

# Spectrophotometric complexation study of $Pb^{2+}$ metal ion with $\beta$ -naphthol Azo dye

**Mr. Sagar Narayan Dakhane\***

*Assistant Professor, MES Abasaheb Garware College, Pune-04 Affiliated to Savitribai pune university Pune Maharashtra, India*

*Email id: sagarsnd@gmail.com*

**Abstract** - In present study  $\beta$ - naphthol azo dye is used to complexation study with  $Pb^{2+}$  metal ions  $\beta$ -naphthol Azo dye-based ligand have been well established for complexation of metal ions. The UV-Visible study of ligand and its complex and effect of pH on complexation study have been established. IR spectra provide the complexing nature between the metal and ligand.

## 1. INTRODUCTION

Owing to importance of dyes, azo dyes play key role in number of studies [1,3]. Azo dyes are the important class and widely used for scientific research, they are the colored and used as pigments [4-6]. Metal chelates of azo dyes ligands are used for dyeing the nylon, wool and silks lead to higher fastness for washing and light [7] Azo dye metal chelate has lot importance due to their electronic and geometrical features. In the present work,  $\beta$ - naphthol azo dye with metallic ion  $Pb^{2+}$  complex was synthesized and characterized by IR

## 2. EXPERIMENTAL

### 2.1 Material and methods:

All chemicals were from Fluka ,and B.D.H with high purity .Melting points of ligand and it's complexes were determined on a Stuart capillary point apparatus.  $^1H$ -NMR and  $^{13}C$ -NMR of ligand recorded by using Burker Ultra Shield (100MHz)

UV-Vis spectra were recorded on a (Bioera Single beam UV-Visible Spectrophotometer. The FT-IR spectra were obtained using IR spectrometer of Shimadzu make, with samples prepared as KBr discs.

### 2.2 Synthesis of azo dye

The azo ligand ( 2-hydroxy-5-((2- hydroxynaphthalen-1-yl) diazenyl) benzoic acid scheme (1), was prepared by dissolving the amine ( 5-amino salicylic acid)(0.01 mol) in mixture of 3 ml HCl Conc. and 25 ml absolute ethanol and stirred for (15) min.in ice bath then ice cold solution of  $NaNO_2$  (10 %) 25 ml was add drop wise on a period of (30) min , the solution become a brown , then add drop wise to another ice cooled solution of 2- naphthole (0.01

mole) in 25 ml of alkaline ethanol , with continuous stirring at  $0-5^\circ C$  , and left over night . The mixture was natural with dilute hydrochloric acid and ammonia solution until (pH=7).The solid product was filtered , washed with cold distilled water ,and dried.

### 2.3 Synthesis of complex:

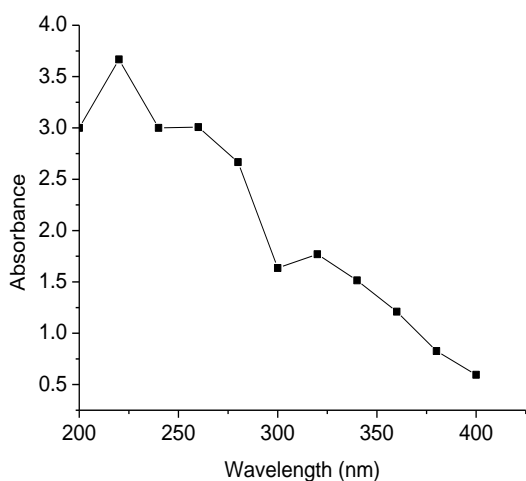
In a 20ml an ethanol solution added 0.5g of azo dye and salt of  $PbNO_3$  0.44gm were dissolved. in 1:1 molar ratio. This reacting mixture was stirred for a while and mixture was heated under reflux for three hours, during this period, the precipitation was completed from, and collected by filtration, then washed with ethanol, and dried under vacuum for 4 hours. The complex was characterized by IR spectra.

## 3. RESULT AND DISCUSSION

### 3.1 UV-Visible Study of azo dye:

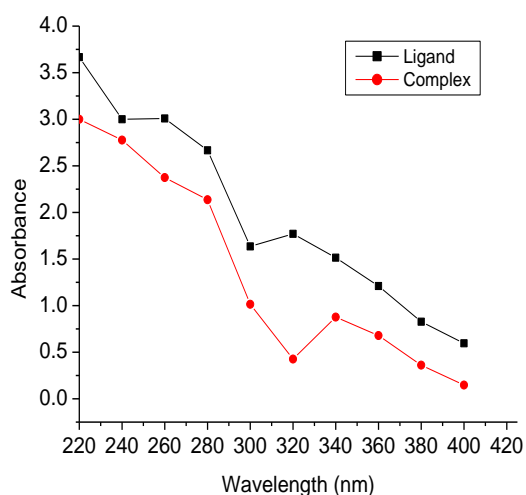
The UV-Visible study of azo dye was study by taking ( $5 \times 10^{-4}$  M) solution in ethanol. The Fig. 1 clearly indicates that the maximum absorption for azo dye is obtained at 340nm is due to the

$n-\pi^*$  transition. However the absorption decreases as the wavelength increases hence 340 nm was used for further study.



