

Optimization of heavy oil hydrocracking through process simulation

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Heavy crude oil upgrading technology is important due to depletion of light petroleum reserves. Among the upgrading technologies, slurry bed reactor system can process the heavy crude oil containing significant amounts of vanadium, chromium, and nickel metals, carbon residue, and asphaltene. The reactor system has many outstanding features over other reactor systems such as better reaction rate, higher heat transfer rate, less hot spot formation, etc. We propose to simulate and optimize the heavy oil hydrocracking using slurry bed reactor system. The mixture of heavy crude oil, hydrogen, and molybdenum based catalysts will be processed in 500ml batch reactor. GC, and H-NMR will be used to analyze the composition of reactants and products. Based on the results, the key reactions will be defined for possible hydrocracking reactions. The process will be simulated using Aspen Plus software to estimate the process operating conditions. Using data from the model, the scale-up model will be prepared to optimize the operating conditions and energy usage of the reactor system. In addition CFD modeling will be conducted to study the mass transfer and heat transfer in the reactor.