

## Cutinase as a Sustainable Solution for Plastic Pollution through Enzymatic Plastic Degradation

Bhavya Makwana

Department of Microbiology, Faculty of Science Marwadi University, Rajkot-Morbi Road, Rajkot, Gujarat, India

Dr. Anjisha Maharshi\*

Department of Microbiology, Faculty of Science Marwadi University, Rajkot-Morbi Road, Rajkot, Gujarat, India

### Abstract:

Plastic pollution has emerged as critical global environmental issue due to massive increase in plastic production, exceeding 431 million metric tons annually, with only 20–25% of plastic is recycled. Traditional plastic waste management methods, including physical and chemical recycling, are often inefficient, and energy-intensive. In this context, enzymatic biodegradation using microbial enzymes such as cutinase offers promising eco-friendly alternative. Present study focuses on the isolation, screening, production, and characterization of cutinase-producing fungi from plastic-contaminated environments. Total 16 fungi isolates were obtained from plastic waste samples collected at dumping sites, out of which 7 isolates showed positive activity on Rhodamine-B agar, indicating potential polyester-degrading capability. Morphological characterization suggested that the dominant isolates belonged to *Aspergillus* and *Penicillium* species. The selected isolates were subjected to enzyme production using czapek-dox medium supplemented with nylon and PVC as carbon sources under static fermentation conditions. Cutinase activity was confirmed using p-nitrophenyl butyrate assay, demonstrating hydrolytic activity through release of p-nitrophenol. Enzyme purification was performed using column chromatography, and SDS-PAGE analysis revealed a protein band of approximately ~38 kDa, confirming the presence of cutinase. Optimization studies indicated that enzyme exhibited maximum activity at 20–25°C and pH range of 7–9, with metal ions influencing enzymatic performance at 1 mM concentration. Among the isolates, VS5, BV1, and UK1 showed significant enzyme production and activity. Overall, this study highlights the potential of fungal-derived cutinase as effective biocatalyst for plastic degradation. The findings contribute to development of sustainable and ecofriendly strategies for managing plastic waste through enzymatic approaches.

### Keyword:

Biodegradation, Cutinase, Enzyme, Fungi, Plastic.