

## Spectrophotometric Determination Of Copper (II) With Schiff Base Derived From 3,4,5 Trimethoxy Benzaldehyde And 2-Amino -6-Methyl Pyridine By Preliminary Adsorption On Polyurethane Foam

Dr. Sunita Tandon

Associate Professor Department of Chemistry  
RR College, Alwar(Rajasthan)

**Abstract:** Spectrophotometric determination of trace amount of Copper (II) after adsorption of its complex with the Schiff base derived from 3,4,5 trimethoxy benzaldehyde and 2-Amino -6-methyl pyridine is described. Copper (II) formed a stable, water insoluble complex with the above Schiff base. This complex was adsorbed on polyurethane foam and was eluted from foam by two portions of 2.5 ml chloroform. The absorbance of the solution measured at 455 nm. Absorbance obeyed Beer's law over the concentration range 10-130  $\mu\text{g}$  of Copper (II) in 5ml chloroform. The molar absorptivity was found to be  $1.3243 \times 10^4 \text{ mol}^{-1} \text{ cm}^{-1}$  at 455 nm and sensitivity being  $1.78 \times 10^{-2} \mu\text{g cm}^{-2}$  of Cu (II) for absorbance of 0.001.

The optimum conditions of the present study were investigated by examining parameters viz. PH, reagent concentration, number of polyurethane foam pieces used shaking time and diverse ions effect of measurements.

Cu (II) causes water pollution and the permissible limit of Cu (II) in drinking water is 1.0  $\mu\text{g/ml}$ . Metal plating, industrial and domestic wastes, mining and mineral leaching are the chief sources of copper pollution in water. It is highly toxic to algae and lower group of plants at moderate levels. *Salvinia natans* L., an aquatic plant was a good accumulator of Cu (II), it survives in surface water for 24 hours even at concentration of Cu (II) as high as 100  $\mu\text{g ml}^{-1}$  of the metal<sup>7</sup>.

Mahapatra et al<sup>8</sup> synthesized Schiff base from furfuraldehyde and 4-amino-2, 3, dimethyl-1-phenyl pyrazole-5-5- one and characterized its Cu (II) complex.

Shukla et al<sup>9</sup> synthesized Cu (II) Complex with Schiff bases derived from 2-pyrrolidone and aromatic amines. Similarly, Cu (II) complex with Schiff base of Salicylaldehyde, Aminophenol's and Anthranilic acids was synthesized by Shukla and Singh<sup>10</sup>.

Thakar and Thaker<sup>11</sup> prepared mixed ligand complexes of Cu (II) derived from Salicylaldehyde with N-Substituted ethylenediamine.

Many spectrophotometric reagents have been reported for the micro-determination of Copper (II)<sup>12</sup>.

"Solid-Liquid Extraction" method using microcrystalline naphthalene has been used for a long time for adsorption and separation, but we have, used technique of Hamon using polyurethane foam pieces as adsorbent. Cu (II) was determined, by measuring absorbance at 455nm of the complex, which is extracted from foam with chloroform.

### Experimental:

A Standard stock solution of Copper (II) 1000ppm was prepared by dissolving requisite amount of hydrated Copper Sulphate in distilled water. Solutions of different concentrations were prepared from this stock solution, after dilution.

### Reagent Solution:

Reagent solution was prepared by dissolving 0.2 gm. Schiff base derived from 3, 4, 5 trimethoxy benzaldehyde and 2-Amino-6-methyl pyridine, in 100 ml ethanol.

### Procedure:

To an aliquot (1ml) of standard stock solution containing 20-110  $\mu\text{g}$  of Copper (II), in a clean dry beaker 2.0 ml of 0.2% reagent solution was added. The pH of solution was adjusted to 5.0 by adding 3.5 ml of acetate buffer solution. The volume of solution was made 10 ml. All the contents were allowed to stand for 2 minutes for complete development of colour. Now already prepared five foam pieces were added. The flask was stoppered and shaken for sixty seconds to

allow the metal complex to be adsorbed on the foam. Polyurethane foam pieces were squeezed by plungers during the shaking time. The complex was eluted from foam by squeezing with two portions of 2.5 ml chloroform. 2.0 gm. anhydrous sodium sulphate was added to remove traces of water. Absorbance was measured in a one cm cell in the wave length region 380-540 nm. Calibration curve was constructed under similar conditions.

