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A rate-based model approach for the absorption of acid gases by aqueous solution of MDEA, using Aspen plus simulator

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ABSTRACT

Gas absorption for the separation of acid gases is a well-known technique in gas refineries. Alkanolamines are widely used for purposes of separation of acid gases from natural gas. Owing to the selective absorption characteristics of MDEA, it have been widely used for the separation processes. In this work, a gas treating unit has been simulated with a rate based approach, using Aspen plus process simulator. In the present work, Austgen's model was used for the prediction of phase equilibrium in the interface of phases and chemical equilibrium in liquid phase, AIChE's correlation for mass transfer coefficients and Chilton and Colburn method for the calculation of heat transfer coefficients. The simulation results demonstrates that it matches exceptionally well with the plant data that indicates the adequecy of used correlations and reaction rates. In order to evaluate and predict the performance of process in different operating conditions, some sensitivity analysis has also been carried out for the key parameters. The results also reveals that the reboiler duty of the regenerator has a considerable effect on the sweet gas quality.

KEYWORDS

Austgen's model;
Rate-based model;
Aspen plus;
Methyldiethanolamine;
Acid gases.

INTRODUCTION

Among processes for sweetening of sour natural gas, removal of acid gas by alkanolamine solutions is used extensively. In this process, as shown in Figure 1, sour gas and alkanolamine solution contacted to each other inside the absorption column which reversible exothermic reactions between solution (weak base) and acid gases (mainly CO_2 and H_2S) are occurred.

In order to regenerate the solution enriched from acidic gas, the exiting solution from absorption columnafter passing through the lean/rich exchanger (as pre-heater of rich amine), enters to the regeneration column. In this column the required heat for regeneration of solution is provided by reboiler. Then regener-

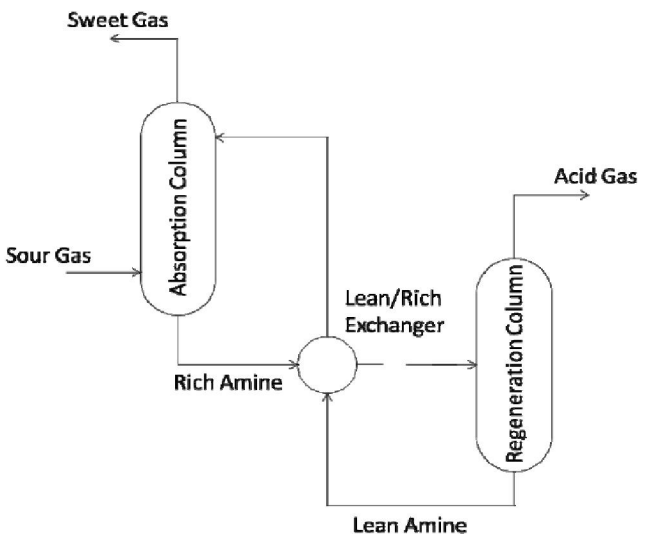

Figure 1 : Basic shematic flow diagram of alkanolamine sweetening process