

Phenol biodegradation by mixed culture in batch reactor — Optimization of the mineral medium composition

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ABSTRACT

A new phenol-degrading microbial consortium with high biodegradation activity and high tolerance to phenol was isolated from activated sludge for hazardous wastewater treatment (Boumerdès, Algeria). Biodegradation kinetics was determined by monitoring biomass and phenol consumption. Mineral medium composition and especially nitrogen source concentration, as well as culture pH, were optimized. The temperature (30°C), the stirring velocity (200 rpm) and the phenol concentration (125 mg L⁻¹) were kept constant; while the initial pH was varied (5–9), and the mineral components were tested in the following concentration ranges: 0.25–2 g L⁻¹ for (NH₄)₂SO₄, 1–4 g L⁻¹ for KH₂PO₄ and NaH₂PO₄ and 0.05–0.2 g L⁻¹ for MgSO₄. All experiments were carried out at a given initial bacterial concentration, 0.08 g L⁻¹ (based on optical density determination, 0.079). Irrespective of the culture conditions, total phenol degradation (125 mg L⁻¹) was recorded for culture times ranging from 20.6 to 31.2 h. The optimal mineral medium concentrations were therefore, 1, 3, 3 and 0.1 g L⁻¹ for (NH₄)₂SO₄, KH₂PO₄, NaH₂PO₄ and MgSO₄ respectively and the optimal pH was 8, leading to a specific growth rate of 0.64 h⁻¹. Higher maximum specific growth rate values were recorded during this work, if compared to those reported in the available literature, even those dealing with mixed culture. This result showed the relevance of the specific microbial consortium used.

Keywords: Biodegradation; Phenol; Microbial consortium; Batch kinetics

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