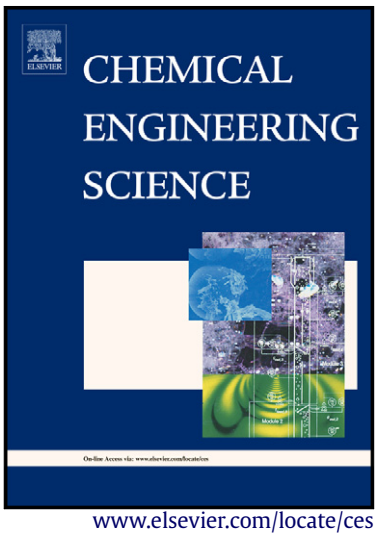

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Mass transfer and kinetics of carbon dioxide absorption into loaded aqueous monoethanolamine solutions

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ABSTRACT

The kinetics of the reaction between carbon dioxide and aqueous solutions of 1 and 5 mole/L monoethanolamine (MEA) pre-loaded with CO_2 were investigated over the temperature range 298 to 343 K and for CO_2 loadings from 0 to 0.4 mole CO_2/ mole MEA in a wetted wall column reactor (WWC) and a string of discs contactor (SDC). A total of 227 new data points are provided for loaded solutions including all underlying data necessary for other researchers to develop own models. Comparisons are made between recent literature data and this study and they are found to be consistent with each other. Three different kinetic models, a simplified soft model, a concentration-based model and an activity-based model were developed and validated against the experimental data and by a penetration type mass transfer model in order to analyze the absorption rate and understand the reaction process. Results show good agreement between the models at low loadings and kinetic parameters are provided for all models. Above a loadings of 0.3 mole CO_2/mole MEA it is recommended to use the activity based model as systematic deviations occurred in the soft and concentration based models. The effect of depletion of free amine at the gas-liquid interface on the kinetic and mass transfer calculations