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# Spectrophotometric Determination Of Uranium With Arsenazo

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## JOVANI CASSIUS

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Spectrophotometric Determination of Uranium(IV) with Arsenazo III. The Spectrophotometric Determination of Uranium in Mixtures of Uranium and TungstenUltraviolet Spectrophotometric Determination of UraniumSeparation of Uranium from Bismuth Using Tris-(2-ethylhexyl)phosphine OxideAn ultraviolet spectrophotometric method for the determination of uranium has been developed which is based on the ultraviolet absorption of the complex of uranium(VI) with tris-(2-ethylhexyl)phosphine oxide. The complex is formed by extracting uranium(VI) from an aqueous 6M sodium nitrate solution in the pH range 2.5-3.0 into 0.1M solution of tris-(2-ethylhexyl)phosphine oxide (TEHPO) in an inert diluent, cyclohexane.Spectrophotometric Determination of Uranium with ThiocyanateSpectrophotometric Determination of UraniumThe Spectrophotometric Determination of

Uranium by Means of the Azide IonSpectrophotometric Determination of Uranium Using DibenzoylmethaneThe Spectrophotometric Determination of Uranium in Mixtures of Uranium and MolybdenumThe Direct Spectrophotometric Determination of Uranium in Sulfate and Carbonate SolutionsThe Spectrophotometric Determination of Uranium Using ArsenazoSpectrophotometric Determination of Uranium in Nuclear WasteSpectrophotometric Determination of Uranium in Highly Impure SolutionsSpectrophotometric Determination of Uranium with Thiocyanate in Butyl Cellosolve-methyl Isobutyl Ketone-water MediumSpectrophotometric Determination of Uranium in Nuclear WasteA spectrophotometric method for determining uranium in nuclear waste was developed using 2-(5-bromo-2-pyridylazo)-5-diethylaminophenol (bromo-PADAP). By extracting the color into Aliquat-336 it was possible to accurately measure U at the 1 .mu.g level. No significant interferences were observed from 34 interfering ions when

a tri-n-octylphosphine oxide (TOPO) pre-extraction of U was used. The effect of pH, color development time, bromo-PADAP concentration, and Aliquat-336 concentration were determined. The method was applied to the analysis of alkaline solutions, filtered solids, sludges, and salt cake nuclear waste forms. The standard deviation for the method with a TOPO pre-extraction was  $\pm 3.7$  percent.

**An Ultraviolet Spectrophotometric Determination of Uranium**

**Spectrophotometric Determination of Uranium and Thorium**

**Spectrophotometric Determination of Uranium and Thorium with Arsenazo**

**Spectrophotometric Determination of Uranium with 8-hydroxyquinoline in Acetone-pyridine Medium**

**Chromatographic Separation and Spectrophotometric Determination of Uranium**

**The Spectrophotometric Determination of Thorium in Uranium**

**The Spectrophotometric Determination of Uranium by the Thiocyanate-TBP Method**

The thiocyanate-TBP method has been used daily at the National Institute for Metallurgy for approximately nine years for the determination of small amounts of uranium in Witwatersrand conglomerate and other siliceous ores. It replaced a spectrophotometric method that required the separation of uranium from most other elements in the sample by extraction with ether. The method involves the formation of uranyl thiocyanate complex of uranium in the presence of EDTA and sodium formate, the extraction of the complex into tri-n-butyl phosphate (TBP), and the measurement of the transmittance of the solvent phase. The procedure is applicable to ore samples, filter cakes and aqueous solutions of low uranium content. The thiocyanate-TBP method has several advantages over the 'ether'

method. **The Spectrophotometric Determination of Uranium in Ores, Residues and Other Materials**

A method for the direct determination of uranium in a cyclohexane solution of tri-n-octylphosphine oxide (TOPO) is presented. The adduct,  $UO_2Cl_2 \cdot 2TOPO$ , that is formed when uranium(VI) is extracted from hydrochloric acid solutions by tri-n-octylphosphine oxide absorbs light in the ultraviolet region. This absorbance is measured at 230 m $\mu$  vs. a TOPO-cyclohexane solution that was contacted with hydrochloric acid of the same concentration as that in the test aliquot. The molar absorbance index is 5500. The method is not selective; of the elements that are extracted by TOPO from hydrochloric acid, iron(III), zirconium, molybdenum, tin and thorium, only thorium can be tolerated. (auth).

**Spectrophotometric Determination of Uranium (IV) with Potassium Ferricyanide** Queen's Printer

**The Spectrophotometric Determination of Uranium in Mixtures of Uranium and Tungsten**

**Ultraviolet Spectrophotometric Determination of Uranium**

**Separation of Uranium from Bismuth Using Tris-(2-ethylhexyl)phosphine Oxide**

**The Direct Spectrophotometric Determination of Uranium in Sulfate and Carbonate Solutions**

The sample is dissolved in nitric acid, and, in the case of uranium fluoride samples, the fluoride is complexed with boric acid. The vanadium is oxidized to the pentavalent state with potassium dichromate. The pH value is adjusted, benzohydroxamic acid is added, and the vanadium complex is extracted into n-hexanol. Interference from iron, titanium, tin, and uranium is eliminated by washing the organic extract with phosphate solution. The transmittance of

the organic solution is measured on a spectrophotometer.

