Flow injection Uranium determination

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A Flow Injection Analysis (FIA) method for uranium determination is presented. This method is based on a colorimetric reaction between Arsenazo III and U(IV), producing an Arsenazo III-U(IV) complex [1] in acid medium (HCl 3,6 molL^{-1}).

Although Arsenazo III is not a specific reagent for uranium, the high selectivity (Figure 1) can be ensured in a strongly acid medium, when in the oxidation state (IV), only zirconium and thorium interfere [2].

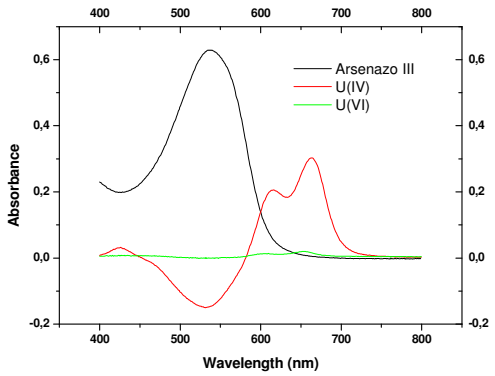

Figure 1. Absorption spectra of Arsenazo III, Arsenazo III-U(IV) and Arsenazo III-U(VI) in acid medium (HCl 3,6 molL^{-1}).

The influence of zirconium can be sharply reduced by carrying out the determination in the presence of oxalic acid and thorium should be preliminary separated. In this method U(VI) is reduced to U(IV) by passing U(VI) solution through column filled with metallic lead [3] in HCl 3,6 molL^{-1} media. U(VI) is reduced to U(IV), reacting with Arsenazo III and then detected in a spectrophotometer at 665 nm (Figure 2).

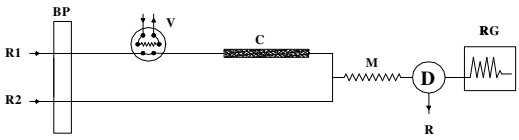

Figure 2. Flow Injection Analysis (FIA) system: (R1) HCl 3.6 molL^{-1} + oxalic acid; (R2) Arsenazo III + HCl 3.6 molL^{-1}; (BP) peristaltic pump; (V) Injection valve; (C) Column reduction; (M) Mixer; (D) Detector; (RG) chart recorder; (R) reject.

Calibration curves have showed a linear behavior (R^2 = 0.9996) between the concentration range of 0.05 and 2.0 mgL^{-1}. A relative deviation standard of 5.5 % (at 0.1 mgL^{-1}) and a detection limit of 0.02 mgL^{-1} were obtained, as well an analytical throughout of 60 sample determinations per hour.

References

[1] Palei, P. N. Analytical Chemistry of Uranium. London. Ann Arbor-Humphrey Science Publishers, Inc., 1970.

[2] Savvin, S. B. Analytical use of arsenazo III – Determination of thorium, zirconium, uranium and rare earth elements. Talanta, 8: 673-685, 1961.

[3] Pérez Pavón, J.L.; Moreno Cordero, B.; Rodriguez Garcia, E.; Hernandez Mendez, J. Determination of uranium using a flow system with reagent injection. Application to the determination of uranium in ore leachates. *Analytica Chimica Acta,* 230: 217-220, 1990.