Evaluation of the foaminess amount of various surfactants for obtain optimum extraction conditions in Dissolved Nitrogen Predispersed Solvent Extraction method

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ABSTRACT

In Dissolved Nitrogen Predispersed Solvent Extraction (DNPDSE) innovative method, optimum conditions for organic phase bubble dispersion formation is provided through selection of appropriate surfactant for polyaphron organic phase and its lowered temperature. hence, after selecting the best working conditions for conducting foam measurement experiments (air flow 1600 Cm3/min, 1:9 Lix to oil percent and 5°C temperature) and measurement of producted foam volume and foaminess unit of various surfactants (based on both techniques of Ross & Suzin and defective cone volume), dilute silicone oil with 0.3 g/l concentration was chosen as the optimum surfactant (due to most foaminess). Moreover, the results of extraction and strip experiments in conventional SX method showed no adverse effect of various silicone oil concentrations on extraction process. On the other hand, in DNPDSE method the highest recovery rate was attained for 0.3 g/l concentration of dilute silicone oil (due to increased conversation CLAs to CGAs).

Key words: Dissolved Nitrogen Predispersed Solvent Extraction (DNPDSE), conventional SX, Colloidal liquid aphron (CLA), Colloidal gas aphron (CGA), Dilute silicon oil, Ross & Suzin technique, defective cone volume technique, foam volume Producted, Fominess unit.

1. Introduction

Solvent extraction is one of the most important hydrometallurgical methods for selectivity remove, purification and concentration of certain elements or solution combinations (Rydberg et all, 2004). This method was first used in Manhattan project in 1940s to refine uranium to make the atomic bomb (Habashi, 2001). Since then considerable researches have been conducted on chemistry, engineering process, extraction mechanisms, contactors development, improved mass transfer and design of solvent extraction equipment for better performance and elimination of its faults (especially for processing of dilute solutions) (Rydberg et all, 2004).

Dissolved Nitrogen Predispersed Solvent Extraction (DNPDSE) is an innovative method used in the way of research effort in this field. In this method, developed using patterns and combining Predispersed Solvent Extraction (PDSE) (Sebba, 1912), Air-Assisted Solvent Extraction (AASX) (Tarkan et all, 2005), Dissolved Air Flotation (DAF) (Teixeira et all, 2007), Spray Column Solvent Extraction (SCSX) (Rydberg et all, 2004), etc, two phase mixture operations is done through replacement of organic phase bubble dispersion (colloid gas aphrons [CGAs]) instead of its droplet dispersion in aqueous phase. But Success of performance of this method is dependent upon providing proper conditions for producing CGAs.

One of the most important conditions is the existence of a surfactant with the highest foaming property for organic phase. In fact, since in DAF process, according to the equation presented by Takahaschi and et al (Feris et all, 1999), minimum required energy of ΔF (Joules) for bubble formation using cavity phenomenon results from the following equation:

$$\Delta F = 16/3\ \pi\ \gamma^3 / (P_0 - P_a)^3 \qquad (1)$$

in which γ is surface tension of water (Nm^{-1}), P_a is atmospheric pressure (atm or Pascal units) and P_0 is saturation pressure (atm or Pascal units), hence decreased air/liquid interfacial tension through increasing foaming amount, besides providing better conditions for nucleation and bubble formation (increased kinetics) application of lower working pressures becomes possible and this is not only economically beneficial (decreased operational costs), but also important for more security (Feris et all, 1999).

Since most of the researches performed in regard to the measure of foaming amount are concentrated on aqueous