electrolytes like NaCl, $NaNO_3$ and Na_2SO_4 (at different ionic strengths) on the distribution coefficient values for some of the metal ions viz. Ni(II), Pd(II), Fe(II), and Pb(II) on these three resins has also been observed. The dependence of adsorption of metal ions viz. Co(II), Ni(II), Pb(II), etc. on the different particle size of these resins has been studied. Separations of various metals have been proposed in the chapter using the three resins. Moreover a method has also been developed for the separation of Pd(II) and has been described in this chapter.

The synthesis and characterization of metal chelates using metal ions viz. Co(II), Ni(II), Cu(II) with SOF, STF and HOF resins form the subject matter of the fourth chapter. Metal chelates were prepared by condensing SOF, STF

and HOF resins with metal acetates. All these metal chelates have high melting points and analysis indicates that they have 1:1 and 1:2 metal ligand stoichiometry. Results obtained from infrared techniques have been discussed to understand the nature of bonding. Thermogravimetry and magnetic susceptibility measurements were also useful in the characterization.

In the fifth chapter the electrochemical behaviour of SOF and STF resins is reported. The fabrication of the membranes using SOF and STF and their characterization and application as membrane sensors for the estimation of metal ion concentration is given in this chapter. STF and SOF resins exhibit selective affinity for a number of heavy metal ions. Consequently these two membranes were tried for the estimation of some metal ions viz. Pb, Cu, Zn. By incorporating the SOF resins as electroactive phase, efforts to develop a sensor for Zn(II) ions has been successfully achieved. The two SOF resin membranes (Polystyrene/PVC based) exhibit very good response to Zn(II) ion and membrane electrode can measure its concentration in a fairly wide range. The membranes of the resin STF can be utilized for Pb(II) ion estimations at low concentration.

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