

Design and optimization Dissolved Nitrogen Predispersed Solvent Extraction method and comparison of its performance with Predispersed Solvent Extraction method

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ABSTRACT

The difference between Dissolved Nitrogen Predispersed Solvent Extraction (DNPDSSE) innovative method and Predispersed Solvent Extraction (PDSE) method is in increased instruments on the apparatus for using features (increased contact area, more dispersion capability and enhanced buoyancy force) due to conversion of Colloidal liquid aphrons (CLAs) to Colloidal gas aphrons (CGAs). The studies conducted after design and optimization of working conditions for the apparatus (2.5 - 3.5 bar pressure, 0.1 l/min sparger air flow and 1.5 L aqueous phase volume), showed that for all conditions of the survey, the recoveris in DNPDSSE method was higher than PDSE method. In addition, obtained pictures of the two methods performance mode indicated presence of CGAs in DNPDSSE method compared with polyaphron aggregations in PDSE method that being a good reason for increased recovery in DNPDSSE method. Most recovery in this method is achieved by using anionic polyaphron NaDBS with fivefold dilution in 3.5 bar pressure.

Key words: Dissolved Nitrogen Predispersed Solvent Extraction (DNPDSSE), Predispersed Solvent Extraction (PDSE), Bubble, Colloidal liquid aphron, Colloidal gas aphron.

1. Introduction

The solvent extraction process is of great importance in industrial world today due to production of high purity products, selective separation of metals and chemicals and also contaminant control. To this end, considerable research efforts have been devoted to develop this technique through design and construction of new contactors to reach better performance compared to common solvent extraction contactors.

Doraiswamy and Sharma (Sanjiv et al, 1994) were among the first to try to reach this goal by excellent review of solvent extraction contactors. According to their investigations, mass transfer rate per unit dispersion volume can be obtained from the following equation:

$$R = K_L A (\Delta C) \quad (1)$$

For a given system with known ΔC (concentration variation), R can increase through increased K_L (mass transfer coefficient in m/s) and increased A (interface area in m^2/m^3). Table 1 shows the range of A and K_L values for various contactors.

| Contactor | $K_L * 10^3$ | Gas hold up | A |
|---------------------------------|--------------|-------------|--------|
| Spary Column | 0.1 - 1 | 0.05 - 0.1 | 1 - 10 |
| Packed Column | 0.3 - 1 | 0.05 - 0.1 | 1 - 10 |
| Column with Mechanical Agitator | 0.3 - 1 | 0.05 - 0.1 | 1- 800 |
| PDSE | - | | 27000 |

Table 1 Comparison of the liquid – liquid contactors (Sanjiv et al, 1994).

This table shows that gravity contactors have $K_L A$ much lower values compared with mixer settlers despite need for much less initial power. Also it is clear that increased $K_L A$ in a mixer settler is mainly due to increased A value. Therefore, if it be possible to increase the interface area resulting from a gravity contactor without affecting K_L value, there would be the likelihood of combining high $K_L A$ and low power required in a contactor (Sanjiv et al, 1994).

Investigations by Sebba in this field have given rise to introduction a new method named Predispersed Solvent Extraction (PDSE). In this method the process of separation of solute from pregnant solution (using solvent extraction