



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title:

Designing of hetero-bimetallic cyclic trinuclear, polymeric chains, and linear trinuclear from Cu(II), Fe(III), and Co(III) complexes using alkali, alkaline, and transition metal ions

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SHORT ABSTRACT

A simple ligand, which is chiral and flexible, was used to synthesize Cu(II) complexes such that the resulting complex can act as a chiral host and is flexible enough to obtain a secondary coordination sphere. Cu(II) bis complex, when reacted with K^+ ion, forms a cyclic trinuclear, which resembles an inorganic crown ether. In this process, the *trans*-oriented Cu(II) bis complex was converted to a *cis*-oriented complex. An excess of [18] crown-6 was added, and the K^+ was removed from the assembly, thereby obtaining a *cis*-oriented Cu(II) monomer. The *cis*-oriented disassembled Cu(II) monomer, when reacted with K^+ , forms back the assembly.

The -R group of the ligand was then changed to a hydrophilic group so that the resulting complexes would be water-soluble. Cu(II) was also replaced by redox-active Fe(III). Depending on the secondary metal ions used, Heterobimetallic complexes of different dimensionality, namely cyclic trinuclear, polymeric chain, and linear trinuclear, were obtained. The 3-dimensional polymeric chain obtained can trap Chloride ions inside the cavity, which can be released in the solution since the polymer is soluble in water. This is evident from the conductance measurement. The spectroscopic study results show the problem associated with testing metal ion detection experiments with hydrolyzable salts of weak bases and assuming the binding of Metal ions without additional evidence. The tests were performed with acid or highlighted the problem of hydrolysis, which is one of the contributions of this work.

The Co(III) bis complex was synthesized. The choice of metal ion is such that the Co(III) complexes are likely to be diamagnetic, so 1H NMR spectroscopy can be used to understand the interactions in the solution. Like its Fe(III) analogue, it forms a polymeric chain when reacted with alkali metal ions. However, we obtained the $[Co^{3+}-M^{2+}-Co^{3+}]$ type of linear heterobimetallic complexes by replacing the alkali metal ions with transition metal ions. The resultant architecture where a Zn(II) or Cu(II) bound water surrounded by an H-bond capable chiral environment is reminiscent of the active site of hydrolytic enzymes.