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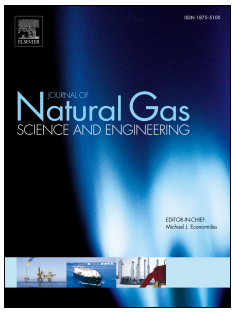

Simulation–based optimization of operating parameters for methanol synthesis process: Application of response surface methodology for statistical analysis

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Simulation–based Optimization of Operating Parameters for Methanol Synthesis Process: Application of Response Surface Methodology for Statistical Analysis

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Abstract:

In this study, the effect of changes in operating conditions is considered following a three–step procedure. Firstly, the process is simulated based on the design data for model validation and model–based optimization. The presented best-fitted kinetic and thermodynamic models in the literatures are utilized to analyze the trends and kinetic features related to methanol synthesis. The variations in the operating conditions such as the inlet temperature and the mole fractions of CO and CO_2 significantly affect the methanol production rate. Low operating performance of the heat exchangers and the alterations in operating conditions contribute to increase of the amount of purge gas of the process from its predicted quantity in the design condition. Since it has been anticipated that the purge gas may rise, a no–flow flare (zero flaring) has been designed and the excess of purge gas is burnt in this flare. Secondly, the process is simulated based on the operating data to calculate the streams conditions. Thirdly, the analysis and statistical optimization are performed. Applying response surface methodology (RSM), the operating conditions of this plant are optimized via simulator–based experimental design in order to maximize methanol production. RSM is a collection of mathematical and statistical techniques useful for modeling and analysis of problems in which a response of interest is influenced by several variables and the objective is to optimize this response. Consequently, the results of the statistical analysis prove that the methanol production rate increases by 7 % applying the optimal operating conditions.

Keywords: Methanol synthesis, Simulation, Optimization, Response surface methodology (RSM), Synthesis analysis, Design Expert

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