

Distribution of mixing efficiency in a split-cylinder gas-lift bioreactor for *Yarrowia lipolytica* suspensions[†]

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Abstract

The distribution of mixing efficiency in a split-cylinder gas-lift bioreactor has been investigated for *Y. lipolytica* suspensions with cells concentration varying between 10 and 50 g/l d.w. The results indicated important variation of mixing time on the height of riser or downcomer, as well as different behaviour of suspensions flows in these two regions. Thus, the less intense mixing for the upward circulation has been recorded for the bottom region, while the most efficient mixing was reached at the top position at higher biomass concentration and aeration rate. This variation is similar to that observed for the downcomer, the intermediary positions being associated with the lowest efficiency of mixing for concentrated yeast cells suspension, due to the bubbles entrapping coalescence and stratification phenomena. The influence of air input rate on turbulence extent is positive only for the superior regions of the riser. For the other positions inside the gas-lift bioreactor this parameter effect depends on the biomass concentration. By means of the experimental data and using MATLAB software, mathematical correlations for mixing time have been proposed for each circulation region, taking into consideration both the operational parameters and the distance from the bioreactor bottom. These equations offer a good concordance with the experiment, the average deviation being of 5.1% for the riser and 5.6 % for the downcomer zone.