Article outline

Figures and tables

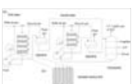
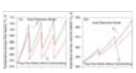


Table 1



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Axial dispersion modeling of industrial hydrocracking unit and its multiobjective optimization

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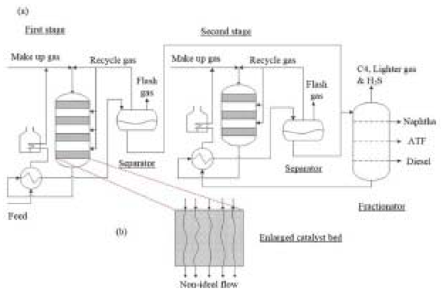
Highlights

- Industrial hydrocracker is simulated using a more realistic axial dispersion model.
- 25-lump kinetics is used with two separate lumps for sulfur and nitrogen compounds.
- A validated model is optimized multiobjectively using genetic algorithm.
- Results show considerable decrease in total hydrogen used in the process cycle.

Abstract

Hydrocracking is one of the most important refining operations used to crack heavy crude oil components into valuable lighter products. It processes less expensive, difficult to crack heavy feedstock to produce low sulfur and low aromatics content hydrocarbon fuels. In this study, a two-stage industrial hydrocracker is modeled using axial dispersion model to incorporate the mixing effects of feed flow. A 25-lump kinetics is used to simulate and validate the plant data. This validated model is then used for three-objective optimization in which the yields of aviation turbine fuel (ATF) and diesel are maximized simultaneously with minimization of the total amount of hydrogen required in a process cycle using a real-coded elitist non-dominated sorting genetic algorithm (RNSGA-II). The Pareto optimal results obtained show the 26% reduction in total amount of hydrogen required in a process cycle, with nearly same diesel and marginally low ATF production compared to plant data.

Graphical abstract



Keywords

Axial dispersion model; Multiobjective optimization; Hydrocracking; Genetic algorithm; Industrial optimization

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