

X-Ray Diffraction Studies of Copper (II) Complexes

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Abstract: XRD of six biologically important copper (II) complexes having urea as a primary ligand and sulphate, nitrate, acetate and chloride as secondary ligands have been studied using Bruker D8 Advance diffractometer at IUC, Indore. The synthesized metal complexes were characterized by XRD measurements in order to elucidate their geometry. The data obtained has been preceding using XRD data analysis program Origin 6.0 Professional. From the experimental measurements, various parameters, e.g., particle size, lattice parameter have been estimated. The XRD analysis revealed the crystalline nature of all the complexes.

KEYWORDS: XRD, Copper Complexes, Urea

I. Introduction

Urea is physiologically very important. It is the chief nitrogenous product of protein metabolism. Urea is used for preparing formaldehyde-Urea resin (plastics)[6], barbiturates [7], and fertilizers [8-11]. Urea is also extensively used in the paper industry to soften cellulose and has been used to promote healing in infected wounds and many other applications in the field of medicine [12-14].

Recently, urea is used for the manufacture of hydrazine in which urea is treated with alkaline sodium hypochlorite.[7]. Urea is used in active dyeing [15] which has an effect on the formation and cleavage of covalent bond between the reactive dye and cellulose. Complexes of urea with some metal ions are used as fertilizers [16-19]. Complexes of urea with zinc sulphate and nitrate, $[Zn(CON_2H_4)_6]SO_4 \cdot H_2O$ & $Zn(CON_2H_4)_4(NO_3)_2 \cdot 2H_2O$ have very important application in this field [20]. These complexes were found to increase the yield of rice more than a dry mixture of urea-zinc salt does. Calcium nitrate-urea complex, $[Ca(Urea)_4](NO_3)_2$, [21,22] was used also as an adduct fertilizer. Some metal-urea complexes have pharmaceutical application, e.g., the platinum-urea complex which is used as antitumor [23].

Recently, urea represents not only an important molecule in biology [24] but also an important raw material in chemical industry [25]. The synthesis and characterization of urea based complexes have been studied and reported [7]. We reported here XRD analysis of some selected copper (II) complexes of carboxylates with urea.

II. MATERIAL

All chemicals used in this study were obtained from

Qualikem Company. Urea was received from Rankem Company. All chemicals were of analytical grade and they were used without purification.

III. Preparation of Copper (II) Carboxylates With Urea Complexes

The compound was prepared using the following general method as reported earlier [2]. Benzoic acid (5g, 0.0206 moles) was dissolved in 50ml of 2M NaOH and stirred with a magnetic stirrer. Metal salt (1.6g, 0.0100 moles) dissolved in 10ml of water was added dropwise to the solution and stirred for 30 minutes. The resulting solution was filtered through a buchner funnel using a suction pump and washed with ethanol. The precipitate was light blue in colour (0.32g). 30ml of water was added to the precipitate formed (0.32g) and it was stirred using a magnetic stirrer. Urea (0.0628g, 0.0010 moles) was diluted with 10ml of water and added to the solution being stirred dropwisely. The resulting solution was stirred for 30 minutes and filtered to dryness through suction. The precipitate (complex) was weighed and dried over KOH. The colour of the complex is light blue.

