ABSTRACT

Hydrodynamics of Bubble Columns With Application
to Fischer-Tropsch Synthesis. (May 1988)
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In this study experiments were carried in two columns of 0.051 m and 0.23 m in diameter and 3 m tall to determine effects of liquid media (Fischer-Tropsch (FT) derived waxes and aqueous solutions), distributor type (sintered metal plate, single and multiple orifice plates), and operating conditions (superficial gas velocity and temperature). Experiments conducted with reactor waxes (Sasol and Mobil) at 200 °C and 265 °C produced hold-up values similar to those of pure liquids, whereas, experiments with paraffin waxes (FT-200 and FT-300) at 265 °C produced high hold-up values and large amounts of foam. But, at 200 °C low hold-up values were obtained and small amount of foam was produced.

In experiments with aqueous solutions it was found that, lowering the surface tension of distilled water changed it from strong coalescing medium to a non-coalescing medium producing high hold-up values accompanied by large amounts of foam. Increasing the viscosity of the foaming system by adding CMC (carboxymethyl cellulose) it was possible to suppress the foam and lower the gas hold-ups close to those of pure liquids.

Bubble size distribution and Sauter mean bubble diameters were obtained using a dynamic gas disengagement technique. Non-coalescing and foaming mediums produced smaller Sauter mean bubble diameter than the coalescing

mediums. Also, significant differences in Sauter mean bubble diameter were obtained with different mediums, even though the gas hold-ups were similar.

Hold-ups and specific gas-liquid interfacial area values for FT derived waxes, pure liquids, and aqueous solutions of butanol were correlated with existing literature correlations. Finally, average gas hold-up correlation was developed for aqueous mixtures of butanol and CMC using the results obtained in this study.