

# Studies on gold sorption from hydrochloric acid medium by polyurethane foam (PUF)

C. S. Pereira<sup>1</sup>, J. L. Mantovano<sup>1</sup>, E. M. M. Ferreira<sup>1</sup>, C. C. Turci<sup>2</sup>.  
e-mail: [crisrina@ien.gov.br](mailto:crisrina@ien.gov.br)

<sup>1</sup> Division of Nuclear Engineering - IEN

<sup>2</sup> Institute of Chemistry - UFRJ

*Keywords: polyurethane foam, gold, sorption.*

Gold is one of the most important noble metal due to its wide application in industry and economic activity. The content of gold in Brazilian ores varies from 0,5 to 12 g Au/t [1].

The low level of gold found in ore samples presents difficulties for its determination by instrumental analytical techniques such as Inductively Coupled Plasma Emission Spectroscopy (ICP), Flame Atomic Absorption Spectroscopy (FAAS) and Dispersive X-Ray Fluorescence (EDXRF), concerning the detection and quantification limits reached by these instruments and the gold final concentration of the sample to be analyzed. Thus, separation and preconcentration using liquid-liquid or solid-liquid extraction (SPE) are required to improve the sensibility and selectivity of these techniques.

In this work it was studied the sorption of Au III by commercial open-cell polyether-type polyurethane foam (Scotch-Brite®) in HCl medium. The influence of acidity and chloride concentrations, kinetic sorption and distribution coefficient were investigated. The experiments were carried out by batch process, using 0,040 g ground PUF in 0,025 L solution, within a HCl concentration range from 0,01 to 1,0 mol L<sup>-1</sup>. After extraction, gold III was either direct determined in the solid phase by EDXRF (Figure 1) or after back-extraction from PUF by Flame Atomic Absorption Spectrometry (FAAS), as well as in the aqueous phase.

The gold sorption shows no dependence on acidity or chloride concentration in the range investigated. The extraction system showed rapid sorption kinetic with a half-life value of 0,82 minutes. It was achieved a distribution coefficient value of 10.700 L Kg<sup>-1</sup> at 20°C for a HCl concentration of 0,3 mol L<sup>-1</sup>. The Langmuir isotherm was successfully fitted. The saturation capacity and adsorption constant values obtained are of (0,38 ± 0,05) mol kg<sup>-1</sup> and (2,89 ± 0,45) 10<sup>4</sup> L g<sup>-1</sup>, respectively.

The use of PUF as adsorbent in batch and/or column systems presented a good option for the preconcentration and separation of Au from other elements commonly associated to its ores, such as copper and silver [2,3]. Other advantages are its low cost, high surface area, cell structure, stability in acid and basic medium, ability of combination with different analytical techniques and particularly feasibility of direct measurement of analyte on PUF solid phase by EDXRF [4]. The sensitivity has increased by a factor of 40, when compared to direct determination of gold in ores samples by EDXRF. The sorption system studied shows rapid kinetic, high sorption capacity with high preconcentration factor within the HCl concentration range investigated. The results indicate that it could be successfully applied to gold preconcentration in order to determine gold in ores and also to its recovery from wastewater as a result of mining, electroplating industries or electronic manufacturing. In gold mining process it could also be used to replace the current process with activated carbon.

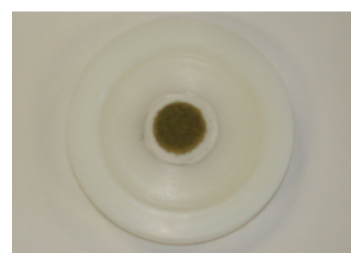


Figure 1- EPU loaded with gold (25mg g<sup>-1</sup>).

## References

- [1] Trindade, R. B. E.; Filho, O. B. Extração de Ouro, Centro de Tecnologia Mineral, 2002.
- [2] Bowen, H.J.M. Absorption by polyurethane foams; New Method of Separation., Journal of Chemical Society, A, p. 1082-1085, 1970.
- [3] Oleschuk, R.D.; Chow, A., The separation and isolation of gold by selective extraction and transport through a polyurethane ether-type membrane, Talanta, v. 43, 1.545-1.554, 1996.
- [4] Carvalho, M. S. et al. Direct determination of Gallium on Polyurethane foam by X-ray fluorescence, Talanta, v. 42, pp. 45-47, 1995.