Chapter 9
Using Phytoremediation to Treat Industrial and Pharmaceutical Wastewater:
Innovations and Future Prospects

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ABSTRACT

Phytoremediation is an economical, environmentally friendly and effective technology that uses plants to treat wastewater. This research focuses on phytoremediation of wastewater industrial and pharmaceutical. Certain fresh plant species, such as Lemna minor, Salvinia minima, Ipomoea aquatica and Centella asiatica, have been shown to decontaminate wastewater environments. For example, these plants helped reduce total suspended solids (TSS) from 50.8% to 85.6%, ammonia nitrogen (NH3-N) from 79.1% to 97.3% and chemical oxygen demand (COD) from 36.46% to 82% in wastewater. The exact results depend on the type of plant and its operating time. In addition, microalgae such as Chlorella pyrenoidosa and Scenedesmus almeriensis have been shown to be highly effective in removing heavy metals such as cadmium (57.14% in just 3 hours) and arsenic (40.7% in 3 hours). In conclusion, phytoremediation is a promising approach in the water treatment sector, particularly for industrial and pharmaceutical wastewater which is heavily contaminated with complex and toxic substances.

1. INTRODUCTION

Wastewater treatment is an important technology in our present day, which is highlighted in a context where scarcity of drinking water and water deficit related to climate change pose major challenges (Ganthavee and Trzcinski, 2023; Jyoti et al., 2024). This is a very complex technique, especially for industrial and pharmaceutical wastewater. This is because these wastewaters often contain chemicals and heavy metals that can be difficult to remove, which pose serious hazards to the environment and human health (Liu et al., 2021; Ruziwa et al., 2023).

Wastewater treatment is a fundamental factor in the preservation of the environment and the sustainable management of water resources. However, traditional methods, such as chemical or physical treatment, have significant weaknesses, including high cost, high energy consumption and the production of environmentally harmful by-products (Deng et al., 2023). As a result of these limitations, there has been a growing exploration of more sustainable and environmentally friendly solutions, among which phytoremediation occupies a central place. This is a biological method that uses the ability of plants to absorb, degrade or stabilize contaminants,