413g Study of Gas-Liquid Volumetric Mass Transfer in Bubble Column Reactors Using Axial Dispersion Model

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The volumetric gas-liquid mass transfer coefficient, kla, in bubble column reactors was estimated experimentally. Optical oxygen probes were implemented to measure the dissolved oxygen concentration in the liquid phase. This work uses axial dispersion model (ADM) to describe the mixing of both liquid and gas phases and to regress the value of mass transfer coefficient. The result of the kla coefficient using ADM is compared with that from using simple CSTR assumptions. The comparison demonstrates that using ADM obtains better fitting to the experimental data, and the ADM achieves consistent results over the whole range of axial sampling positions along the reactor. CSTR model could under-estimate the kla values by up to 25% at given conditions. This work shows mixing behavior of bubble column reactors has significant deviation from CSTR which needs to be considered in mass transfer study. Effects of gas velocity, operating pressure, and reactor diameter on mass transfer were investigated.

Keywords: Mass transfer, Bubble column, Gas holdup, Optical oxygen probe, Axial dispersion model