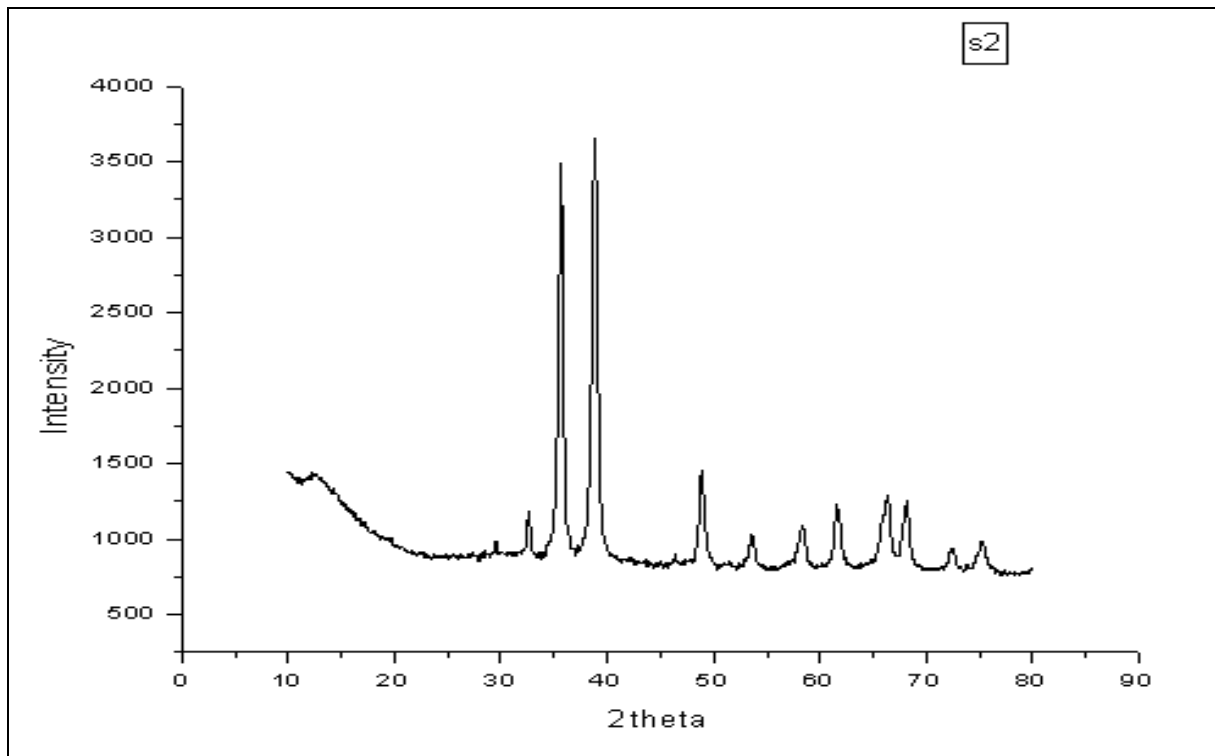
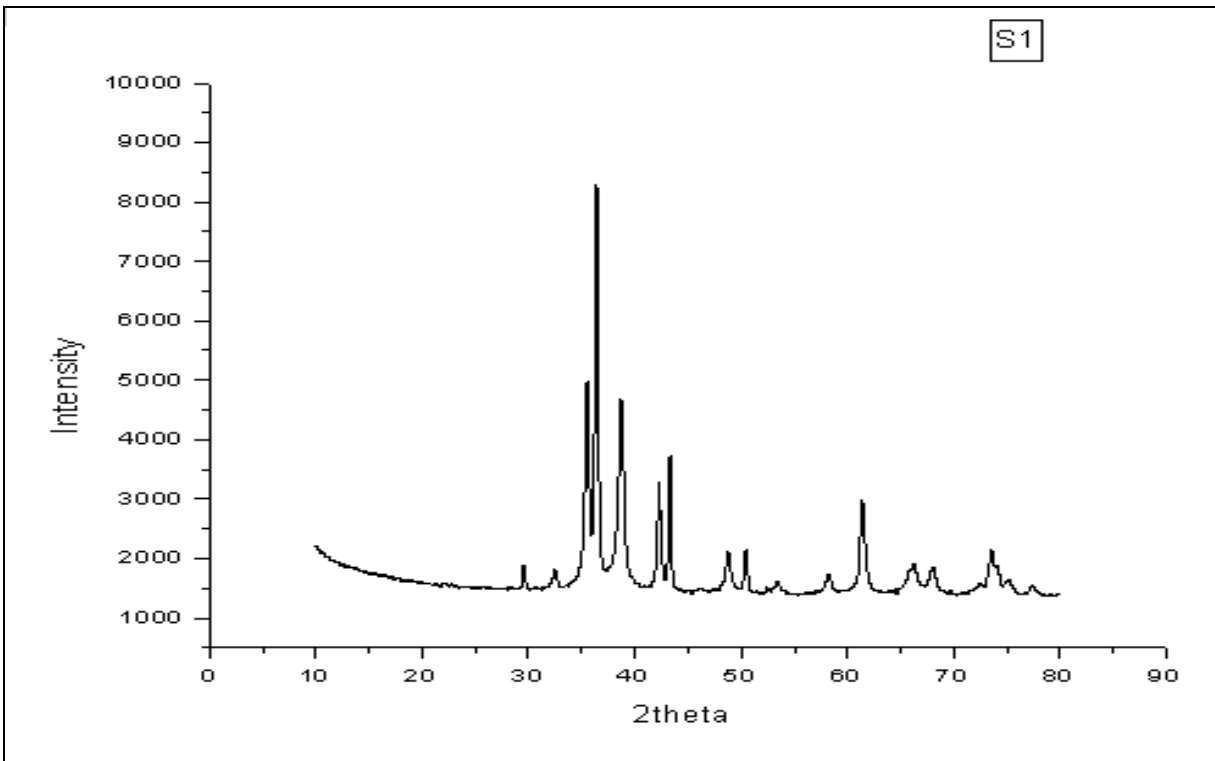
IV. Experimental

