

ORIGINAL ARTICLE

Investigation of Gas Hold up and Power Consumption in a Stirred Tank Bioreactor Using Single and Dual Impeller Configurations

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ABSTRACT

A laboratory stirred tank bioreactor with six single and dual-impeller configurations was tested to obtain the optimum operating conditions for future biological processes. Six impeller combinations consisting of three basic impeller types, namely Rushton turbine (RT), pitched 4blade (P4B) and pitched 2blade (P2B) downward flow were investigated in 1.77 L bioreactor working volume. Power consumption and gas hold-up measurements were taken over a range of 100-1000 rpm of stirring speed and 1-5 Lmin⁻¹ of air flowrates, for all the six combinations consisting of any single and dual impellers. Using predicted data some empirical correlations were derived which present relations in estimation of power consumption in stirred tanks with various impeller configurations. Electrical measurement method was used to determine the power drawn in the stirred bioreactor. Gas hold-up increased with an increase in stirring speed and superficial gas velocity for all the impellers employed. The number and type of impellers in stirred bioreactor had considerable influence on gas hold-up behavior of the stirred bioreactor. Besides, Rushton turbine-dual Impeller gave comparably maximum gas hold-up, but at significantly higher power consumption levels. The proposed correlations offered good agreement with the experimental data.

Keywords: Gas hold-up, Stirred bioreactor, Power consumption, Dual-impeller