**Figure 1. UV-Visible Study of azo dye**

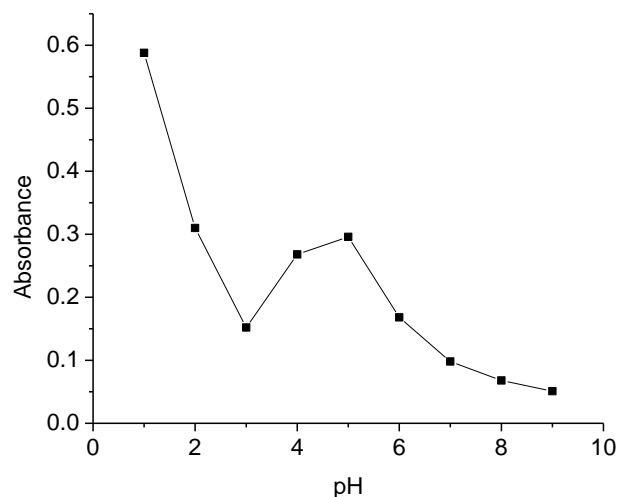
UV-Visible study of azo dye and  $Pb^{2+}$  was studied by ethanolic solution of the ligand ( $5 \times 10^{-4}$  M) and lead nitrate in water by adding some conc. nitric acid ( $5 \times 10^{-5}$  M). From the graph ( Fig.2 ) it was observed that the complex shows the maximum absorbance at 350 nm and decreasing the absorption intensity , which is due to  $n-\pi^*$  transition confirmed the complex formation.



**Figure 2. UV-Visible Study of azo dye and  $Pb^{2+}$  Complex**

### 3.2 Effect of pH:

The effect of pH on complexation has been studied for the dye and  $Pb^{2+}$  metal ion by varying the pH from 1 to 9. From the Fig.3 it is cleared that the effect of pH has pronounced effect on complex formation. As pH increases there is initially decreases absorption of complex upto pH 3. However further increase in pH the absorption intensity increases and at pH 5 there is sharp enhancement of absorption.



**Figure 3. Effect of pH on complex**

### 3.3 IR Study:

The IR study shows the possible mode of interaction between azo dye and  $Pb^{2+}$  metal ion. A strong band at  $3075\text{ cm}^{-1}$  which belongs to phenolic  $-OH$  group of azo dye which shifted to  $3046\text{ cm}^{-1}$  supports the complex formation. The band assigned for  $-N=N-$  were at  $1365\text{ cm}^{-1}$  which is shifted to  $1317\text{ cm}^{-1}$ . The stretching frequency attributed to  $C-N$  vibration decreases to  $1143\text{ cm}^{-1}$  in complex is shifted to  $1140\text{ cm}^{-1}$ .

