

Studies on Complexation of β -naphtholazo dye and Pb^{2+} metal ion Spectrophotometrically

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ABSTRACT

Complexing ability of Pb^{2+} metal ion with β -naphtholazo dye is established. The stoichiometry between M: L is 1:1 and effect of pH on complexation study have been established. IR spectra provide the complexing nature between the metal and ligand.

Keywords: Azo dye, Pb^{2+} metal ion, I.R. spectra.

I. INTRODUCTION

Azo dyes are an important class of organic compounds having at least a conjugated chromophore azo ($-N=N-$) group and the largest and most versatile class of dyes. Owing to its wide application in various fields it becomes research of interest. Azo dyes have number of uses such as dyeing of textile fiber and coloring of different materials, and biological-medical studies, for plastics, and advanced applications in organic synthesis [1-4]. Azo dyes consider significant analytical reagents for the micro-estimation of metal ions. Among the dyes azo dyes play vital role in the complexation studies and reported the number of commercial dyes [5-7]. In present paper we have studied the complexing ability of Pb^{2+} metal ion with azo dye. As Pb^{2+} metal have toxic effect on environment it is important to trace out the lead ion from various sources.

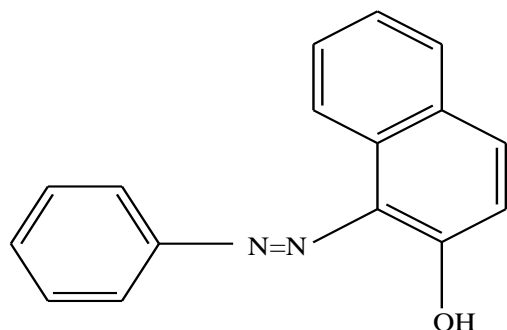


Fig.1. β -naphtholazo dye

II. EXPERIMENTAL

Instrumentation

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

Synthesis of complex:

The salt of PbNO_3 0.44gm were dissolved in 10ml of ethanol, and added 0.5g of azo dye to 20ml of ethanol solution, 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.

UV-Visible Study of ligand and its complex:

The complexation study of β -naphtholazo dye ($5 \times 10^{-5} \text{M}$) and Pb^{2+} ($5 \times 10^{-6} \text{M}$) metal was studied and it was observed (Fig.1) that the ligand shows the maximum absorbance at 240 nm, which is responsible for $\pi - \pi^*$. Upon addition of metal ion solution there is slight increase in absorbance suggest the complexation.

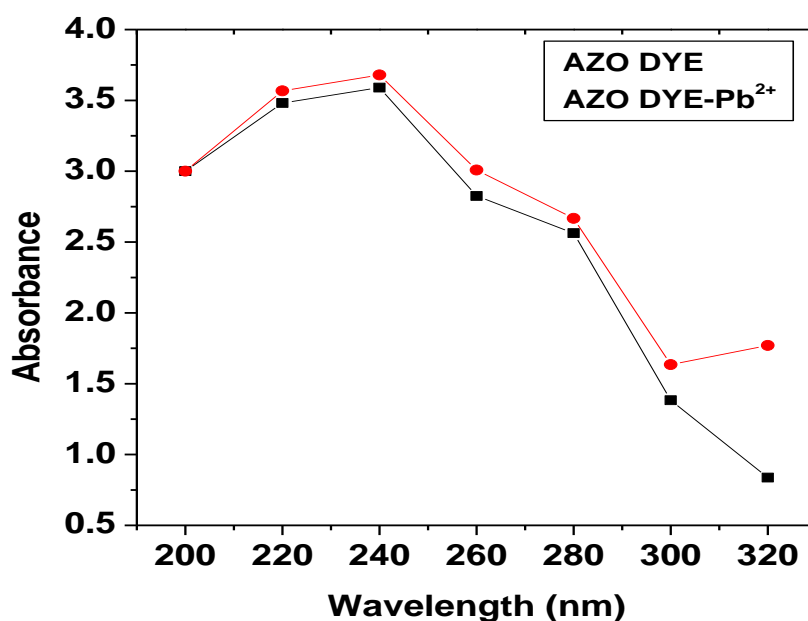


Fig. 2. UV-Visible Study of ligand and its complex

Effect of pH on Complexation:

