EXPLORING THE POTENTIAL OF FUNGAL ENZYMES FROM THE GENUS *CYCLOCYBE* FOR EFFICIENT BIODEGRADATION OF SYNTHETIC POLYMERS

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ABSTRACT

The global concern over synthetic plastic waste has intensified, with 22 million metric tons entering the environment annually, contributing to a total accumulation of over 6 gigatons since the widespread plastic production began in 1950. Current strategies to alleviate this environmental burden are inadequate, necessitating alternative and sustainable approaches for tackling plastic pollution[1,2]. Microbial enzymes, particularly those from fungal strains, are emerging as biotechnological tools for waste circularity. The broad enzymic machinery of fungi, capable of degrading not only recalcitrant organic compounds such as lignin, cutin, and waxes but also xenobiotics with similar structures, demonstrates the potential for plastic materials degradation[3]. This study aimed to evaluate various strains of the genus *Cyclocybe* (Basidiomycota) for their ability to depolymerize plastics and, one step further, to identify the possible enzymatic mechanism. Screening of 29 fungal strains for polymer-degrading activity was conducted on agar plates containing synthetic polymers, including polyester and polyether polyurethane. Strain identification at the species level was achieved through the study of morphoanatomic characteristics and DNA sequencing. Positive biodegradation results led to the selection of strains for evaluation in submerged fermentations using the mentioned polymers as sole carbon sources. Throughout the fermentation process, culture supernatants were assayed for turbidity, protein content, while selected oxidative and hydrolytic enzymatic activities were quantified through spectrophotometric assays. Substrate degradation was assessed for potential chemical modifications via ATR-FTIR spectroscopy. The established screening foundation could predict enzymic activity on synthetic polymers, providing a crucial tool for discovering novel enzymes, supporting the potential of fungi and their enzymic machinery as powerful tools for degrading plastic waste.

KEYWORDS

Plastic, biodegradation, fungi, screening, biocatalysis

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