Supramolecular Chemistry-I

Prof. Parimal Kanti Bharadwaj

Department of Chemistry

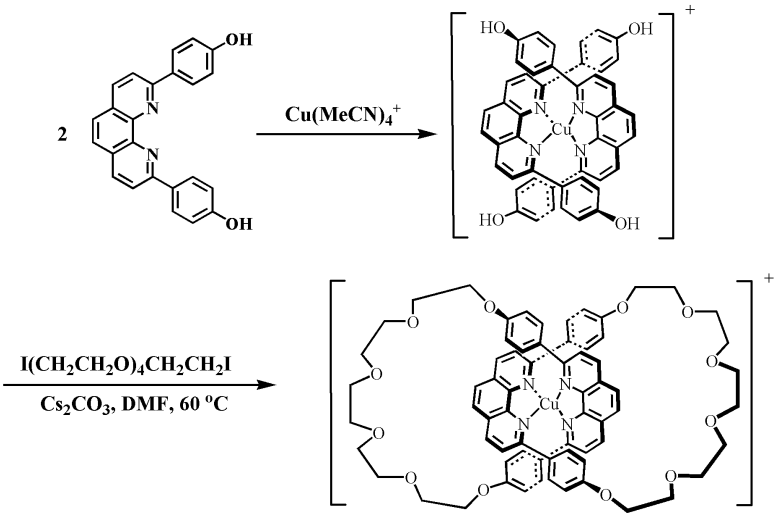
IIT Kanpur

Week - 04

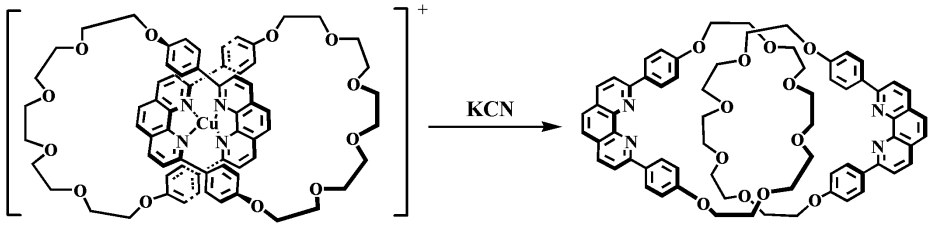
Lecture - 17

In my previous lecture, we showed how to make catenanes using metal ions as template. We used Cu^{+} ion as a template. What will happen if we use a Ni^{2+} or a Zn^{2+}ion as a template? tetrahedral, it has a tendency to Ni^{2+} forms square planar structure with four nitrogen atoms that are strong donors. Zn^{2+} although forms tetrahedral coordination geometry, it tends to form great than four coordination. But Cu^{+} always favour four coordinate tetrahedral complex.

Therefore, when you make these compounds like catenanes, you have to have knowledge of coordination chemistry also and properties of different metal ions. So, looking at this, we came to the conclusion that we will take a first row transition metal ion and that is preferably Cu^{+} because it will become tetrahedral and that is what we want. Once this compound is formed, we will do molecular mechanics. So, molecular mechanics calculation we can get optimum structure of this and as soon as we get optimum structure of this particular compound, we know the distance between these oxygens.

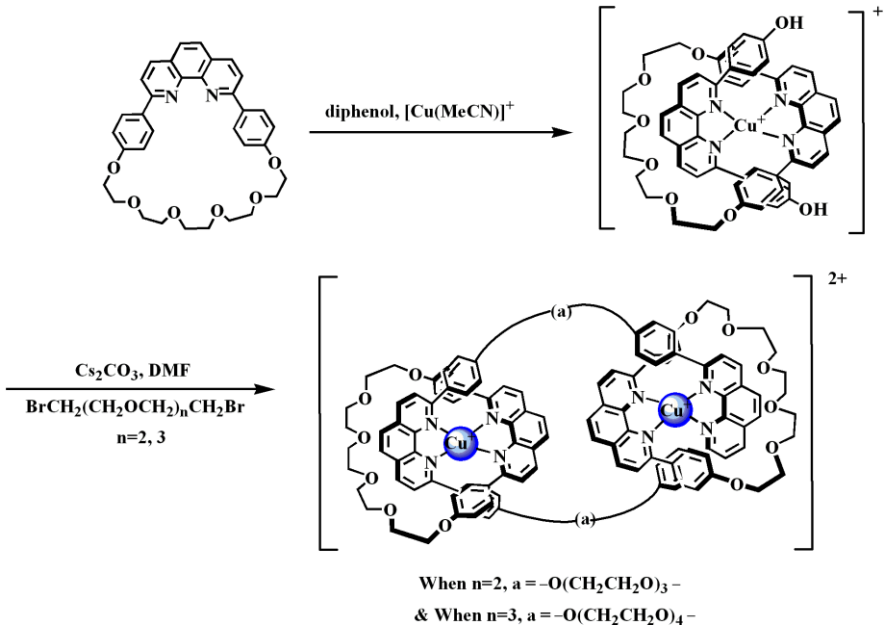


So, if we now reacted with potassium cyanide excess, potassium cyanide excess will take out copper one. It will take out copper one and I am ended with the desired [2]-catenane.



Now, my question to you would be at this point what will happen to this? Why the phenanthroline moieties are far from each other? They are far because of steric reasons and so all ethereal oxygens are in the middle. So, remember crown ether likes to bind to alkali metal or alkaline earth metal ions. So, if I give an alkali metal ion, it will bind in the middle. But if I add a transition metal ion specially copper or nickel, then the two phenthroline units will be dragged in to bind the transition metal. So, the two macrocycles move depending upon the situation.

Now we can find out how to make [3]-catenate.



So, I stop here today. We will now see can we synthesize catenane without the use of metal ions and that is what will be our aim in the next class. Thank you very much.