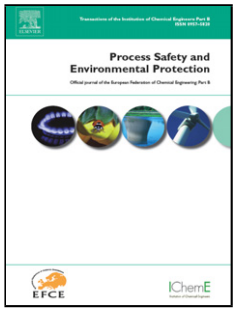

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PII: S0957-5820(17)30145-3
DOI: http://dx.doi.org/doi:10.1016/j.psep.2017.04.028
Reference: PSEP 1058

To appear in: *Process Safety and Environment Protection*

Received date: 25-8-2016
Revised date: 7-4-2017
Accepted date: 25-4-2017

Please cite this article as: Ortiz-Monsalve, Santiago, Dornelles, Juliana, Poll, Eduardo, Ramirez-Castrillón, Mauricio, Valente, Patricia, Gutterres, Mariliz, Biodecolourisation and biodegradation of leather dyes by a native isolate of Trametes villosa.Process Safety and Environment Protection http://dx.doi.org/10.1016/j.psep.2017.04.028

Biodecolourisation and biodegradation of leather dyes by a native isolate of *Trametes villosa*

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Highlights

- A Brazilian native fungal strain of *Trametes villosa* SCS-10 was able to biodecolourise and biodegrade different leather dyes;
- The biodecolourisation and biodegradation of dyes have been confirmed by UV-Vis and FTIR spectral analyses;
- *In vitro* and *In situ* conditions of treatment have been studied and compared;
- The amount of colour removal by enzymatic biodegradation and biosorption has been quantified by the use of the enzymatic inhibitor sodium azide (NaN_3).

Abstract

Dyeing is an important step in the leather manufacture process. Effluent from this stage contains some types of synthetic dye that may be a threat to the environment and human health. Biological treatment of dye-containing wastewaters by microorganisms has been presented as a cost effective and promising environmentally friendly alternative. In the present work, the potential of Brazilian native white-rot fungi strains, collected and screened to produce extracellular ligninolytic enzymes, was evaluated for the biodecolourisation and biodegradation of different azo tannery dyes. The strain SCS-10 showed high activity of ligninolytic enzymes and allowed the colour removal of dyes in solid media. This isolate was characterised morphologically and identified as *Trametes villosa*, based on a molecular analysis of the internal transcribed spacer (ITS) region sequences. *T. villosa* SCS-10 showed high biodecolourisation efficiency for the dyes assessed, achieving 95.71 ± 1.29, 92.76 ± 0.99 and 96.84 ± 1.39% for Acid Red 357, Acid Black 210 and Acid Blue 161, respectively, at 100 mg L^{-1}, 30 °C, pH 5.5 and 150 rpm, within 168 h of treatment. Remarkable peaks of laccase activity (1150–1550 UL^{-1}) were observed during specific periods in the biodecolourisation process. The complete inhibition of Lac activity by sodium azide (NaN_3, 0.1 mM) led to biodecolourisation values of 13.29 ± 0.93, 12.30 ± 0.46 and 20.05 ± 2.08% for AR357, AB210 and AB161, respectively. These results confirmed the main role of laccase in colour removal, although biosorption also had a minor involvement in biodecolourisation. *In vitro* assays also showed the efficiency of decolourisation of the leather dyes. The enzymatic crude extract produced by *T. villosa* allowed 85.45 ± 3.43 (AR357), 76.96 ± 1.39 (AB210) and 90.17 ± 0.97% (AB161) of biodecolourisation when enhanced by the use of the redox mediator 1-hydroxybenzotriazol