

High-rate biodegradation of petroleum hydrocarbons in a H₂O₂-induced bioreactor using the peroxidase-mediated process

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Abstract

A bacterial peroxidase-mediated oxidizing process was developed for biodegradation of total petroleum hydrocarbons (TPH) in the SBR. Complete biodegradation of high TPH concentration (7.5 g/L) attained in the bioreactor at a low amount (0.6 mM) of H₂O₂ and a reaction time of 22 h. The experimental specific TPH biodegradation rate level as high as 44.3 $mg_{TPH}/g_{biomass}\cdot h$ obtained in the process. The reaction time required for complete biodegradation of TPH concentrations of 2.5, 5, 7.5 and 10 g/L was 21, 22, 28 and 30 h, respectively. The catalytic activity of the hydrocarbon catalyzing peroxidases was determined to be 148.5 U/mg biomass. The biodegradation of TPH in seawater was similar to that in fresh media (no saline). The GC/MS analysis of the effluent indicated that all classes of hydrocarbons could be well-degraded in the H₂O₂-induced SBR. Accordingly, the peroxidase-mediated process is a promising method for efficiently biodegrading a concentrated TPH-laden saline wastewater.

Keywords: petroleum hydrocarbons, biodegradation, enzyme, peroxidase, salinity