### **The Spectrophotometric Determination of Uranium in Mixtures of Uranium and Molybdenum**

A spectrophotometric method for determining uranium in nuclear waste was developed using 2-(5-bromo-2-pyridylazo)-5-diethylaminophenol (bromo-PADAP). By extracting the color into Aliquat-336 it was possible to accurately measure U at the 1  $\mu\text{g}$  level. No significant interferences were observed from 34 interfering ions when a tri-n-octylphosphine oxide (TOPO) pre-extraction of U was used. The effect of pH, color development time, bromo-PADAP concentration, and Aliquat-336 concentration were determined. The method was applied to the analysis of alkaline solutions, filtered solids, sludges, and salt cake nuclear waste forms. The standard deviation for the method with a TOPO pre-extraction was  $\pm 3.7$  percent.

*Spectrophotometric Determination of Uranium and Thorium with Arsenazo*  
PADAP is a very sensitive reagent for the determination of uranium. The PADAP method is relatively unaffected by the presence of associated ions, particularly if a compensating blank is applied. Only Cr(3+), As(5+), PO<sub>4</sub>(3-), and V(5+) have been found to give any serious interference, and the levels of these ions in Witwatersrand ores are usually well below those likely to cause interference. The presence of aluminium extracted from the ores will increase the level at which As(5+) and PO<sub>4</sub>(3-) interfere. A comparison of the PADAP method with the thiocyanate method shows that the former has advantages in sensitivity, tolerance for interfering ions, and, possibly, precision. If the PADAP

procedure is combined with an extraction step, the tolerance of the method for interferences is increased to an extent where the ions introduced by complete dissolution of a 2 g sample of a silicate ore do not interfere. By the use of this technique it has been shown that the insoluble uranium in Witwatersrand silicate ores varies from 4 to 10 ppm of U<sub>3O<sub>8</sub></sub>.

### *Extraction and Spectrophotometric Determination of Uranium as Uranyl-benzoate-rhodamine B Complex*

An ultraviolet spectrophotometric method for the determination of uranium has been developed which is based on the ultraviolet absorption of the complex of uranium(VI) with tris-(2-ethylhexyl)phosphine oxide. The complex is formed by extracting uranium(VI) from an aqueous 6M sodium nitrate solution in the pH range 2.5-3.0 into 0.1M solution of tris-(2-ethylhexyl)phosphine oxide (TEHPO) in an inert diluent, cyclohexane.

### **Waters - Determination of Uranium(VI) - Spectrophotometric Method**

The thiocyanate-TBP method has been used daily at the National Institute for Metallurgy for approximately nine years for the determination of small amounts of uranium in Witwatersrand conglomerate and other siliceous ores. It replaced a spectrophotometric method that required the separation of uranium from most other elements in the sample by extraction with ether. The method involves the formation of uranyl thiocyanate complex of uranium in the presence of EDTA and sodium formate, the extraction of the complex into tri-n-butyl phosphate (TBP), and the measurement of the transmittance of the solvent phase. The procedure is applicable to ore samples, filter cakes

and aqueous solutions of low uranium content. The thiocyanate-TBP method has several advantages over the 'ether' method.

Spectrophotometric Determination of Uranium Using Dibenzoylmethane

The LASL automated spectrophotometer, designed for determination of 1 to 14 mg of uranium and 0.5 to 14 mg of plutonium, has been evaluated for determination of lower levels of uranium to 0.12 mg. The essentially linear response of absorbance is maintained and the standard deviation for a single measurement is constant at about 0.013 mg of uranium, corresponding to a maximum uncertainty of about 10 percent at the 0.12-mg limit. The instrument was applied to the analysis of a series of low-level-concentration, 0.07- to 0.8-mg/ml uranium samples. The results were not statistically different from those obtained by a manual spectrophotometric method.

*Spectrophotometric Determination of Uranium Using Dibenzoylmethane*

The Spectrophotometric Determination of Uranium in Ores, Residues and Other Materials

Laboratory Method No. 92-70

*Spectrophotometric Determination of Trace Uranium in Plutonium Nitrate and Oxide with 2-(2-pyridylazo)-5-diethylaminophenol*

*The Spectrophotometric Determination of Uranium by the Thiocyanate-TBP Method*

**The Spectrophotometric Determination of Uranium by Means of the Azide Ion**

*Direct Spectrophotometric Determination of Uranium in Cyclohexane Solutions of TRI-n-OCTYLPHOSPHINE Oxide*

**An Ultraviolet Spectrophotometric Determination of Uranium**

The Spectrophotometric Determination of Uranium in Mixtures of Uranium and Tungsten

**Evaluation of the LASL Automated Spectrophotometer for Uranium Determination at Submilligram Levels**

**Spectrophotometric Determination of Molybdenum in Uranium Alloys**

Separation by Ethyl Acetate Extraction and Spectrophotometric Determination by the Thiocyanate Method in Acetone-water Medium