Chapter 3
Emerging Biotechnological Methods for Industrial Wastewater Treatment

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ABSTRACT

Numerous bacterial species convert hazardous substances into smaller, environmentally benign compounds. This process is known as biological wastewater treatment. The ability of the microorganisms to remove waste on their own & collaborate with one another is what determines how effectively the biotreatment approach performs. This chapter explores how bacterial species eliminate organic pollutants from wastewater through biotechnological methods like composting, bioremediation, and biodegradation. It highlights the effectiveness of these environmentally friendly techniques and the crucial role biotechnology plays in wastewater treatment. The chapter reviews various biotechnological approaches, emphasizing that bioengineering techniques are more beneficial for human health and water quality compared to chemical methods. While these techniques are promising, further development

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is needed to fully capitalize on their benefits.

1. INTRODUCTION

As water makes up between 65 and 70 percent of the human body, it is necessary for all living organisms. Water is still the most important element since without it, there would be no life on Earth. Water that has been used and includes impurities that lower its quality is referred to as wastewater. Heat, silt, organic matter, radioactive materials, synthetic substances, and decomposing organic matter are examples of pollutants. Remembering that most of the trash in our garbage is biological is crucial (Sathya et al., 2023). As a kind of self-cleaning, rivers are able to absorb and break down some of these biological contaminants. Even while the natural world can purify itself, human activity generates much more biological waste than the stream can process. Contaminated water is responsible for around 30% of diseases and 40% of deaths globally, according to the WHO. Therefore, it's essential to create techniques for waste material cleaning that allow for reuse without endangering the environment (Saini et al., 2023).

In today's environment, the industrial sector has thrived. Significant industrial activity generates large amounts of waste, particularly wastewaters, which are very desired for reuse given the paucity of potable water in most countries. When trash is removed, serious environmental problems arise (Zhang & Wu, 2007). As a consequence of the expansion and development of new products, manufacturing lines encounter new and persistent waste forms (González et al., 2018). These pollutants would be too much for convectional wastewater systems to handle, exacerbating the world's already severe drinking water problems. Therefore, it is essential to discover creative strategies to reduce the effect of wastewater on the environment that is already degraded. However, clean, fresh drinking water has become scarce due to pollution from heavy industry, especially in the majority of African countries (Moscoviz et al., 2016). This chapter's primary focus is on the most current advancements in biological and membrane wastewater treatment technology. Membranes are a very inventive kind of cleaning technology that are widely used and have a significant impact on many different sectors, including the processing of greasy and oily industrial water (Wu et al., 2020).

Conventional biological wastewater treatment is widely employed in residential, municipal, & commercial settings to remove organic contaminants and break down fertilizer. Anaerobic and aerobic are the two categories of organic waste cleanup methods (Fei et al., 2010). While aerobic therapy needs air for the bacteria to break down organic molecules, anaerobic therapy may operate in oxygen-free settings. While trickling screens and rotating biological contactors are examples of linked