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Research Paper

Degradation of benzo[*a*]pyrene by *Pleurotus ostreatus* PO-3 in the presence of defined fungal and bacterial co-cultures

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Benzo[*a*]pyrene, a high molecular weight polycyclic aromatic hydrocarbon possesses carcinogenic, teratogenic, and mutagenic properties. The present study focuses on benzo[*a*]pyrene degradation by *Pleurotus ostreatus* PO-3, characterization and identification of metabolites produced and the extent of degradation in the presence of axenic culture of *P. ostreatus* PO-3 and defined co-cultures of the basidiomycete with bacteria and non-basidiomycete fungi. Thin-layer chromatography revealed that *P. ostreatus* PO-3 transformed benzo[*a*]pyrene to polar metabolites. Following degradation, appearance of numerous peaks in the mass spectrum indicated that benzo[*a*]pyrene degradation was a result of the metabolic activity of *P. ostreatus* PO-3. A degradation product corresponding to the *m/z* 284.2 was detected which could possibly be B*a*P-quinone, resulting from the oxidation of benzo[*a*]pyrene. Compared to the axenic culture of *P. ostreatus* PO-3 (64.3%), co-cultures of *P. ostreatus* PO-3 and *Penicillium chrysogenum* MTCC 787 and *P. ostreatus* PO-3 and *Pseudomonas aeruginosa* MTCC 1688 could degrade 86.1 and 75.1% of benzo[*a*]pyrene, respectively. Thus it could be inferred from the present investigation that the combined catabolic activities of *P. ostreatus* PO-3 with bacteria and non-basidiomycete fungi can produce synergistic effects to enhance B*a*P degradation. The increase in the generation of polar metabolites as degradation products from the recalcitrant parent compound advocates the potential application of *P. ostreatus* PO-3 in benzo[*a*]pyrene bioremediation.

Abbreviations: B*a*P – benzo[*a*]pyrene; HMW PAH – high molecular weight polycyclic aromatic hydrocarbon; HPLC – high performance liquid chromatography; *m/z* – mass-to-charge ratio; TLC – thin layer chromatography

Keywords: *Pleurotus ostreatus* PO-3 / Benzo[*a*]pyrene / B*a*P-quinone / Co-cultures / Bioremediation

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Introduction

High molecular weight polycyclic aromatic hydrocarbon (HMW PAH) such as benzo[*a*]pyrene (B*a*P) has been listed by the United States Environmental Protection Agency (USEPA) as a priority pollutant owing to its recalcitrant nature. It also behaves as a potent teratogen, mutagen, and carcinogen. Utilization of B*a*P is affected by its low water solubility, resulting in decreased availability for microbial degradation [1].

Several white-rot fungi such as *Phanerochaete chrysosporium*, *Trametes versicolor*, *Stropharia coronilla*, *Pleurotus ostreatus*, *Irpex lacteus*, *Bjerkandera adusta*, etc. can rapidly oxidize B*a*P with their extracellular lignin modifying enzymes such as lignin peroxidases, manganese peroxidases, laccases, and other oxidases thereby raising interest in the use of these basidiomycetes for the degradation of B*a*P. However, the inability to isolate a single potent microbial culture showing complete B*a*P mineralization indicates that such a process in nature is mediated by the cooperative metabolic activities of mixed microbial populations [2].

While B*a*P degradation by various white-rot fungi is well documented, there is considerably lesser knowledge

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