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Spectrophotometric Studies on Piroxicam-Cu(II) Complex

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Piroxicam has been found to form yellow coloured complex with Cu(II) in neutral medium, soluble in chloroform and absorbs maximum at 404 nm. Job's method gave the metal-to-ligand ratio as 1:2. The complex solution obeyed Beer's law within the range of 1.50 mcg to 20 mcg/mL of piroxicam added.

INTRODUCTION

Piroxicam (4-hydroxy-2-methyl-N (2-pyridyl)-2H-1, 2-benzothiazine-3-carboxamide-1,1-dioxide) is used as an effective analgesic and anti-inflammatory agent in rehumatoid arthritis and acute gout[1].

Different analytical methods like HPLC[2], colorimetry[3] and UV spectrophotometry[4] have been used for the estimation of piroxicam. However, no systematic studies on the complex formation of the drug seems to have been carried out. The present work, therefore, is aimed to study the interaction of piroxicam with bivalent copper ion spectrophotometrically in the visible range.

MATERIALS AND METHODS

A Shimadzu (model 160-A) UV-VIS spectrophotometer with matched glass cells of 1 cm path length was used for current studies.

Stock solutions of piroxicam (USP) in $CHCl_3$ and that of copper acetate in methanol, each of 2×10^{-3} M, were prepared which were then diluted to get the desired concentration. The solvents used were of spectroscopic grade.

Spectra of the complex

A set of following two solutions was prepared and their spectra were recorded from 350 nm to 500 nm (Fig. 1a and 1b).

(A) 2 mL of 5×10^{-4} M piroxicam + 3 mL $CHCl_3$

(B) 2 mL of 5×10^{-4} M piroxicam + 2 mL $CHCl_3$ +
1 mL of 5×10^{-4} M Cu(II)

The spectra of the complex was obtained by plotting the difference of the above two spectra (Fig. 1c).

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Stoichiometry

Job's method of continuous variation[5] with equimolar and non-equimolar solutions of the reagents was employed for determining metal to ligand ratio in the complex molecule. Various mixtures of the piroxicam solutions in $CHCl_3$ and that of copper acetate in methanol were prepared in the usual way and their absorbance recorded at 404 nm. Absorbances were also recorded of the same number of piroxicam solutions, used as blank, which were prepared under identical conditions except the addition of Cu(II). The difference in the absorbances of each of the above solutions and the corresponding "blank" was plotted against the mole fraction of the reagents to obtain the Job's curves (Fig. 2).

Beer's law

Varying volumes (0.2, 0.4, 0.6, . . . , 1.8 mL) of 2×10^{-4} M piroxicam were added to 1.0 mL of 10^{-3} M copper acetate solution and the volume was raised to 5 mL by adding $CHCl_3$ and absorbance of the mixture was recorded at 404 nm (Fig. 3).

RESULTS AND DISCUSSION

A considerable increase in the absorbance of piroxicam-Cu(II) mixture over that of piroxicam alone was a clear indication of the interaction between the two (Fig. 1a and 1b). The difference of the two curves gave the spectra of the complex (Fig. 1c) with shows that the complex absorbs maximum at 404 nm ($\varepsilon = 12{,}500$).

