SPECTROPHOTOMETRIC STUDIES OF URANIUM (VI)-PONGAMOL COMPLEX

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Received October 11, 1965

(Communicated by Prof. T. R. Seshadri, F.R.S., F.A.Sc.)

ABSTRACT

The spectrophotometric studies of uranium (VI)-pongamol complex have been carried out in 50% aqueous ethanolic solutions. Pongamol produces a yellow complex with an aqueous uranyl salt solution, the complex is soluble in 50% aqueous ethanol. The complex is quite stable for 24 hours, the optical density remaining constant at pH 5.6-7.1. The complex obeys Beer-Lambert's law at 390 μm in the concentration range of 1 to 5 p.p.m. of uranium in solution. The molar composition of the pongamol uranium (VI) complex has been found to be 2:1, and its tentative structure has been suggested. The cations and anions which interfere in the estimation of uranium using pongamol have been indicated.

INTRODUCTION

PONGAMOL (5-benzoyl-acetyl-4-methoxy benzofuran)\(^1\) (I) has been reported to give a colour reaction with ferric chloride and the iron (III) complex, so produced has a molar composition of 1:1.\(^3\) The present investigations on the possible use of pongamol as an analytical reagent have shown that an ethanolic solution of pongamol produces with an aqueous solution of uranium (VI) salt a deep yellow complex soluble in 50% aqueous alcohol. The complex has an absorption maximum at 390 μm and its optical density remains constant at pH 5.6-7.1. The complex obeys Lambert-Beer's law...
at 390 m\(\mu\) in the concentration range of 1 to 5 p.p.m. of uranium in solution. The molar composition of the complex as determined by Job's method of continuous variations has been found to be 2:1. The complex is stable for 24 hours. Most of the cations cause serious interference. The estimation of uranium can, however, be carried out even in presence of large quantities of acetate, oxalate, sulphate, and phosphate ions.

**Reagents and Apparatus**

A 1 \(\times\) 10^{-3} molar solution of pongamol was used. The standard solution of uranium (1 \(\times\) 10^{-3} M) was obtained from uranyl nitrate (A.R.). All other reagents used were of B.D.H. (A.R.) or Merck (pro-analysis) quality.

Spectrophotometric measurements were made using Unicam spectrophotometer model SP 600. Beckman pH meter model H2 was employed for pH measurement and dilute solutions of HCl and NaOH were used for pH adjustment.

**Absorption spectra.**——The absorption spectra of uranium (VI)-pongamol complex in ethanolic solution showed a maximum at 390 m\(\mu\) and all subsequent observations were made at this wavelength.

**Minimum Amount of Reagent Necessary for the Determination of Uranium**

To 1·0 ml. of 10^{-3} M uranium (VI) solution, increasing amounts of 10^{-3} M reagent were added, the total volume maintained at 25 ml. in each case and the medium of solution in each case was 50% ethanol. The optical densities of each of these solutions were measured at 390 m\(\mu\) and it was found that there was no increase in the optical density after the addition of more than 6 ml. of the reagent.

**Effect of pH on the Optical Density of Uranium (VI)-Pongamol Complex**

A stock solution of the complex having a uranium concentration of 2 \(\times\) 10^{-4} moles/litre was prepared maintaining the alcohol water ratio at 1:1. 10·0 ml. of this complex was taken and the volume made up to 25 ml. with aqueous ethanol (1:1) containing requisite amount of sodium hydroxide or hydrochloric acid so that the pH of the resultant solution was between 1 and 11. It was observed that the optical density of the complex remained constant at pH 5·6-7·1.

The uranium (VI)-pongamol complex is quite stable at room temperature (30° C.), the optical density remaining constant for 24 hours at pH 5·6-7·1.

The complex obeys Lambert-Beer's law at 390 m\(\mu\) between the concentration range of 1 to 5·0 p.p.m. of uranium in solution.