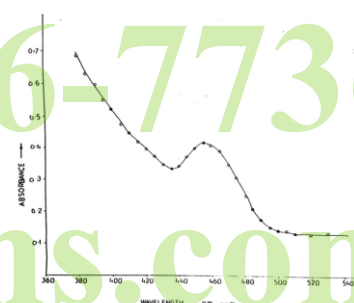


FIG-4(A) ABSORPTION SPECTRA OF COPPER COMPLEX  
COPPER - (II) : 75  $\mu\text{g}$   
pH : 5.0  
0.2% REAGENT SOLUTION : 2.0 ml  
POLYURETHANE FOAM : 5 PIECES

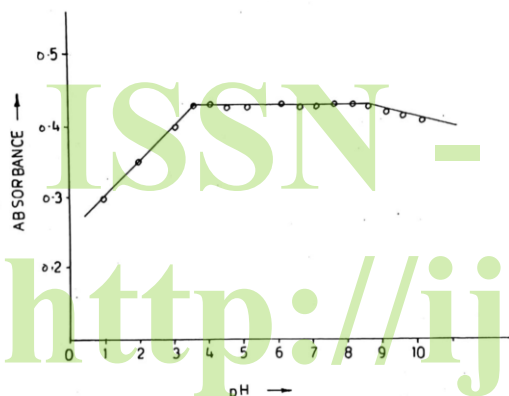


FIG-41(A) EFFECT OF pH

COPPER (II) : 75  $\mu$ g  
 WAVELENGTH : 455 nm  
 0.2% REAGENT SOLUTION : 2.0 ml  
 POLYURETHANE FOAM : 5 PIECES

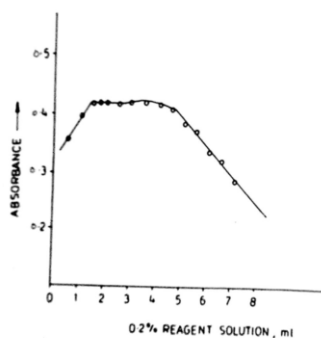


FIG-42(A) EFFECT OF REAGENT CONCENTRATION

COPPER (II) : 75  $\mu$ g  
 WAVELENGTH : 455 nm  
 pH : 5.0  
 POLYURETHANE FOAM : 5 PIECES

other conditions constant. Results are given in Fig. 4.2 (A), Table 4.2 (A). Absorbance Increased up to 1.5 ml then achieved a maximum constant value over range 1.8 to 4.0 ml. Therefore, 2.0 ml of 0.2% reagent was added for all absorbance measurements.

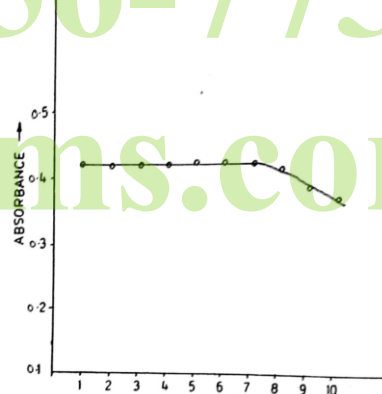


FIG-43(A) EFFECT OF ADSORBENT

COPPER (II) : 75  $\mu$ g  
 WAVELENGTH : 455 nm  
 pH : 5.0  
 0.2% REAGENT SOLUTION : 2.0 ml  
 POLYURETHANE FOAM : 5 PIECES  
 SHAKING TIME : 60 Sec

