

5. Conclusion

In this work, the complexes of Cu(I) halides with *N*-phenylthiourea ligand have been synthesized. These complexes are obtained from direct interaction of ligand with copper(I) halides by mole ratio variation in suitable solvent. The system was heated about 60°C and stirred for 4 h. Then, the structures were identified from infrared spectroscopy and single crystal X-ray diffraction techniques. The structures have shown to have tetrahedral copper(I) geometry coordinated through sulfur atom from ligand in all complexes. These complexes are

1. $[\text{Cu}(\text{ptu})_4]\text{Cl}$, the structure of compound is monomeric distorted tetrahedral which consists of a $[\text{Cu}(\text{ptu})_4]^+$ cation and a Cl^- anion in molecule. Copper atom is coordinated tetrahedrally by four sulfur atoms. The monomeric structure $[\text{Cu}(\text{ptu})_4]\text{Cl}$ crystallized in a tetragonal system, space group $I\bar{4}$.
2. $[\text{Cu}_4(\text{ptu})_6\text{Br}_4]$, the structure consists of two independent $[\text{Cu}_4(\text{ptu})_6\text{Br}_4]$ units, the spacegroup is $P\bar{1}$. Each Cu atom is coordinated tetrahedrally by three S atoms and a Br. The overall complex has an adamantane-type cluster structure with S atom from *N*-phenylthiourea as bridging and Br as terminal ligands.
3. $[\text{Cu}_4(\text{ptu})_6\text{I}_4]$, the structure consists of two independent $[\text{Cu}_4(\text{ptu})_6\text{I}_4]$ units, the symmetry is $P\bar{1}$. Each Cu atom is coordinated tetrahedrally by three S atoms and I. The overall complex has an adamantane-type cluster structure with S atom from *N*-phenylthiourea as bridging and I as terminal ligands.

Reactions between copper(I) halides and thiourea(tu) or substituted thioureas frequently generate a variety of complexes which have unpredictable stoichiometry and stereochemistry. In the future, we hope that the studies of Cu(I) and substituted thiourea complexes and other complexes which ligand contains sulfur donor-atom by single crystal X-ray diffraction have been increased. This research is the database of complexes which made up from Cu – S coordinated bonds which may be useful in solid state applications.