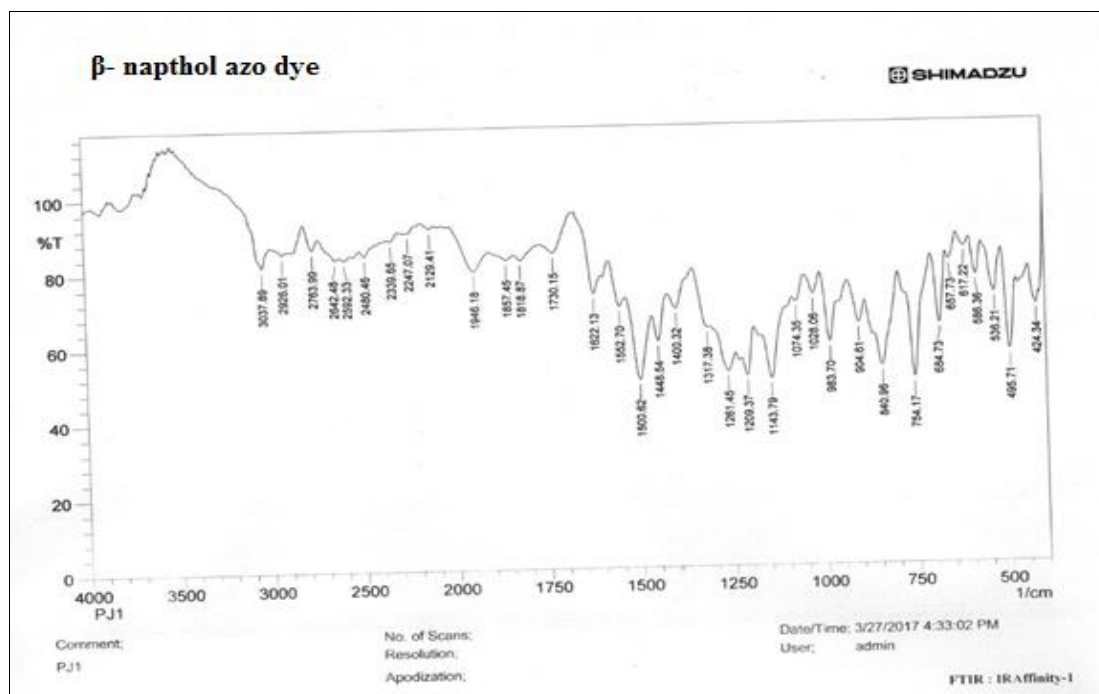


Figure 4. IR spectra of Azo dye

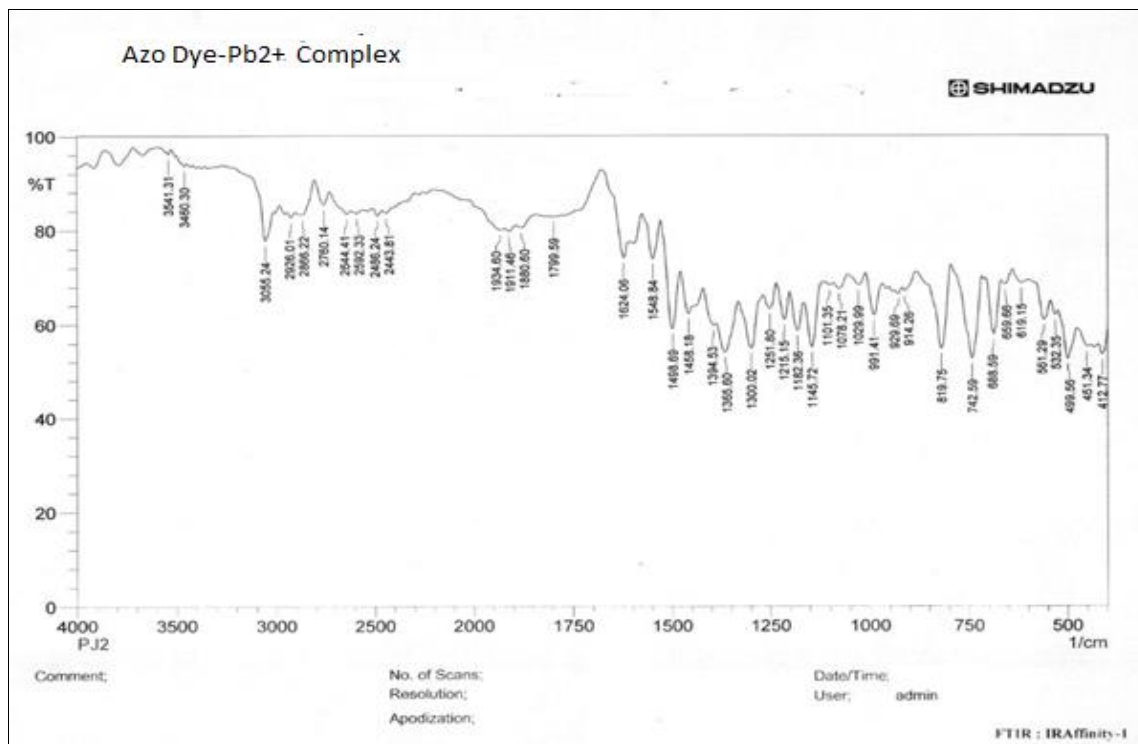


Figure 5. IR spectra of Complex

#### 4. CONCLUSION

In conclusion,  $\beta$ - naphthol azo dye has good complexing ability with the  $Pb^{2+}$  metal ions. Effect of pH influenced the complex formation. The decreasing stretching frequency in the IR shift values of  $-OH$  and  $-N=N-$  functional group of ligand confirmed the complexing nature.

#### 5. ACKNOWLEDGMENTS

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#### 6. CONFLICTS OF INTEREST

The authors declare that the article was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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