SIMULTANEOUS SPECTROPHOTOMETRIC DETERMINATIONOF IRON(II) AND TOTAL IRON WITH 1,10-PHENANTHLOLINE

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Introduction. When 1,10-phenanthroline is added to a solution containing both iron(II) and iron (III), a reddish orange iron(II) complex and a yellow iron(III) complex form immediately. The iron(II) complex has an absorbance maximum at 512 mμ, at which wave length there is little absorption by the iron(III) complex. The two complexes have identical absorbance coefficients at 396 mμ. A method is presented for the determination of iron(II) and total iron in the same solution by simultaneous measurements of absorbance at 396 mμ and at 512 mμ.

Aim. In the method for the simultaneous determination of iron(II) and total iron reported in the present paper, advantage is taken of the difference in the absorption spectra of the reddish orange iron(II) and the yellow iron(III) complexes which are formed instantly on the addition of 1,10-phenanthroline to a solution containing these ions.

Materials and methods. Weigh out a 300.0 mg sample and dissolve it in distilled water slightly acidified with sulfuric acid. Dilute to 250 cm^3 in volumetric flask. Each sample then should be analyzed immediately without interruption.

Withdraw three 1 cm^3 aliquots and place each in a separate 25 cm^3 volumetric flask. Add 10 cm^3 of 0.3% 1,10-phenanthroliae solution, buffer with 5 cm^3 of 0.2M potassium biphthalate solution, and dilute to the mark with distilled water. Read the absorbance of each solution at 396 mμ and 512 mμ as soon as possible and not later than 30 minutes after the complexes are formed.

Results and discussion. Determine the concentration of total iron and the approximate concentration of iron(II) from standard concentration curves at 396 and 512 mμ, respectively. Obtain the approximate concentration of iron(III) by difference. Find the absorbance value corresponding to this approximate concentration from the standard curve for iron(III) at 512 mμ to obtain the corrected concentration of iron(II) from the appropriate standard curve. For the correct concentration of iron(III), subtract the corrected concentration of iron(II) from the concentration of total iron already determined. The results are not changed appreciably by a second approximation.

Results of analyses by the 1,10-phenanthroline method are in good agreement with results obtained independently by a method involving accepted procedures of high accuracy. Comparison of results from these methods is particularly advantageous because in one case iron(II) is determined directly and iron(III) gotten by difference, whereas in the other case the determination of iron(III) is direct and that of iron(II) is by difference.

The concentrations of total iron determined with 1, 10-phenanthroline are in close agreement with values obtained with T iron. This indicates that, although the absorbance coefficient of the 1,10-phenanthroline complexes at 396 mμ is relatively small, absorbance measurements at this wave length give satisfactory results for total iron.

Conclusions. The method presented in this paper is to be recommended for its simplicity. Two simultaneous spectrophotometric measurements on the same solution are sufficient for an analysis. No preliminary steps such as reduction, oxidation, or extraction of the sample are necessary.