

Enhancing laccase activity towards Phenanthrene degradation: a systematic analysis using *Phellinus noxius* BRB 11 laccases with three synthetic mediators

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Abstract

Purpose: Polyaromatic hydrocarbons (PAHs) are carcinogenic, mutagenic, highly persistent and recalcitrant compounds present in various environments. This study was performed on Phenanthrene (PHE) degradation enlisted by US-EPA in 16 PAHs group needs to be degraded using eco-friendly strategies. PHE (100 ppm) final concentration was subjected to only crude laccase enzymes degradation, and with the addition of 1-Hydroxybenzotriazole (1-HBT), 2,2,6,6-Tetramethylpiperidinyloxy (TEMPO), and Violuric acid (VA) as mediators.

Methods: These mediators were used in 0.1, 0.3, 0.5, 1, 2, 3, and 4 mM concentration. Solid State Fermentation was performed by *Phellinus noxius* BRB 11 species using Oil Palm Empty Fruit Bunch (OPEFB) biomass as media for crude laccase production.

Results: This study showed promising results for PHE degradation within 6 hours of incubation using crude laccase with mediators. TEMPO was the most efficient mediator with highest degradation rate on 0.1 mM following until 2 mM concentration. PHE degradation was high at 0.1 mM but starts decreasing as 1-HBT and VA mediators approached to higher concentrations. Four metabolites; 9-Phenanthrol, 9,10-Dihydro- 9,10-dihydroxyphenanthrene, Phenol, 2-methyl and Phenol, 3-methyl were detected by GC-MS and the possible pathways was identified. Toxicity analysis revealed that degraded compound was less toxic to *Artimia salina* and *Vigna radiata* species.

Conclusion: This study represents a strong optimization data using these three mediators which could be used for future research to enhance environmental pollutants degradation.

Keywords: Crude laccase, Synthetic mediators, Phenanthrene, Biodegradation, Bio- detoxification