

Fungi solubilisation of low rank coal: Performances of stirred tank, fluidised bed and packed bed reactors

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Abstract

Coal biosolubilisation was investigated in stirred tank reactor, fluidised bed and fixed bed bioreactors with a view to highlight the advantages and shortcomings of each of these reactor configurations. The stirred aerated bioreactor and fluidised bioreactor represent slurry reactor systems enabling a comparative study. Direct comparison between these and the fixed bed bioreactor could not be carried as the corresponding particle sizes will result to a pressure drop in the fixed bed reactor. Coal solubilisation showed a higher coal weight loss in the stirred tank slurry bioreactor in comparison to the fluidised bed slurry bioreactor at 5% (w/v) coal loading and 600–850 μm coal fractions. Higher aeration is required in the fluidised bed bioreactor than in the stirred tank slurry bioreactor at constant coal loading and particle size because in fluidised bed bioreactor aeration was also used for mixing. Coal biosolubilisation in the packed bed bioreactor was minimal. The low performance was attributed to the large coal particle size fraction (1.5–2 mm) used. Minimal damage to the fungal culture was observed. However, clogging of bed by fungi resulted in channelling or misdistribution that ultimately leads to poor and unpredictable internal mass transport.