Teeranun Nakyai 2010: Modeling and Simulation of a Gas-Liquid Reactor in Co-current and Counter current Flows. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Sunun Limtrakul, D.Sc. 158 pages.

Mathematical models are developed for predicting gas-liquid reaction regime and reactor performance in co-current and counter current modes based on film model coupling with mixing cell model. The models were solved by boundary element method (BEM). These models were applied for three case studies including the gas liquid reactions of CO_2-NaOH, H_2S-Fe^{3+}(EDTA) and CO_2-Na_2CO_3. The simulation results showed that the reaction of CO_2-NaOH takes place only in the liquid film. Thus it is a fast reaction. The reaction of H_2S-Fe^{3+} (EDTA) is an intermediate reaction and takes place in both liquid film and liquid bulk. Thus, the reaction of CO_2-Na_2CO_3 is a slow reaction. The reactions take place only in the liquid film. The conversions for all case studies depend on the degree of flow mixing. Variation of mixing cell number, N from 1 to ∞ shows that the flow behavior as well as the reactor performance approach to those in a complete mixed flow at N=1 and a plug flow at $N=\infty$. Furthermore, a counter current mode for all case studies gives higher conversion than that in a co-current mode due to higher mass transfer in the counter current. The enhancement factor (Ea) for a plug flow system (at very high N) is the smallest and that for a CSTR is the greatest. Finally, predictions of the performances of the riser for H_2S removal and the downcomer for Fe^{3+}(EDTA) regeneration in the Lo-Cat air-lift reactor are in good agreements with the experimental results.

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