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Rate and equilibrium based modeling with the sequential quadratic programming optimization method for glycol dehydration of produced natural gas

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Abstract

Determining the optimum temperature and pressure for the dehydration of natural gas in a glycol absorption unit and the recovery of the glycol from the glycol water mixture in a desorption unit is of great importance. Although, the equilibrium base model for the absorption column design had been in use, the rate based model for the absorption unit offers a promising technique and had been proven to be more accurate in determining the parameters for the design. In this study, dehydration of a natural gas plant was modelled with optimization of its parameters. The effects on cost were adequately studied. Sensitivity analysis resulting from the simulation showed that a lower temperature for effective absorption of the water from the gas stream by triethylene glycol (TEGlycol) solvent is expected, while a higher temperature and higher reboiler duty is required for the regeneration of the solvent from the Rich TEGlycol stream in a distillation column. The sequential quadratic programming (SQP) direct optimization method was employed to optimize the major parameters of the natural gas dehydration plant. The optimum temperature of 267 °F and Reboiler duty of 169,789 Btu/h gave a 0.99 TEGlycol recovery purity. A minimized capital cost of 3.73 million US Dollars and operating cost of approximately 1 million US dollars was also observed.