289ab Hydrodynamic and Mass Transfer Parameters in a Slurry Bubble Column Reactor Operating under Fischer-Tropsch Conditions

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The present study focuses on the determination of the volumetric liquid-side mass transfer coefficient, (kLa), gas holdup, (εG) and the bubble Sauter mean diameter, (dS) for N2 and He in Fischer-Tropsch products (Sasol wax) in the presence and absence of Fischer-Tropsch catalyst (iron and alumina). The data were obtained in a pilot-scale slurry bubble column reactor of 0.3-m in diameter and 3-m high, operating under Fischer-Tropsch conditions. The transient physical gas absorption technique was used to determine kLa, the manometric method was used to calculate the gas holdup, and the Dynamic Gas Disengagement (DGD) technique was employed to determine the bubble size and bubble size distribution. The Central Composite Statistical design technique was adopted to investigate the effects of the pressure, temperature, catalyst loading, and superficial gas velocity on the reactor behavior.

Both the gas holdup and mass transfer parameters were found to increase with increasing the system pressure and to decrease with increasing the volumetric solid concentration. The increase of operating temperature and superficial gas velocity led to the increase of the gas holdup and mass transfer parameters. Increasing solid concentration significantly increased the Sauter-mean bubble diameter, while increasing pressure, temperature and superficial gas velocity had only weak influence on the Sauter-mean bubble diameter. Also, under similar operating conditions, the gas holdup values for N2 were always greater than those for He in SasolWax-Alumina slurry.