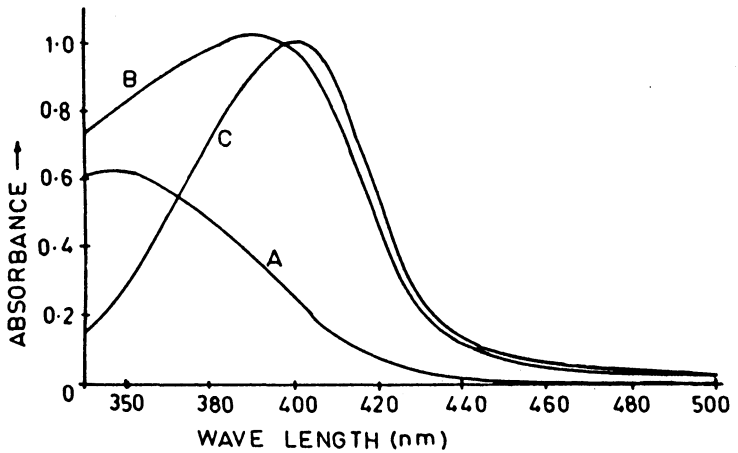

Fig. 1 Absorption spectra of the piroxicam-Cu(II) complex (A: 2×10^{-4} piroxicam, B: 2×10^{-4} M piroxicam + 1×10^{-4} M copper acetate, C: the difference of A and B)

Job's curves (Fig. 2), both equimolar and non-equimolar, clearly indicate the metal-to-ligand ratio to be 1:2 in the complex molecule.

The coloured solution of the complex was found to follow Beer's law (Fig. 3) within a fair range of ligand concentration (1.50 to 20 mcg/mL). This may possibly be used as a highly sensitive method for the estimation of piroxicam.

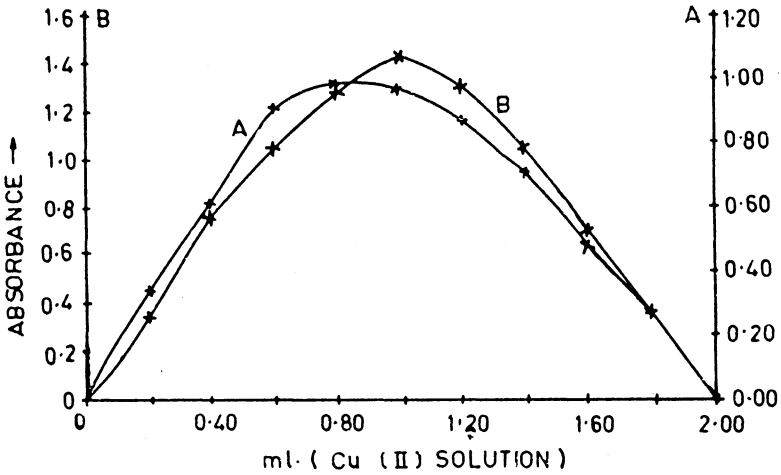

Fig. 2 Job's curve (A: Equimolar and B: Non-equimolar) (A: [Pr] = [Cu] = 5×1^{-4}M, B: [Pr] = 1.0×10^{-3}M, [Cu] = 5×10^{-4}M, Total volume 5 mL in each set). [Pr → Piroxicam; Cu → Copper(II) ion]

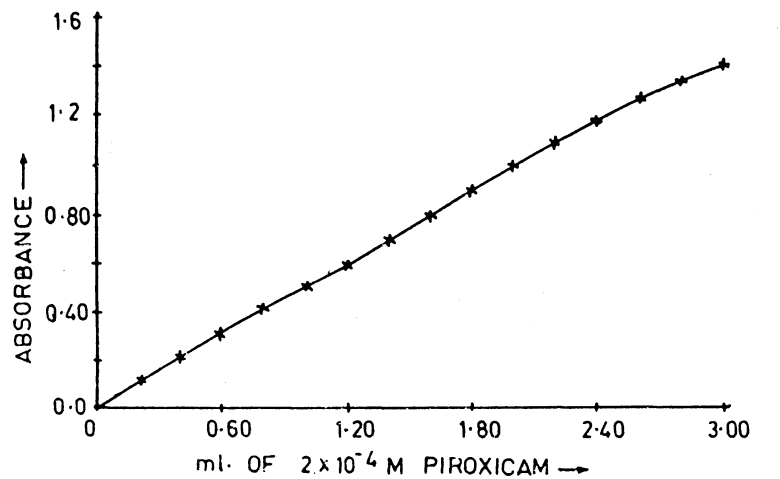

Fig. 3 Verification f Beer's & Lambert's law. (Varying volume of 2×10^{-4}M piroxicam solution added to fixed excess of copper acetate solutions; total volume 5 mL).

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