83f Application of a Stereoscopic Vision System for the Accurate Measure of Air Bubbles Density Trapped in Oil Drops in a Model Fermentation System

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Complex mixing processes require the dispersion of up to four phases. Particularly in bioprocesses, mass transfer usually determines the overall productivity. Mass transfer is associated to the size of air bubbles and oil drops and their particular distribution in the system. In a model system simulating the conditions of a fermentation process for the production of aroma compounds, we have studied the dispersion of air (gaseous phase), oil (immiscible liquid phase) and solid phase (microorganism of complex morphology) by an advanced image-analysis technique. This technique allowed us to visualize more clearly the highly complex interactions of the liquid and gaseous phases in the mixing tank. It has also been observed that some of the air bubbles and aqueous phase droplets remain trapped in the organic phase. Furthermore, the presence of biosurfactants such as a soluble protein increased considerably the formation of these complex oil structures, which are likely to be a multiple dispersion. By the acquisition and analysis of stereoscopic images of oil drops and air bubbles, we were able to measure the relative depth of each particle or discard the inclusions into drops in order to discern accurately if the air bubbles and water droplets were trapped in the oil drops or there was only a superposition of particles in different focal planes. In this work we report the accurate measurement of the density of bubbles trapped in the oil drops as a function of the concentration of soluble protein (bovine serum albumin) using the stereoscopic vision system. A detailed evaluation of the interactions between the phases would allow to clarify the mechanism by which air bubbles and water droplets are trapped or introduced into oil drops. This will contribute to understand how the different physicochemical conditions affect the mass transfer and the productivity of the process.