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APPLICATIONS OF PNEUMATIC BIOREACTORS IN WASTEWATERS TREATMENT

1. MIXING EFFICIENCY AND DISTRIBUTION IN SPLIT-CYLINDER GAS-LIFT BIOREACTOR FOR VISCOUS MEDIA

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Abstract

The distribution of mixing time for a split-cylinder gas-lift bioreactor has been investigated for simulated broths with apparent viscosities up to 26 cP. The results indicated important variation of mixing time on the height of riser or downcomer, as well as different behavior of dispersion flows in the two regions. Thus, the highest mixing efficiency for the ascending circulation has been recorded for the intermediary positions, placed above the sparger. Contrary, for the downcomer, the intermediary positions are associated with the lowest efficiency of mixing, due to the bubbles entrapping phenomenon. Moreover, at air superficial velocities over 1.05×10^{-3} m/s, the influence of air input rate on turbulence extent is continuously positive for the riser, while it became negative for the downcomer. 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 parameter and the distance from the bioreactor bottom. These equations offer a good concordance with the experiment, the average deviation being of 3.3% for the riser and 6.6% for the downcomer zone.

Key words: pneumatic bioreactor, gas-lift bioreactor, split-cylinder, mixing time, simulated broth

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