Research article

Study of sparger location on solid suspension in a triple-impeller stirred vessel

Tiam You Se1, Abdul Aziz Abdul Raman1,2, Raja Shazrin Shah Raja Ehsan Shah1, Shaliza Ibrahim2 and Mohamad Iskandir Mohamad Nor3

Article first published online: 9 DEC 2015
DOI: 10.1002/aic.1959
© 2015 Curtin University of Technology and John Wiley & Sons, Ltd.

Keywords:
sparger location; power consumption; gas hold-up; triple-impeller; solid suspension

Abstract
Several advantages such as good gas and solids dispersion have been associated with triple-impeller system for three phase mixing processes. In this work, minimum impeller speed required for achieving just suspended condition was studied with gassing using three Rushton turbines as agitators. The effects of sparger location and gas flow rate on the just suspension speed, gas hold-up, gas-liquid mass transfer coefficient and power consumption were discussed. Sparger placed above the bottom impeller showed the highest gas hold-up at just suspended condition with the same total power consumption as the other two sparger locations. The highest gas hold-up value achieved was 12% at total power consumption of 370 W. The data obtained fitted well into the equation of the exponential model (log b = log X0 + k log N) when the sparger is located below the bottom impeller. Significantly lower k values can be obtained when the sparger is shifted above the bottom impeller. The sparger location above the bottom-most impeller is proposed to be superior for industrial application of aerated solid suspensions where at least 8% saving on power consumption can be achieved. © 2015 Curtin University of Technology and John Wiley & Sons, Ltd.