The effect of pH on complexation has been studied for the dye and Pb^{2+} metal ion by varying the pH from 1 to 7. From the graph (Fig.3) it was observed that the effect of pH has pronounced effect on complex formation. As pH increases there is slight increase in absorption of complex at pH 5 there is sharp enhancement of absorption. Further increased in pH there is decreases the absorption of complex.

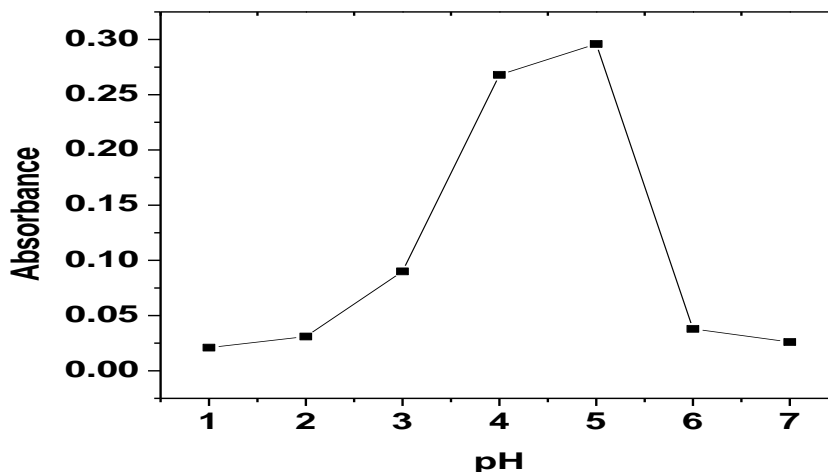


Fig.3.Effect of pH on Complexation

Stoichiometry of the Complex:

The Jobs method is used to determine the stoichiometry of Azo dye- Pb^{2+} complex. The solutions of azo dye and Pb^{2+} were mixed in different mole ratios keeping the sum of dye and metal ion concentration constant and the absorbance were measured at 240 nm of wavelength. The plot of absorbance versus mole fractions is shown in (Fig 4). The maximum absorption was observed for the mole ratio of 0.5, therefore it indicates the reaction stoichiometry between azo dye and Pb^{2+} is 1:1.

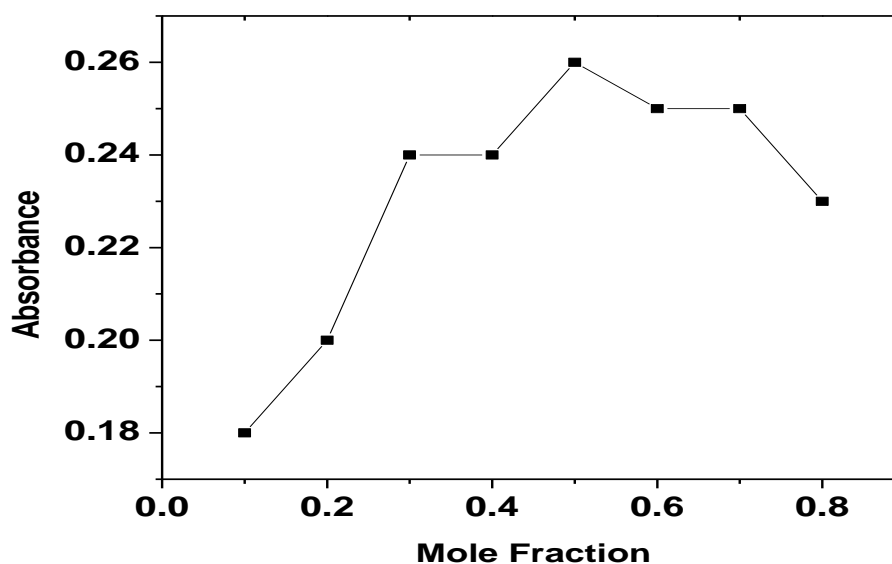


Fig.4. Stoichiometry of the complex

IR Study:

