SUMMARY

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Chelating polymers are the polymers containing functional groups capable of chelating with metal ions. They can be distinguished from chelate polymers or coordination polymers which would include (1) polymers resulting from the suitable condensation of metal ions with ligands, (2) polymers resulting from the polymerization of coordination complexes or chelates and (3) products obtained by insertion of metal ions into polymeric ligands.

Chelating polymers may be obtained as linear polymer chains or as cross-linked polymeric networks depending largely on the functionality of monomers. They posses ion exchange properties. Since the ionic functional groups are hydrophilic, these groups attached to polymeric matrix tend to draw the whole ionic resin system into solution. To prevent this, the polymer structure in the synthetic resin is held together with cross-linkers forming a three dimensional insolubilized network.

Linear chelating polymers include (i) natural chelating polymers such as alginic acid, chitin, chitosan, nucleic acids, etc (1-4) and (ii) synthetic chelating polymers obtained by addition or condensation polymerization and containing such ligands as glycine (5), hydroxamic acid (6), hydroquinoline derivatives (7,8), etc. Cross-linked polymeric networks were studied for their ion-exchange characteristics by Hering (9), Kennedy (10), Manecke (11), Skogseid (12), etc.

Salicylic acid-formaldehyde condensation polymers were investigated by de Geiso, et al (13), Davies, et al (14), etc. Chelating polymers based on 8-hydroxy quinoline-formaldehyde were reported by Lillin (15), Parrish (16), Tolmacher, et al (17), de Geiso, et al (18), Jones and Nyssen (19), etc.

Considerable work has been carried out in our laboratories on different aspects of chelate polymers and chelating polymers, such as pyrolyzed polychelates (20), ion exchange resins (21), chelating polymers (22), etc. Literature survey showed that poly vinyl alcohol forms hemiacetals and acetals (both intra molecular and intermolecular). Though many acetals are useful for various purposes, acetals containing suitable functional groups have not been studied as chelating polymers mainly because of the relative unstability of the acetal bond.

Hence it was planned

(i) to prepare formals, chlorals, etc of poly vinyl alcohol and to study their general, sorption and solubility characteristics,

(ii) to condense ethyl aceto acetate, salicyl aldehyde, etc with poly vinyl alcohol and to study their general, sorption and solubility behaviours,

(iii) to condense formals of poly vinyl alcohol with 8-hydroxy quinoline, salicyl aldehyde, etc and to study their general, sorption and solubility behoviours,

(iv) to condense bis-phenol-A, etc with formaldehyde and chelating agents and to study their general, sorption and solubility characteristics,

(v) to modify some of the products by multiple condensation etc and to study their sorption characteristics, and

(vi) to prepare membranes based on the preparatory methods of some of these products and to study their ion exchange properties.

The investigations were carried out as planned and the results of these investigations are corelated and discussed.

Three grades of poly vinyl alcohol, namely Koch-light make, SD Chem make and Loba-Chemie make, differing in their degree of hydrolysis and degree of polymerization were used in these investigations.

Poly vinyl alcohol was condensed with different amounts of formaldehyde in presence or absence of starch, in water, glycerine or poly ethylene glycol medium and under acidic, alkaline or alkali-acids conditions. The yields of the products are corelated.

Poly vinyl alcohol was also condensed with (i) ethyl aceto acetate, (ii) salicyl aldehyde, (iii) chloral or (iv) formaldehyde and 8-hydro quinoline under different conditions and their yields are correlated.

All these different formals get dissolved in water slightly and hence these products were further resinified with resorcinol and formaldehyde. The products were found to be insoluble in various solvents and stable to 1N acid or alkali. Their degree of swelling in water and ion exchange capacity for Cu(II), Ni(II) and Zn(II) ions were studied.

Further, chelating resins were prepared from (i) bisphenol-A and formaldehyde, and/or epichlorhydrin and chelating agents, (ii) acrylamide, formaldehyde and chelating reagents and (iii) m-amino phenol, carbon disulphide and formaldehyde. Their degree of swelling and ion exchange capacity for Cu(II), Ni(II) and Zn(II) ions were investigated.

Membranes were prepared without using support or reinforcement. These were from the systems (i) poly vinyl alcohol, formaldehyde (or ethyl acetoacetate or chloral), resorcinol and chelating agent, (ii) poly vinyl alcohol, formaldehyde, melamine and chelating agent and (iii) poly vinyl alcohol, ethyl acetoacetate (or chloral), melamine, butyraldehyde and chelating agents. These membranes were studied for their degree of swelling and ion exchange capacity for Cu(II), Ni(II) and Zn(II) ions.

The work was carried out under UGC Fellowship programme.

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