

Hydrodynamic characteristics and model of fluidized bed reactor with immobilized cells on activated carbon for biohydrogen production

ABSTRACT

A mathematical model of minimum fluidization velocity (U_{mf}) was developed based on the hydrodynamic characteristics of the fluidized bed reactors (FBR) with immobilised cells attached to activated carbon at thermophilic biohydrogen fermentation. The maximum hydrogen productivity rate of 7.8 mmol H₂/L.h and hydrogen yield of 2.2 mol H₂/mol of sugar consumed was obtained when the HRT was shortened from 48 h to 6 h. The presence of the immobilised cells enriched the biomass composition in the FBR from 4.9 to 7.1 g VSS/L and maximum energy generated was 58.7 KJ H₂/L.d. The FBR had to be operated at a high U_{mf} of 0.05e0.44 cm/s and a low terminal velocity of 2.11 cm/s to prevent the immobilised cells from washed out from the FBR, hence achieved an adequate fluidization system. A screening of the microbial population by DGGE revealed that the *T. thermosaccharolyticum* sp. was dominant for all the HRTs, thereby indicating that this bacterium is resilient to environmental disturbances.

Keyword: Biohydrogen production; Immobilised cells; Hydrodynamic characteristics; Minimum fluidization velocity; Terminal velocity; Fluidized bed reactor