Characterization of carbon dioxide absorption in GLL systems

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Abstract
Reactors involving two liquid phases (organic and aqueous) are considered as alternative of other systems because these new reactors may improve the overall process efficiency. Two different fields of application have been considered: (i) reactors to clean gaseous streams by means of the capture of pollutant gases; (ii) bioreactors that enhance the oxygen mass transfer rate. This is very important when the gas phase absorption is the limiting step in the global process. In these cases, an increase in the gas transfer rate could produce an important increase in the process productivity. Several studies have analysed the effect of different organic liquids on the gas absorption process but different experimental results have been obtained with contradictory conclusions.

Present work includes the analysis of carbon dioxide mass transfer rate from a gaseous phase to a liquid one modified by the addition of different quantities of organic compound. The last one component was two silicones with different viscosity to evaluate the influence of this physical property upon the mass transfer process. Also, the influence of a surfactant (used to emulsion stabilization) upon the global process has been also analysed.

The studies of carbon dioxide mass transfer to liquid phases were carried out using the equipment employed in previous work related to the absorption processes (Gómez-Díaz et al, 2008). The gas/liquid contactor used in these studies has been a square section bubble column (size = 7 cm; height = 100 cm), made in methacrylate and using a liquid phase volume of 3 liters. The gas sparger has been a glass capillary with only one orifice (internal diameter: 1.6 mm). The gas flow-rate was measured and controlled with two mass flow controllers (5850 Brooks Instruments). The mass flow controllers employed in the present study for the gas flow-rate and pressures were calibrated by the supplier.

A photographic method has been used to evaluate the gas-liquid interfacial area. The bubble diameter was measured using a photographic method based on images of the bubbles taken along the height of the column, from bottom to top. A minimum number of 80 well-defined bubbles along the bubble column were used to evaluate the size distribution of the bubbles in the liquid phase employed, and for each gas flow-rate that has been used.