Biodegradation of p-hydroxybenzoic acid by Pseudomonas putida

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ABSTRACT

Due to the toxicity of p-hydroxybenzoic acid and its presence in a wide range of industrial wastewaters, new developments are needed to efficiently remove this phenolic pollutant. In this study, and for first time, pure Pseudomonas putida (DSM4478) culture was used for biodegradation of p-hydroxybenzoic acid in shake flask experiments at 28°C and concentrations between 0 and 200 ppm, obtaining removal rates of approximately 48 mg/L h under optimal conditions. Increasing initial p-hydroxybenzoic acid concentrations resulted in higher specific growth rates, lower yields, and longer lag phases. From batch experiments carried out with p-hydroxybenzoic acid as limiting substrate, the kinetic constants of the Monod equation were μm = 0.47 h⁻¹ and Ks = 19 ppm and the length of the lag phase increased linearly with p-hydroxybenzoic acid concentration. Under oxygen-limiting conditions, biomass yield, duration of the lag phase and specific growth rate were considerably reduced. Finally, using the fitting parameters obtained for the Gompertz model, the best conditions for maximum growth of the P. putida (DSM4478) and for a maximum assimilation rate of p-hydroxybenzoic acid per bacterium were also evaluated.

Keywords: Biodegradation; Gompertz model; p-hydroxybenzoic acid; Pseudomonas putida; Oxygen limiting conditions