

Spectrophotometric Studies of Various Fe(III)-Substituted Aminothiophenol Systems

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The complex formation process between Fe(III) and various substituted aminothiophenols has been investigated spectrophotometrically and formation of fairly stable complexes inferred. The complexes absorb at 460 and 470 nm.

INTRODUCTION

Organosulphur compounds are known for their pharmacological activities¹. Their utility as medicaments has been firmly established^{2,3}. Various mercapto organic derivatives that have been synthesized in this laboratory as reaction intermediates in the synthesis of different sulphur containing heterocyclic compounds have been found to be clinically important^{4,5}. They could be used as antibacterial and antiviral reagents⁶. The present communication deals with spectrophotometric studies of Fe(III)-substituted aminothiophenol systems.

EXPERIMENTAL

The chemicals and reagents used were of A.R. quality. The various ligands used for spectrophotometric investigations were 2-aminothiophenol (I), 2-amino-5-methoxy-benzenethiol (II), 2-amino-5-ethoxy benzenethiol (III), 2-amino-5-methyl benzenethiol (IV), 2-amino-5-chloro benzenethiol (V).

All these ligands were synthesized by the procedure reported earlier⁷ and their solutions in dioxane purified by standard method⁸, were employed for further experimentation. Ferric nitrate A.R. grade was used for preparation of Fe³⁺ ion solution.

Spectrophotometric measurements were made using an Elico Digital spectrophotometric Model CL-27 with digital display having an accuracy of ± 0.01 for absorbance values. A range of 410–800 nm was used for measurements. The optical density scale of the instrument was calibrated using a standard solution of potassium dichromate⁹. The absorbances were recorded with an interval of 10 nm. However, in the range of wavelength where λ_{\max} was observed the optical density was recorded with an interval of 5 nm using 50% water-dioxane (v/v) mixture as a blank.

Procedure

The final composition of the solution containing the Fe(III) ion, various ligands and sodium perchlorate was 50% distilled water (v/v). The ionic strength of the solution was maintained 0.1 M by the addition of an appropriate amount of 1 M sodium perchlorate solution.

As expected, the Beer's law was found to be obeyed in the concentration range employed for the investigation.

RESULTS AND DISCUSSION

The composition of the complexes and their stability constants were determined by employing (1) Job's method of continuous variation, and (2) Varielle's method of isobestic points.

The details of the procedure followed in these methods were the same as reported earlier^{10,11}.

While subjecting the various solutions to spectrophotometric measurements care was taken to adjust their pH values to around 3 so that maximum absorption was observed.

From Job's method of continuous variations formation of 1:1 complex was inferred (Fig. 1a). There was however possibility of formation of species having

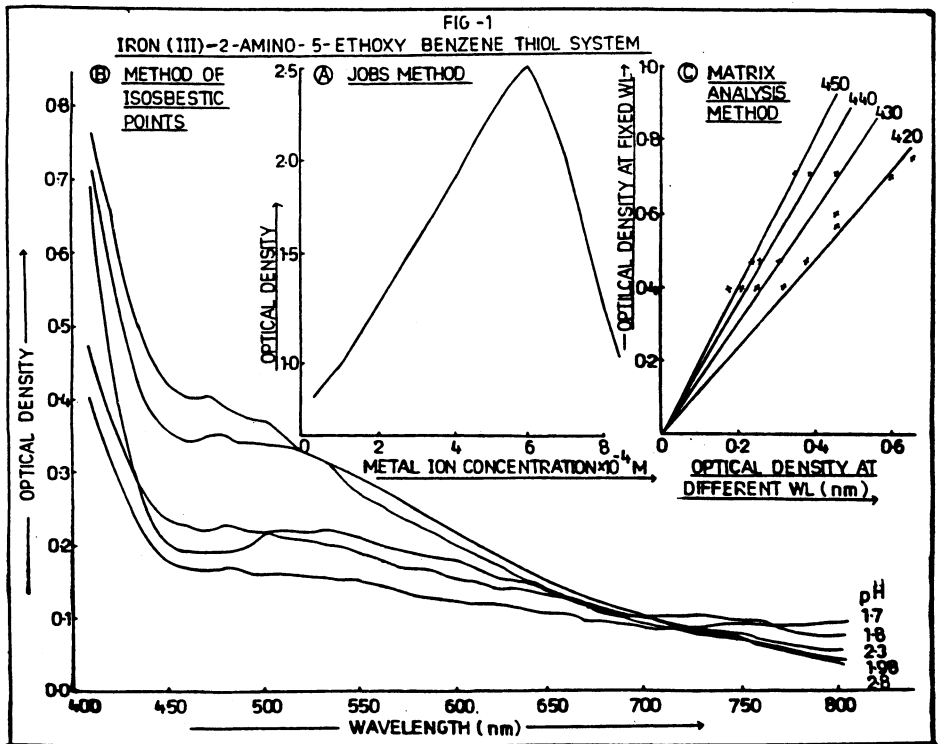


Fig. 1

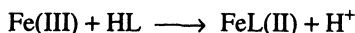
different compositions (*i.e.*, 1:2, 1:3). This was examined by employing Varielle's isobestic point method (Fig. 1b) and concluded that there was only one species of complex present in the solution. The conclusion was further confirmed by subjecting the data to matrix analysis method¹² (Fig. 1c).

The conditional stability constants of these complexes are reported in Table 1.

TABLE-1
CONDITIONAL STABILITY CONSTANTS FOR Fe(III)-VARIOUS
SUBSTITUTED *ortho*-AMINO THIOPHENOL SYSTEMS

Ligand No.	Stability constant
I	3.75
II	3.43
III	3.25
IV	2.72
V	2.36

The various substituted amino thiophenols seem to form the complex by deprotonation. If the ligand is represented as HL, its reaction with metal ion could very well be represented as follows:



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