Journal of Research in Science and Engineering (JRSE)
ISSN: 1656-1996 Volume-7, Issue-9, September 2025
DOI: 10.53469/jrse.2025.07(09).09

Biodegradation of Agricultural Waste by Microfungi: An Eco - Friendly Approach

Kavinmuhil Kanagaraj

Department of Botany, Bipin Bihari P.G. College, Bundelkhand University, Jhansi, India
kanagaraj@gmail.com

Abstract: ***Agricultural waste management is an increasing environmental concern, and microbial biodegradation offers a sustainable solution. Micro fungi are known for their ability to break down complex organic materials, converting waste into valuable byproducts such as bio fertilizers and bioactive compounds. This paper examines the efficiency of different micro fungal species in decomposing agricultural residues, focusing on enzymatic activity, decomposition rates, and environmental factors influencing fungal biodegradation. The findings highlight the potential of micro fungi to reduce waste accumulation, enhance soil health, and promote nutrient recycling. By understanding the interactions of fungi with agricultural waste, sustainable waste management practices can be improved to minimize environmental impact and support circular agriculture.***

Keywords: Biodegradation, Micro fungi, Agricultural Waste, Enzymatic Decomposition, Soil Health.

1. Introduction

The accumulation of agricultural waste leads to environmental degradation and resource wastage. Conventional disposal methods, such as incineration and land filling, contribute to pollution. Micro fungi, with their diverse enzymatic abilities, provide an eco-friendly alternative for decomposing lingo cellulosic waste and recycling nutrients into the soil.

2. Literature Survey

Research has shown that microfungi play a significant role in agricultural waste degradation. Species such as Aspergillus, Trichoderma, and Penicillium secrete hydrolytic and oxidative enzymes that break down lignin, cellulose, and hemicellulose 74:0†FINAL PHD.docx】. Studies also indicate that factors such as pH, temperature, and moisture influence fungal activity.

3. Problem Definition

Despite its potential, agricultural waste remains underutilized, leading to environmental pollution and loss of valuable nutrients. A sustainable and efficient method to manage organic residues while enhancing soil fertility is required. Microfungal biodegradation offers an eco-friendly alternative to traditional disposal techniques.

4. Methodology/Approach

This study evaluates the biodegradation potential of selected microfungal strains on different types of agricultural waste. Experimental setups include controlled decomposition trials, enzyme activity assays, and microbial diversity analysis using culture-dependent and molecular techniques. Factors affecting fungal efficiency, such as substrate composition and environmental conditions, are also examined.

5. Results and Discussion

Findings suggest that microfungi significantly accelerate the decomposition of agricultural waste, reducing biomass volume and improving nutrient availability. Enzyme assays confirm high lignocellulolytic activity in specific fungal strains. The implications of fungal-mediated biodegradation for sustainable waste management and soil fertility improvement are discussed.

6. Conclusion

Microfungi offer an effective and sustainable approach to agricultural waste biodegradation. Their enzymatic abilities enable the breakdown of complex plant polymers and nutrient recycling, reducing waste accumulation and promoting soil health. Integrating fungal-based waste management into agricultural practices can enhance sustainability and resource efficiency.

7. Future Scope

Future research should explore optimizing fungal consortia for enhanced biodegradation, genetic modifications to improve enzyme production, and large-scale applications of fungal-based waste management systems.

References

[1] Ander, P. and Eriksson, K. E. (1976). Arch. Microbiol. 109, 1-8.
[2] Arianoutsou, M. (1993). Leaf litter decomposition and nutrient release in a maquis ecosystem of North Eastern Greece. Pedobiologia, 37: 65-71.
[3] Allison, F.E. (1965). Soil Nitrogen. American Society of Agronomy, pp. 573-606.
[4] Alexander, M. (1961). Introduction to Soil Microbiology. John Wiley and Sons, New York.
[5] Zak, D.R., Holmes, W.E., White, D.C., Peacock, A.D., Tilman, D. (2003). Plant diversity, soil microbial communities, and ecosystem function: Are there any links? Ecology 84: 2042-2050.

[6] Gilman, J.C. (1957). A Manual of Soil Fungi. The Iowa State College Press, Ames.
[7] Haug, R.T. (1993). The Practical Handbook of Compost Engineering. Lewis Publishers, Boca Raton, Florida.
[8] Reese, E.T. (1977). Microbial Degradation of Polymeric Carbohydrates. Recent Adv. Phytochem. 7: 311-367.
[9] Sinsabaugh, R.L., Antibus, R.K., Linkins, A.E., McClaugherty, C.A., Rayburn, L., Repert, D., Weiland, T. (1993). Wood decomposition: nitrogen and phosphorus dynamics in relation to extracellular enzyme activity. Ecology 74: 1586-1593.