CHAPTER 4

SUMMARY AND CONCLUSION

The investigation comprises synthesis and characterization studies of polyacrylates containing pendant ligand with nitrogen and hydroxyl functions and their Cu(II)/Ni(II) complexes in DMF medium, along with application oriented studies for the complex, poly(2H4AAPH)-Cu(II)/Ni(II) as a model. The following salient results emerged out of this investigation:

- Acrylates containing pendent ligand with nitrogen and hydroxyl functions undergo free radical polymerization under inert atmosphere with moderate conditions giving the polymers in good yield.
- The polymers in DMF are converted to polychelates in good yields, by treatment with aqueous solution of Cu(II)/Ni(II) ions.
- The polymers are freely soluble in THF, DMF, DMAc, and DMSO and insoluble in benzene, toluene, acetone and methanol, while the polychelates are insoluble in all these solvents.
- The molecular weights of the polymers ($\overline{M_W}$) are moderately high of the order $3.72 \times 10^4 - 3.96 \times 10^4$ as evidenced by viscosity and GPC.
TGA and DSC studies reveals that the polychelates are more heat resistant than the respective polymer counterparts, the initial decomposition (10%) being around 300°C for the latter as against around 350°C for the former.

The amorphous nature of the polymers in contrast to crystallinity of the respective polymer-metal complex is indicated by DSC and XRD analysis.

Elemental analysis reveals that the metal to polymeric ligand ratio is 1:2 in all the cases. Further, metal ion uptake by the polymers follows the order: poly(DHBAH)-F > poly(2H4ABAH) > poly(2H4mBAH) > poly(DHAPH)-F > poly(2H4AAPH) > poly(2H4MAPH) > poly(DHBPH)-F > poly(2H4ABPH) > Poly(2H4MABPH) at different pH, and all the polymers shows higher metal ion uptake at higher pH at different concentration of electrolytes.

As evidenced by infra-red, EPR and magnetic moment data, in the case of Ni(II) polychelates co-ordination with the metal involves C=N and –OH groups of the carbonyl compound along with two water molecules leading to octahedral structure. On the other hand, the structure of Cu(II) complex is square planar where co-ordination with metal is only through -N and –OH functions.

All the polychelates possess poor electrical conductivity as shown by electrical conductivity measurements, thus behaving as insulators.

Application oriented study on poly(2H4AAPH)-Cu(II)/Ni(II) complexes reveal the following:
Both complexes catalyze hydrolysis of ester and initiate polymerization of N-vinyl pyrrolidone.

Recovery/recyclability of the polymers from the complexes in acid medium (7M) HCl is good and reproducible. Further, the polymers are stable in the said acidic conditions.

Cu(II) complex catalyze the oxidation of cyclohexanol to cyclohexanone in the presence of H₂O₂, while Ni(II) chelates do not.

The model study of synthesis and characterization of poly(2H4AAPH) complexes with Cu(II) and Ni(II) ions indicate that:

- Cu(II) complex is square planar
- Ni(II) complex is octahedral

Recovery of the polymers from the polychelates in acid medium is good, the polymers being stable under those acidic conditions. This will be of immense value in water treatment and recovery of trace metal ions.