The IR spectroscopic analyses were studied and it helps to interpret the possible mode of interaction between azo dye and Pb^{2+} metal ion. A strong band at 3050 cm^{-1} which belongs to phenolic $-OH$ group of azo dye which

shifted to 3033cm^{-1} supports the complex formation. The band assigned for $-\text{N}=\text{N}-$ were at 1365cm^{-1} which is shifted to 1322cm^{-1} . The stretching frequency attributed to C-N vibration decreases to 1145cm^{-1} in complex is shifted to 1143cm^{-1} .

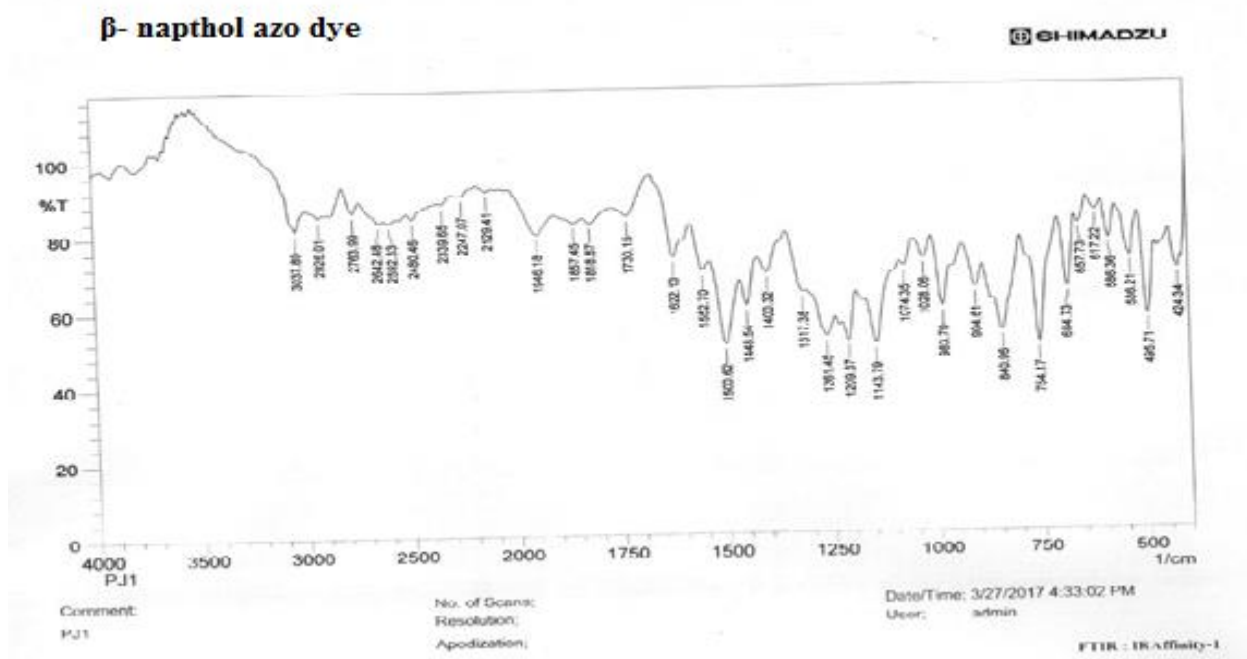


Fig. 5. (a) IR Spectra of β -naphtholazo dye

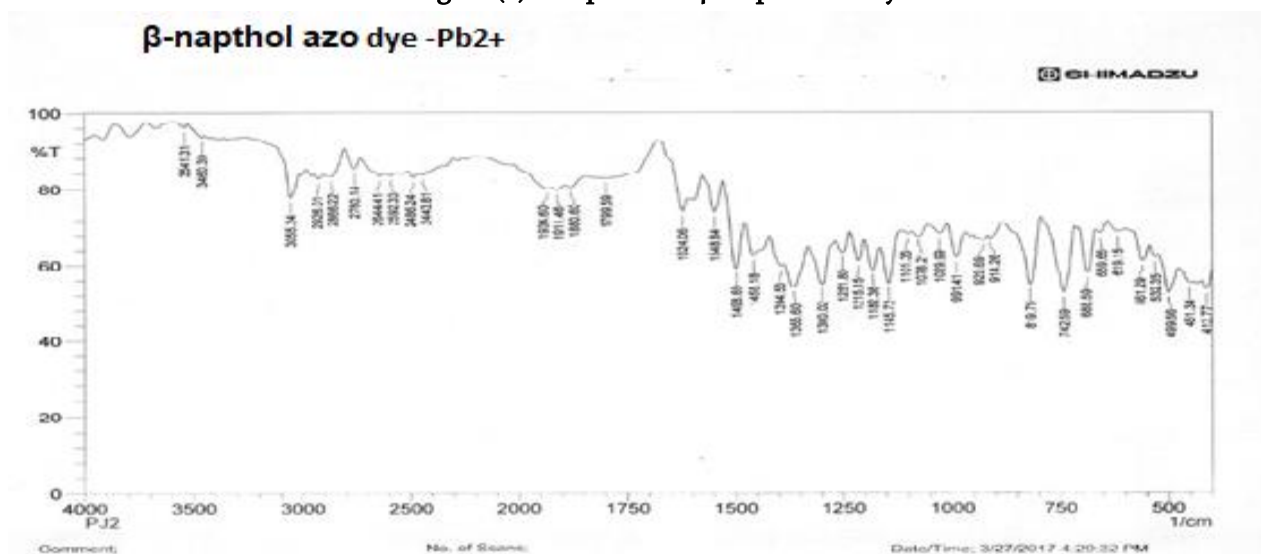


Fig.5.(b) IR spectra of Complex

III. CONCLUSION

In conclusion, We have reported the complexing ability of Pb^{2+} with β - naphtholazo dye. The stoichiometry between M:L found 1:1. Effect of pH influenced the complex formation and at pH-5 complex shows maximum absorbance. The decreasing