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Effect of hydrodynamic characteristics on the performance of biofilm for degrading phenol in inverse fluidized bed biofilm reactor

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ABSTRACT

The influence of some hydrodynamic effects on the performance of biofilm in inverse fluidized bed biofilm reactor (IFBBR) was studied with low-density polystyrene support particles of various sizes (2.9, 3.5, and 3.8 mm) using *Pseudomonas fluorescens* for the degradation of phenol. The biofilm reactor was operated under different superficial air velocities for a fixed settled bed height of particles to study the effect of hydrodynamics on biofilm thickness, biofilm dry density, bioparticle density, and attached and suspended biomass concentrations for efficient biodegradation of phenol. There is evidence that the chemical oxygen demand reduction and phenol degradation efficiency were found to be high at the optimized superficial air velocity with controlled biofilm thickness and for a stable and dense biofilm dry density. The results of the study revealed that with increase in superficial air velocity, the biofilm thickness and bioparticle density decreases while the biofilm dry density and suspended biomass concentration increases. However, above a critical superficial velocity (optimal superficial velocity) the detachment force does not control the outgrowth of the biofilm anymore and the thickness increases rapidly with decreasing suspended biomass concentration. The optimal superficial velocity for better biodegradation of phenol was found to 0.240, 0.220, and 0.230 m/s for the particle sizes of 2.9, 3.5, and 3.8 mm, respectively. The particle size of 3.5 mm has been found to be the optimal particle size for efficient biodegradation of phenol in IFBBR with better hydrodynamic effects and biofilm morphology.

Keywords: Hydrodynamics; Superficial air velocity; Biofilm; Inverse fluidized bed; Biodegradation

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