Surface Methodology Based on Process Simulation in Extractive Distillation

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Abstract:

Methylal can be blended in diesel oil to reduce gas pollutants and to improve performance of a diesel engine. Methylal (Dimethoxymethane, DMM) can be synthesized by the reversible reaction of methanol excess and formaldehyde or paraformaldehyde to eliminate the chemical equilibrium. A mixture of methylal and methanol can be separated by extractive distillation system that combines with an extractive distillation (EDC) and entrainer recovery (RDC) column. Disadvantage of the extractive distillation system is the great energy consumption especially in the EDC. The design of EDC needs to be optimized the energy consumption and product purity. In this work, a conventional entrianer (DMF) was substituted by a lower-toxic of entrainer such as propylene-glycol. The response surface methodology (RSM) was used to optimize the condition in EDC design. The parameters and their interactions had significant effect on energy consumption in the reboiler and product purity. The optimal parameters of EDC could be determined by RSM with simulation runs and the predicted results by the RSM gave good agreement with the simulated results. Purity of 99.90 % methylal was withdrawn in the overhead of the EDC that could be achieve.

Keywords: Azeotropic mixture ▪ Extractive distillation ▪ Propylene glycol ▪ Response surface methodology