Thesis Title	Oxygen Mass Transfer coefficient in Air-lift Fermentor: Correlation Equation and Scale-up Application
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Abstract

The study was performed in 2 scales;(1) in the 20 litres air-lift fermentor(diameter 0.150 metre) with 2 sizes of draft tubes, 0.075 and 0.100 metres diameter and (2) in the pilot-scale air-lift fermentor of 370 litres(0.4 metres diameter)with a draft tube 0.28 metres diameter.The experiments consisted of two parts;the study of oxygen mass transfer at difference glucose concentration without microorganism cell and (2)the study of oxygen mass transfer during the cultivation of Saccacharomyces cerevisiae yeast.Air flow rate was the independent variable in the experiments.

The resulting oxygen mass transfer coefficient correlation equation studied in the 20 litre fermenter,at no-micro organism condition was found as;

$$K_L aD^2/\mathcal{D}_L = c(\nu_L/\mathcal{D}_L)^{0.5}(gD^2\rho_L/\sigma_L)^{1.038}(g\rho_L^2 D^3/\mu_L^2)^{0.24}(U_G/(gD)^{1/2})^{1.3}$$
$$(1+A_d/A_r)^{-2}$$

c was a function of fermentor volume and operating conditions as follow

Operating condition:no cell

$$c = -0.00002V + 0.01438$$

Operating condition:single cell protein fermentation

$$c = 0.000052V + 0.01706$$

The equation equation could be simplified to the form:

$$K_L a = K_1(1+ A_d/A_r)^{-1.2}(U_G)^r$$

where K_1 is 3.122 and r is 1.3

In Scaling-up from the 20 litre fermentor to 370 litre fermentor at constant A_d/A_r (ratio of cross section area of draft tube to cross sectional area of fermentor),the simplified equation of the form:

could only predicted the result in the 370 litre air-lift fermentor at high U_{sg} and only during the cultivation of yeast.

Keywords: Air-lift Fermentor/Scale-up/Oxygen Mass Transfer Coefficient /correlation equation/Saccharomyces cerevisiae