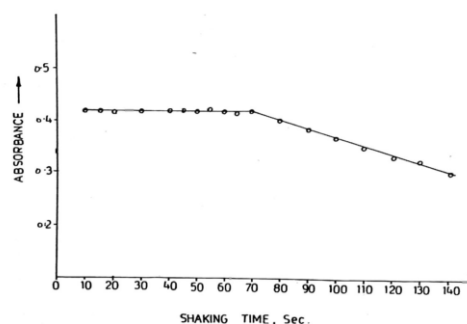


FIG-44(A) EFFECT OF SHAKING TIME

WAVELENGTH : 455 nm  
 pH : 5.0  
 0.2% REAGENT SOLUTION : 2.0 ml  
 POLYURETHANE FOAM : 5 PIECES

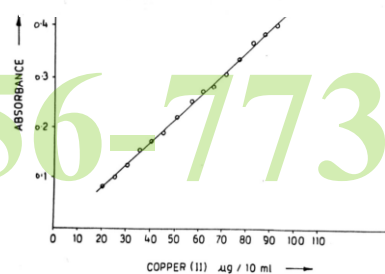


FIG-45(A) CALIBRATION CURVE FOR COPPER

WAVELENGTH : 455 nm  
 pH : 5.0  
 0.2% REAGENT SOLUTION : 2.0 ml  
 POLYURETHANE FOAM : 5 PIECES

## Results and Discussion

### Absorption Spectra:

A sample solution of Copper (II) containing 75  $\mu$ g of Copper (II), 2.0 ml of 0.2% reagent solution and 3.5ml of acetate buffer solution was mixed to adjust the pH of solution at 5.0. The Copper (II) complex formed was adsorbed on prepared five polyurethane foam pieces with frequent squeezing. The complex was then eluted and absorbance was measured in the range 380-540 nm of wave length. Results have been shown in Fig. 4.0 (A). The curve of complex has maxima at 455nm so this wave length was chosen for absorbance measurements.

### Effect of pH :

In order to study this effect absorbance of Copper (II) solution containing 75  $\mu$ g of Cu (II) was measured at 455nm in the pH range 1-10. The results are shown in Fig. 4.1(A), Table 4.1(A). Accordingly the absorbance first increases with pH, attains maximum constant value in the range 3.5 to 9.0. Therefore, pH of solution was adjusted to 5.0 for all absorbance measurements.

### Effect of Reagent Solution:

The amount of reagent solution varied maintaining the

**Effect of Adsorbent:**

In this effect number of polyurethane foam pieces were varied. Here complex was adsorbed on varying number of foam pieces and absorbance of complex eluted from them was observed. It is maximum and almost constant Initially up to seven then decreases slightly, hence a number of five was fixed for all studies. Results are shown in Fig. 4.4(A), Table 4.4 (A).

**Calibration Curve for Copper (II):**

With the optimum conditions described above, the calibration curve for Cu (II) was constructed at wave length 455 nm. The linearity was tested over the concentration range 20-110  $\mu\text{g}$  of Cu (II) present. Results are shown in Fig. 4.5(A), Table 4.5(A). The molar absorptivity was found to be  $1.3243 \times 10^4 \text{ mol}^{-1} \text{ cm}^{-1}$  at 455 nm and sensitivity being  $1.78 \times 10^{-2} \mu\text{g cm}^{-2}$  of Cu (II) for absorbance of 0.001.

**Effect of Diverse ions:**

The interference due to various diverse alkali metal salts and diverse metal ions was examined. The possible interference, due to their presence has been shown in Tables 4.6(A) and 4.7(A).

**Precision:**

Precision of the proposed method was estimated with ten samples of copper (II) complex solutions containing 75  $\mu\text{g}$  of Copper, which provided a mean absorbance of 0.421 which a standard deviation of 0.22%.

Table 4.1 (A) : Effect of pH

pH	Absorbance at 455 nm
1.0	0.300
2.0	0.350
3.0	0.400
3.5	0.426
4.0	0.426
4.5	0.425
5.0	0.425
5.5	0.427
6.0	0.425
6.5	0.425
7.0	0.426
7.5	0.426
8.0	0.426
8.5	0.424
9.0	0.405
9.5	0.410
10.0	0.405

Cu (II) : 75 $\mu\text{g}$ ,  
0.03% Reagent. 2.0 ml,  
Polyurethane Foam : 5 Pieces,  
Shaking Time : 60 Sec.

Table 4.2 (A) : Effect of Reagent Concentration.

0.2 % Reagent M.I.	Absorbance at 455 nm
0.5	0.360
1.0	0.390
1.5	0.420
1.8	0.420
2.0	0.420
2.5	0.415
3.0	0.420
3.5	0.425
4.0	0.420
4.5	0.415
5.0	0.390
5.5	0.375
6.0	0.349
6.5	0.325
7.0	0.290

Cu (II) : 75 $\mu\text{g}$ ,  
pH : 5.0  
Polyurethane Foam : 5 Pieces,  
Shaking Time : 60 Sec.

Table 4.3 (A) : Effect of Adsorbent.

No. of Polyurethane Foam Pieces Used	Absorbance at 455 nm
1	0.421
2	0.420
3	0.420
4	0.422
5	0.430
6	0.430
7	0.425
8	0.420
9	0.398
10	0.375

Cu (II) : 75 $\mu\text{g}$ ,  
pH : 5.0  
0.2% Reagent : 2.0 ml,  
Shaking Time : 60 Sec.

