

# Chapter 7

## Employing Biotechnology for the Treatment of Organic Refuse

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### **ABSTRACT**

*Waste accumulation has become an alarming issue to the environment. The treatment of organic waste through biotechnological approaches has emerged as a promising solution to improve the quality of health and nature. The wide range of methods includes microbial consortia, enzymatic process, employing genetically engineered organisms and degradation, conversion and valorisation of organic waste. Large scale application of bioremediation, anaerobic digestion and composting prove highly effective and potential. Advancement in the field of synthetic biology and metabolic engineering have enhanced the use of specific microorganism to allow improvement in the yield value of by-product like biogas, biofuels and biofertilizers. Integration of biotechnology in organic waste management not only helps in curbing environmental pollution but also contribute to the circular economy by converting waste products into resources. Hence, this integration is essential for the achievement of sustained waste management and for the recovery of resource.*

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## 1. INTRODUCTION

An increase in the industrialization and urbanization in recent years has led to an uncontrolled increase in organic waste, that led to posing serious damage to health and the environment. Traditional methods of waste management, like landfilling and incineration are unsustainable method of waste management due to its limitation in resource recovery and environmental damage. Hence, biotechnological approaches have been developed its way in sustainable solution for treatment and valorisation of organic waste (Ashokkumar et al., 2022).

Biotechnology is efficient in harnessing metabolic capabilities of microorganisms, enzymes and plants, allowing organic waste to get degraded, transform and get converted into valuable product. This application of biotechnology methods and technique not only help in efficient management of waste but also help in circular economy by recovering of resources and converting it into renewable energy. Various techniques such as composting, bioremediation and anaerobic digestion make use of natural biological processes that allows breaking down of organic matter leading to production of biofuels, biogas, biofertilizer and other bio-based materials (Ezejiolor et al., 2014; Wang et al., 2013).

Various biotechnological innovations have resulted in efficient waste management and its upcycling. This advancement increased the specificity and efficiency of biotechnological processes. Genetically engineered microorganism has modified their ability to target a specific type of waste and to transform it into specific type of organic waste, optimizing its degradation pathway and converting it into valuable by-products. These innovations can be implied on a large scale, and this provide an alternative for conventional waste management techniques (Ezejiolor et al., 2014).

This chapter focuses on the potential of biotechnology to create sustainable future. The latest development in biotechnology, such as organic waste treatment, and its potential challenges and understanding of their mechanisms are highlighted in this chapter.

## 2. APPLICATION OF BIOTECHNOLOGY IN SEVERAL FIELDS

Biotechnology plays a crucial role in several areas of organic refuse treatment, not only prevents environment degradation, but also provide leverage biological processes by converting waste into productive compounds. Hence, biotechnology is efficient in maintaining the sustainability of environment as well as health. The first application of biotechnology in organic refuse finds in bioremediation, where bacteria and fungi are incorporated to break down hazardous substances like pesticides, heavy metals, and petroleum hydrocarbons, they convert these toxic compounds in less hazardous compounds. This method maintains the ecological balance by degrading and detoxifying organic pollutants by employing these microorganisms. Microorganisms also finds its efficiency in composting technique, where bacterial and fungi are used to convert organic waste into nutrient rich soil amendment. This process is aerobic decomposition of organic waste into humus that plays crucial role in maintaining fertility and health of soil. This method is extremely helpful in reducing use of landfills (Hershberger, n.d.).

- a. **Anaerobic digestion** is another important application of biotechnological process. Under this process microorganism break organic waste under complete absence of oxygen and convert it into biogas i.e., mixture of methane and carbon dioxide along with a digestate. Anaerobic digestion is very efficient in managing waste effluents from livestock, food processing and wastewater treatment plants. The

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