The present work had an objective of exploring various parameters affecting the gel formation involving well defined metallogelator complexes. It also intended to explore the novel properties and applications of metallogels.

- Gel forming ability of various tricopper(II) complexes, **$[Cu_3(L)_3(H_3ins)]X_3$**, based on myo-inositol where L are various tertiary aromatic diamines like 2,2'-bipyridine analogues and X are various anions have been examined.
- The dependence of gel formation on various simple and complex anions as well as mono- and dicarboxylates has been examined.
- However, the gels can accommodate various anions to different extent, typically very weakly coordinating anions are less accommodated while those with significant coordinating tendency can be accommodated to a greater extent.
- The presence of a carboxylate is found to be essential for the formation of gels. Thus, some of the very stable metallogels are formed when **X** = acetate or a similar alkyl carboxylate anion.
- In general, all carboxylates can yield stable gels, however, as the hydrophobicity/ carbon chain increases, the gels become less stable and result in precipitation.
- The T_{gel} value decrease with the increase in alkyl chain length in the carboxylate anions.
- The effect of variation in the capping ligands, **L**, has been examined. These capping ligands have been varied as 2,2'-bipyridine, 6,6'-Dimethyl-2,2'-bipyridine, 1,10-phenanthroline, 5-Nitro-1,10-phenanthroline, 2,9-dimethyl-1,10-phenanthroline (neocuproine), 3,4,7,8-tetramethyl-1,10-phenanthroline and biquinoline.
- It has been observed that the T_{gel} and water retention capacity decreases with increase in the bulk of the capping ligands.
- The metallohydrogels formed by $[Cu_3(phen)_3(H_3ins)]X_3$ complex, containing 1,10-phenanthroline, as a metallogelaor, have been found to have a striking ability to accommodate various organic solvents like methanol, ethanol, DMSO and DMF.
- The metallogels synthesized using caustic alkali were even more versatile than the carbonate gels and they could even uptake CH_3CN and THF in addition to other solvents mentioned above.
- The T_{gel} values have been found to depend on the nature and the amount of solvent incorporated.
- THF and hydrocarbon solvents could not be accommodated.

- The phenanthroline containing gels have a tremendous solvent uptake capacity, especially for methanol. They can accommodate 20 times the volume of methanol of their own volume at room temperature. These have a complex gelator to methanol ratio of 0.75 : 100 (i.e.0.75 % w/w). Thus, these complex gelators behave as supergelators for methanol.
- The metallogels have been found to catalyze aerobic oxidation of various diphenols namely 3,5-di tert-butylcatechol (3,5-DTBC), 4-methyl catechol, pyrocatechol, resorcinol, hydroquinone and 2,3-dihydroxy naphthalene.
- The gels have been found to possess SOD mimic activity with significantly low IC_{50} values (0.37-1.02 μM) indicating that these metallogelators can very efficiently dismutate superoxide.
- The gels bind with DNA through intercalation, the binding constants with DNA and BSA have been evaluted. Both, UV-Vis spectroscopy and fluorescence, studies show that the gels having phenanthroline and neocuproine as capping ligands have strong binding with DNA and BSA.
- The gels are found to have good antimicrobial activity, especially the phenanthroline and neocuproine containing gels also show very good activity against gram positive bacteria. The gels having phenanthroline as capping agents have lower MIC and were found to be more active than Ciprofloxacin, a standard antibiotic.
- The cytotoxicity studies on human hepatoma (HepG2) cell line shows that the metallogelator complexes especially **232** and **332** have excellent cytotoxicity and very low IC_{50} values.

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