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DETERMINATION OF OPTIMAL CONDITIONS FOR THE DEGRADATION OF MICROPOLLUTANTS BY LACCASE FROM *Trametes versicolor*

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Abstract

Many hydrophilic organic compounds present at low concentrations in municipal wastewater, such as several pharmaceuticals, biocides and pesticides, are recalcitrant in conventional wastewater treatment plants. To improve the biodegradation of these compounds, oxidoreductase enzymes such as laccases could be used. Laccase activity is, however, strongly dependent on the conditions of the treatment such as pH, temperature, reaction time and enzyme concentration. In this study, the optimal conditions for the degradation of two anti-inflammatory pharmaceuticals (Diclofenac and Mefenamic acid), one biocide (Triclosan) and one plastic additive (Bisphenol A) by laccase from *Trametes versicolor* were determined. Experiments were conducted in spiked solutions (20 mg L⁻¹ of each compound) at seven different pH values (from 3 to 9) and enzyme concentrations (from 10 to 190 mg L⁻¹), five different reaction times (from 1h to 7h) and three temperatures (10, 25 and 45°C) following a Doehlert experimental design. The results were then fitted with a quadratic model to determine the optimal values. All the chosen factors had a significant effect on the degradation of the micropollutants with the highest influence shown by pH. Optimal conditions vary from one compound to the other but lie between pH 4.5 to 6 and 30°C to 40°C. The experiments showed that a concentration of 100 mg L⁻¹ (725 U L⁻¹) of laccase was sufficient to obtain a good removal rate (> 90%). The four compounds were completely removed after 5 h with these optimal conditions, showing the high potential of laccases to improve biodegradation of environmentally persistent compounds.