All complexes are prepared by chemical root method. X-ray diffraction pattern have been recorded by Bruker D8 advance diffract meter at IUC, Indore

V. Results and Discussion

XRD pattern is shown in fig 2. The XRD pattern is indicative of their crystalline in nature which is confirmed by 5 main peaks positioned. Lattice parameter $a(\text{\AA})$, is found to be in range of 4.22 to 4.25 \AA . The X-ray analysis reveals that the sample is cubic in phase as seen from the presence of extra peaks in XRD pattern. The average lattice parameter and particle size have been determined by the formula $A^2 = \lambda^2 * h^2 + k^2 + l^2 / 4 * \sin^2 \theta$ and $t = 0.9 \lambda / B \cos \theta$.

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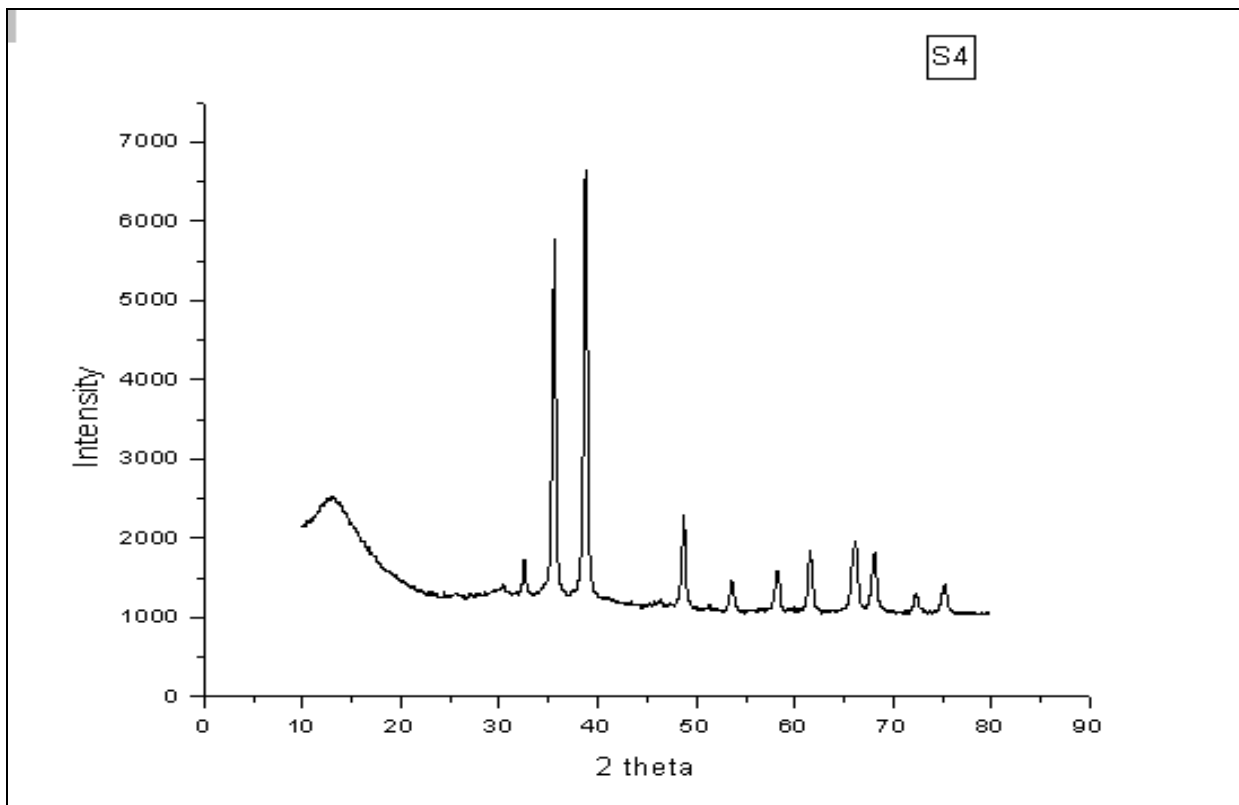
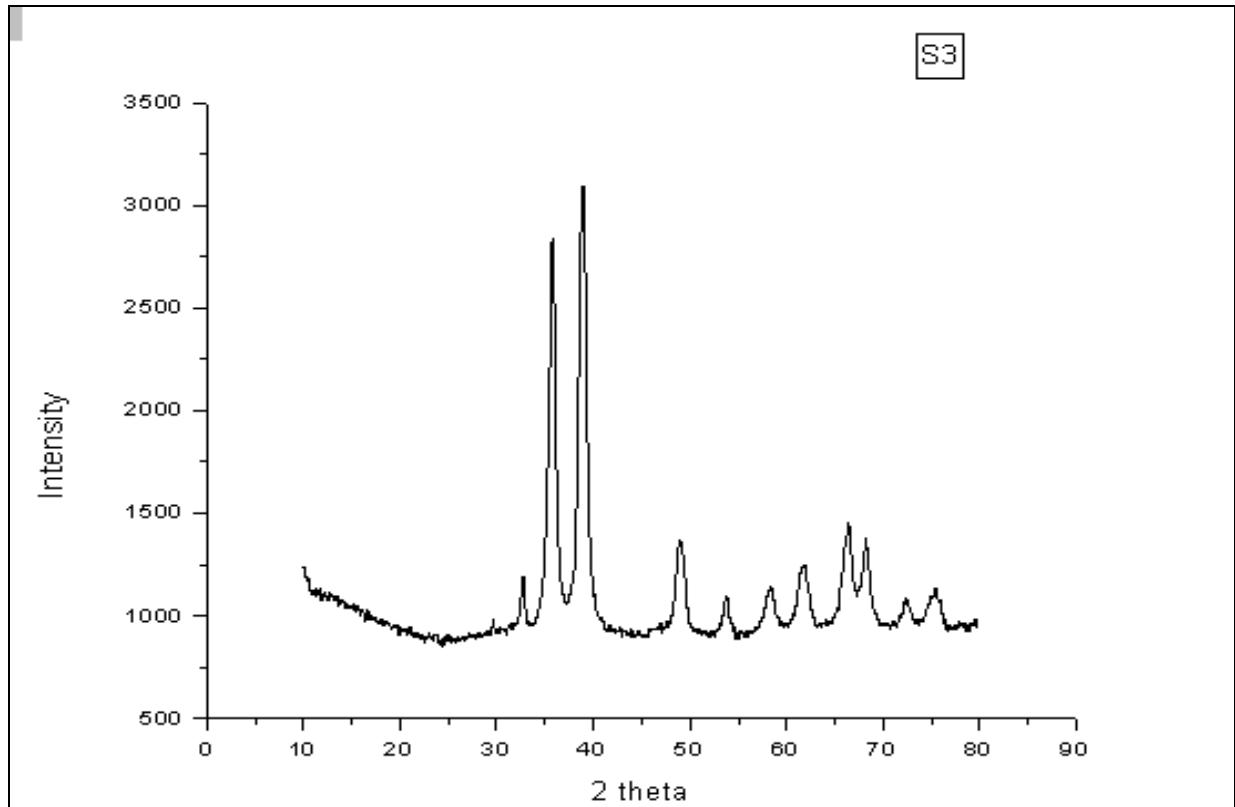


Fig 1. XRD Spectra of Urea Complexes.

Table-1 for lattice parameter and particle size

Complexes	Lattice parameter (Å)	Particle size (nm)
[Cu(CON ₂ H ₄) ₆]Cl.H ₂ O	4.22	0.453
[Cu(CON ₂ H ₄) ₆]NO ₃ .H ₂ O	4.19	0.293
[Cu(CON ₂ H ₄) ₆]SO ₄ .H ₂ O	4.16	0.205
[Cu(CON ₂ H ₄) ₆]CH ₃ COO.H ₂ O	4.25	0.407

VI. Conclusion

XRD studies reveals that the Complexes are crystalline in nature and lattice parameter and particle size is also show that Cu (II) Complexes cubic in nature. All the peaks match with the soft ware JCPDF.

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