

## Control and minimization of crud in a shallow layer gravity settler

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**Keywords:** liquid-liquid systems, crud, shallow-layer gravity settler

In large-scale liquid-liquid extraction installations (facilities, plants) that use mixer-settler set-ups, correct and careful design and construction of the settler units are critical both to the overall economy of the process and the smooth operation. Experimentation-based modelling of shallow-layer (horizontal-flow) gravity settlers is thorny because the depth and composition of the dispersion band vary along settler length and because biological/impurity interfaces (crud) may mechanically hinder the longitudinal development of the band and chemically alter (modify) the interfacial tension and significantly affect the time-scale of the coalescence process. The main future objective is the acquisition of accurate experimental data about the geometry (length and thickness) of the dispersion band as well as its structure (drop-size distribution and dispersed phase hold-up) along the length of a shallow-layer gravity settler, under both steady and transient states, for different operating conditions (agitation power input, phase flow rate and feed hold-up). These data, together with the appropriate value of the interfacial tension, are critical for ascertaining the optimal values of the phenomenological parameters of the model describing the behaviour of the settler.

Previous work (Baptista *et al.* 2005) in pilot plant experiments using pure water and kerosene phases, in closed circuit and under steady operating conditions has shown that dispersion band length stabilization was not attained, even at long experimentation times. Crud formation at the interface was observed. Crud analysis, by fluorescent microscopy using Propidium Iodide as a probe, suggested the presence of bacteria in the gelatinous-like material (crud) (Ribeiro *et al.*, 2008). The use of a biocide resulted in a dramatic decrease in crud formation and allowed the dispersion band stabilization.

In order to make these data reliable and reproducible, the effects of the formation and accumulation of crud at the water-organic interface must be taken into consideration, controlled and minimized by using appropriate biocides, the side effects of which on the interfacial tension must also be acknowledged. The appropriate techniques for these measurements have been developed and tested in previous work.

In the present work batch scale experiments are performed over kerosene-water agitated mixtures with and without biocide addition. Working cycles of several agitation/decantation times are accomplished in jar tests and different operating conditions are tested: phase ratios, agitation intensity, cycle time and quality/quantity of biocides added. In order to accelerate the crud formation in these tests the use of kinetic accelerators (nutrients) is envisaged. The effects of crud and biocide presence over the interfacial tension are measured using a new volume drop method tensiometer.

The results obtained in the present work are of critical importance for a future use of biocides in pilot and industrial equipment utilization plants.

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## **References**

M. C. F. Baptista, R. P. M. Silva, M. M. M. Ribeiro, M. M. L. Guimarães, and A. M. A. Fiúza, (2005). Measuring Dispersion Band Quantities in Shallow-Layer Settlers, 9<sup>th</sup> Int. Chemical Engineering Conf., Coimbra, Portugal; EFS28.

Ribeiro, M. M. M., Soares, E. V., Guimarães, M. M. L., Fiúza, A. M. A., (2008). Stability of the dispersed Band in a Shallow layer settler. Accepted for publication in the Proceedings do ISEC 2008 - International Solvent Extraction Conference, Denver, EUA, September 2008,