Table 4.4 (A) : Effect of Shaking Time.

Shaking Time (Seconds)	Absorbance at 455 nm
10	0.424
15	0.424
20	0.415
30	0.420
40	0.422
45	0.422
50	0.422
55	0.423
60	0.420
65	0.420
70	0.420
80	0.400
90	0.385
100	0.370
110	0.350
120	0.325
130	0.325
140	0.300

Cu (II) : 75ug,

pH : 5.0

0.2% Reagent : 2.0 ml,

Shaking Time : 60 Seconds

Table 4.5 (A) : Calibration Data for Cu (II)

Cu (II) Concentration (ug)	Absorbance at 455 nm
20	0.085
25	0.100
30	0.125
35	0.160
40	0.175
45	0.190
50	0.225
55	0.260
60	0.275
65	0.280
70	0.315
75	0.340
80	0.375
85	0.365
90	0.400
95	0.435
100	0.450
105	0.480
110	0.500

pH : 5.0,

0.2% Reagent : 2.0 ml,

Polyurethane Foam : 5 Pieces,

Shaking Time : 60 Sec.

Table 4.6 (A) : Effect of Diverse Alkali Metals.

Alkali Metal Salts	Amount Added (mg)	Cu (II) Found (ug)
KCl	50	74.4
	100	74.2
K <sub>2</sub> SO <sub>4</sub>	40	72.3
	100	72.0
Na <sub>2</sub> SO <sub>4</sub>	30	75.8
	100	75.2
KNO <sub>3</sub>	50	73.9
	200	74.1
NaNO <sub>3</sub>	50	76.2
	150	75.8
Na <sub>2</sub> CO <sub>3</sub>	40	76.3
	100	74.8
Na <sub>2</sub> HPO <sub>4</sub>	50	74.1
	100	74.8
Sodium Oxalate	50	74.9
	300	74.6

Cu (II) : 75 ug,

pH : 5.0,

0.2% Reagent : 2.0ml,

Polyurethane Foam : 5 Pieces,

Shaking Time : 60 Sec.

Table 4.7 (A) : Effect of Diverse Metals Ions.

Diverse Metal Ions	Amount Added (mg)	Cu (II) Found (ug)
Co (II)	50	74.9
	100	74.3
Cd (II)	50	75.0
	100	75.3
Ca (II)	40	74.2
	100	73.9
Pb (II)	40	74.4
	150	73.3
Ni (II)	50	73.9
	100	74.1
Mn (II)	50	73.9
	100	73.6
Sn (II)	50	75.0
	100	74.8
Bi (III)	30	73.8
	80	73.2
Fe (III)	40	74.8
	150	74.6
Cr (III)	50	74.1
	100	73.9
Mo (VI)	50	74.2
	200	74.8

Cu (II) : 75 ug,

pH : 5.0,

0.2% Reagent : 2.0ml,

Polyurethane Foam : 5 Pieces,

Shaking Time : 60 Sec.

REF



## References:

1. R.N. Hole, G.N. Everett Jr. and A. Chakaraworthy; Prog. Inorg. Chem. 7, 83 (1966)
2. L. Sacconi; Coord. Chem. Rev. 1, 126 (1966)
3. S. Yamada; Coord. Chem. Rev. 1, 415 (1966).
4. R.A. Mashelkar; J. Ind. Chem. Soc. 63, 149 (1986).
5. U. Gupta, C. Chopra and A.L.J. Reo; Chem. Environ. Res. 1, 67 (1992).
6. A. S. K. Sen and N. G. Mondal; Chem. Environ. Res. 1, 2 (1992).
7. A. K. Sen and N. G. Mondal; Water, Air and Soil Pollut. 1, 49 (1990).
8. Bipin Mahapatra, D. Ponda, Dilip Kr. Das, B. K. Patel and S. C. Chaudhary; J. Ind. Chem. Soc. 65, 661 (1988).
9. P. R. Shukla, Jayant Bhargava; J. Ind. Chem. Soc. 60, 128 (1983).
10. P. R. Shukla, V. K. Singh and A. M. Jaiswal; J. Ind. Chem. Soc. 60, 321 (1983)
11. B. T. Thakar and Purnima Thaker; J. of Institute of Chemists, 56, (1984)

ISSN - 2456-7736

<http://ijircms.com/>

ISSN - 2456-7736  
<http://ijircms.com/>