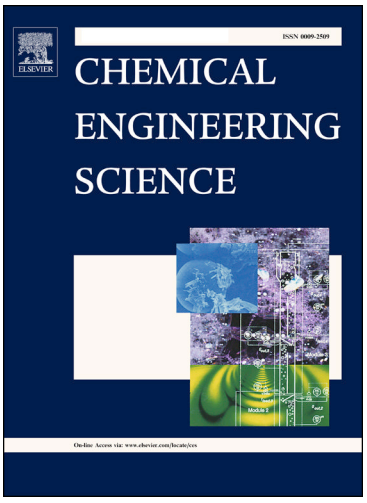

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Fischer-Tropsch synthesis in vertical, inclined and oscillating trickle-bed reactors for offshore floating applications

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Abstract Fischer-Tropsch synthesis performance in vertical, inclined and oscillating trickle-bed reactors for offshore floating applications was examined via a complex dynamic three-dimensional multiphase model based on volume-averaged mass, momentum, and species balance equations in liquid and gas phases and simultaneous diffusion and chemical reactions within the catalyst. Angular sinusoidal oscillatory motion of the trickle-bed reactor between vertical and an inclined position and between two inclined symmetrical/asymmetrical positions was examined. The behavior of inclined and oscillating Fischer-Tropsch trickle-bed reactors is atypical because the reactants in the main reactions originate from the gas phase and because a fraction of useful CO can be redirected in water gas-shift reaction. The performance of Fischer-Tropsch synthesis in the presence of water-gas shift reaction increases slightly with amplification of packed bed inclination even if the distortion of axial symmetry of liquid holdup and axial velocity radial distributions becomes considerable. Also, in asymmetric oscillating trickle-bed reactors the performance of Fischer-Tropsch synthesis is slightly improved. This enhancement is maximal for the reactor moving between vertical and an inclined position when the time-dependent waves of CO and H_2 conversion develop around the steady-state solution of the middle inclination angle. The oscillatory Fischer-Tropsch performance moves towards the steady-state solution of the vertical state when the asymmetry between two inclined positions diminishes. Symmetric oscillating trickle-bed reactors generate an oscillatory Fischer-Tropsch performance around the steady-state solution of vertical state which is affected by the angular motion parameters of the reactor.