

VOLUMETRIC MASS TRANSFER COEFFICIENT IN AN EXTERNAL-LOOP AIRLIFT REACTOR WITH SELF-AGITATED IMPELLERS CONTAINING AQUEOUS SUCROSE SOLUTION

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Abstract

External-loop airlift reactor are widely employed in biochemical and pharmaceutical industry mainly due to their simple construction, low energy requirements and good mixing characteristics. Their productivity is mostly controlled by gas-liquid mass transfer. Due to the widespread demand for the improvement of yield and productivity various alteration in construction have been proposed to enhance mass transfer rates and hence, increase productivity of airlift reactors. One of the possibilities is the instalment of various internals for the breakage of bubbles in order to reduce mean bubble size and consequently increase interfacial area and volumetric mass transfer coefficient.

In this work, the influence of installed self-agitated impellers on the volumetric mass transfer coefficient in an external-loop airlift reactor containing Newtonian viscous fluids was investigated. Tap water or aqueous 46 wt.% sucrose solutions were used as liquid phase. To quantify the effect of impellers on mass transfer all experiments were performed in a configuration without impellers and a configuration with impellers.

The results showed that in both airlift configurations the volumetric mass transfer coefficient increases with the increase of superficial gas velocity. In Newtonian sucrose solution volumetric mass transfer coefficient values were significantly lower (up to a factor of 3) in comparison to water mainly due to lower interfacial area available for mass transfer. The instalment of self-agitated impellers increased volumetric mass transfer coefficient in the range 13-40% because of the reduction in mean bubble diameter and minor decline in liquid velocity. The improvement in volumetric mass transfer was more pronounced in water as a liquid phase since water initially produces larger bubbles compared to sucrose making it more susceptible to the effect of impellers. Also, higher increase in volumetric mass transfer coefficient was obtained at lower superficial gas velocities in both liquid phases.

Key words: external-loop airlift; volumetric mass transfer coefficient; self-agitated; impellers

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