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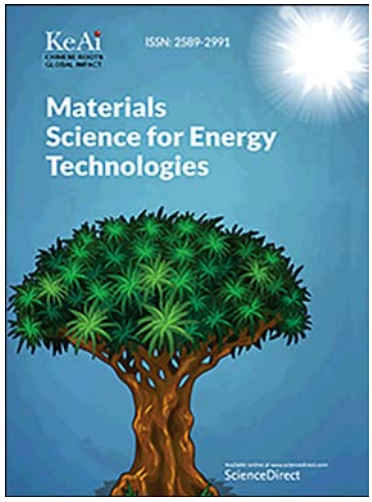

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Preparation, characterization and trifluralin degradation of laccase-modified cellulose nanofibers

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Abstract

Laccase, an oxidoreductase enzyme, can biodegrade persistent pesticides and other xenobiotics to less toxic monomers. The present work involves immobilization of laccase onto activated nanocellulose fibers (CNFs) extracted from bagasse. The laccase grafted CNFs were characterized by different techniques. %Immobilization and the activity, stability and reusability of the immobilized laccase was studied using 2,2-azino-bis-(3-ethylbenzthiazoline-6-sulfonic acid) as substrate. The %immobilization was calculated to be 85% with a maximum activity of 0.38 U/mg. 60.5% activity was retained even after 15 repeated uses of the immobilized enzyme. Moreover the immobilized enzyme was found to be stable with 75% relative activity after a period of 45 days. The laccase grafted CNFs were evaluated in degradation of trifluralin, a toxic pesticide resistant to natural transformation or degradation processes, in the presence of humic monomers, guiacol and catechol. Results show 100% degradation of trifluralin in 24h in the presence of guiacol as mediator.

Keywords: Biowaste utilization; Cellulose nanofibers; Laccase immobilization; Trifluralin degradation; Reusability and storability

1. Introduction

Laccase (EC 1.10.3.2, *p*-diphenol: dioxygenoxidoreductase), a biocatalyst belonging to the family of oxidases, has been successfully extracted from a wide range of fungi.[1] It is blue in colour due to the presence of a cluster of four copper atoms that form the catalytic core of the enzyme. It catalyzes oxidation of toxic aromatic substrates such as phenols and amines to non-toxic monomers, dimmers or polymers with the help of a molecule of oxygen.[2] Laccase has been shown to mediate degradation or covalent coupling of pesticides and other xenobiotics with