stretching frequency in the IR shift values of $-\text{OH}$ and $-\text{N}=\text{N}-$ functional group of ligand confirmed the complexing nature.

IV. REFERENCES

- [1] . H. Song, K. Chen, D. Wu and H. Tian, *Dyes Pigments*, 60, 2004, 111.
- [2] . K. Tanaka, K. Matsuo, A. Nakanishi, M. Jo, H. Shiota, M. Yamaguchi, S. Yoshino and K. Kawaguchi, *Chem. Phar. Bull.*, 8, 1984, 3291.
- [3] . H. Hartman and M. Schulze, *Dyes Pigments*, 15, 1991, 255.
- [4] . A.T. Peters and E. Chisowa, *Dyes Pigments*, 22, 1993, 223.
- [5] . Eren T., Kose M., Kurtoglu N., Ceyhan G., McKee V. and Kurtoglu M., *Inorg. Chim. Acta*, 430, 2015, 268-279.
- [6] . Abdel-Ghani N.T., Mansour A. M., Abo El-Ghar M. F., El-Borady O. M. and Shorafa H., *Inorg. Chim. Acta*, 435, 2015, 187-193.
- [7] . Ferreira G.R., Marcial B.L., Garcia H.C., Faulstich F. R. L., Dos Santos H. F. and de Oliveira L F.C., *Supramol. Chem.*, 27(1-2), 2015, 13-20.