

Degradation of chlorophenol mixtures in a fed-batch system by two soil bacteria

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Abstract

This work was undertaken to investigate the effect of variations of the feed rate on a fed-batch set-up used to degrade xenobiotics. The mixture of substrates was composed of PCP, 2,4,6 TCP and 2,3,5,6 TeCP (pentachlorophenol, 2,4,6 trichlorophenol and 2,3,5,6 tetrachlorophenol respectively). Two acclimated bacteria isolated from soil were used: *Pseudomonas aeruginosa* and *Achromobacter* sp. nov. The different flow rates tested were: I: 0.5 mL·min⁻¹, II: 1.67 mL·min⁻¹ and III: 2.00 mL·min⁻¹. Our results show that during fed-batch operation the 2,4,6 TCP exhibits an earlier degradation than the other compounds, for all of the flow rates tested. This indicates that in this case the degradation of the most recalcitrant compounds (PCP and 2,3,5,6 TeCP) is benefited by the increase in biomass of bacteria, due to the metabolisation of a less recalcitrant compound (2,4,6 TCP). The defined parameter, specific degradation rate (SDR), was demonstrated to be very useful for comparing the degradation abilities at different flow rates of a fed-batch system. The degradation efficiencies were shown to be higher than 90% for all of the cases and to decrease as the feed rate increases. However, the SDR, a parameter that involves the rate of degradation and the biomass, increases as the flow rate increases. At a feed flow rate of 2 mL·min⁻¹ SDR reaches a maximum of 12.476 x 10⁻¹⁰ mgCP·h⁻¹·CFU⁻¹. Finally, among the feed flows tested, taking into account both the degradation efficiency and the SDR, 2 mL·min⁻¹ is the most convenient flow rate for chlorophenol degradation in fed-batch systems. An even higher degradation efficiency (97%) can be achieved by using the feed rate of 2 mL·min⁻¹ followed by an additional batch post-treatment of 2 h, with a SDR of 13.136 x 10⁻¹⁰ mg CP·h⁻¹·CFU⁻¹.

Keywords: Chlorophenol; fed batch system; aerobic degradation; waste treatment; microbial biocatalysis