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edbiotec@ucv.cl
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La Rotta, Camilo E.; D'Elia, Eliane; Bon, Elba P.S.
Chloroperoxidase mediated oxidation of chlorinated phenols using electrogenerated hydrogen peroxide
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Pontificia Universidad Católica de Valparaíso
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Abstract

Chloroperoxidase (CPO) from Caldariomyces fumago catalyses the oxidation of several chlorinated phenols (CP) commonly found in industrial waste waters in the presence of hydrogen peroxide. This study compares the direct addition of hydrogen peroxide (DA) with its continuous electrogeneration (EG) during the enzymatic oxidation of CP. Reaction mixtures were studied containing chemically modified CPO, hydrogen peroxide and the phenolic substrates: phenol (P), 4-chlorophenol (4-CP), 2,4-dichlorophenol (2,4-DCP), 2,4,6-trichlorophenol (2,4,6-TCP) and pentachlorophenol (PCP), in 100 mM sodium-potassium phosphate buffer pH 6.0, at 25ºC. Results were compared in terms of residual phenol concentration (oxidation efficiency), precipitate formation (removal) and residual enzyme activity (stability). With the electrochemical system evaluated at -620 mV SCE, and continuous aeration the maximum H2O2 concentration of 1.2 mM was obtained. Under this conditions and after 4 hrs using EG, no phenol or 4-CP were detected, and 97%, 93% and 88% of 2,4-DCP, 2,4,6-TCP and PCP were degraded, respectively. The use of EG improves enzyme half-life time in comparison to the results obtained by DA.

Keywords

Biodegradation, bioelectrochemistry, Caldariomyces fumago, chlorinated phenols, chloroperoxidase, hydrogen peroxide electrogeneration.