Chanin Sraphet 2010: Catalytic Cracking of Heavy Oil in A Downer Reactor with Heat Loss Through the Wall. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Terdthai Vatanatham, Ph.D. 149 pages.

A mathematical model of catalytic cracking of heavy oil in a downer reactor with heat loss through the wall was developed based on the dispersion model and 4-lump kinetics. The model was used to predict the product yield and the temperature distribution in non-isothermal, isothermal, and adiabatic cases. In this work, the effect of heat loss through the wall was included into the dispersion model of catalytic cracking of heavy oil in the downer reactor. The rate of heat losses through the wall was obtained from the heat transfer experiments. The overall heat transfer coefficient obtained experimentally was used to calculate the rate of heat loss and added in to the energy balance equation. The correlation of overall heat transfer coefficient is in the form of $U = 0.000408 G_g^{3.31} G_s^{1.37}$ kW/m^2.K. This equation is applicable in the temperature range of 300 - 560 ^{o}C, the solid flux of 2.2 - 5.6 kg/m^2.s, and the gas flux range of 3.8 - 5.8 kg/m^2.s. Simulation results show that the heat loss effect causes the axial temperature profiles in the simulated non-isothermal reactor to be lower than the adiabatic and isothermal cases. The reduction in temperature gives lower reactant conversion at the same feed conditions. At the ambient inlet solid temperature (35 ^{o}C), the reaction does not occur in the reactor. A high inlet solid temperature leads to a higher conversion. The conversion to products is affected by inlet gas temperature, inlet solid temperature, gas flux, and solid flux. The highest gasoline yield is obtained with isothermal downer reactor with high solid catalyst temperature and feeding rate and the length of 3 m.

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