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Chaudhery Mustansar Hussain
Neha Srivastava
Ghazanfar Hussain *Editors*


# Fungi in Wastewater Treatment

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*Editors*
Chaudhery Mustansar Hussain
Chemistry and EVSC
New Jersey Institute of Technology
Newark, NJ, USA

Ghazanfar Hussain
Department of Education Lahore
Division of Science and Technology
Lahore, Pakistan

Neha Srivastava
Indian Institute of Technology (BHU)
Department of Chemical Engineering
&Technology
Varanasi, Uttar Pradesh, India

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# Chapter 17
# Economic and Regulatory Aspect of Fungal Bioremediation

**Shom Prakash Kushwaha, Pushpendra Soni, Syed Misbahul Hasan, Kishley Mishra, Alisha Bano, and Ahsan Ahmad Khan**

**Abstract** Fungal bioremediation is the process of detoxification and degradation of environmental pollutants through the metabolic capability of fungi. It involves heavy metals, hydrocarbons, and persistent organic compounds. Fungi possess diverse enzymatic systems like laccases, peroxidases, and hydrolases that convert contaminants into less toxic forms. It thus serves as an eco-friendly and cost-effective method to reduce pollution. Filamentous fungi are especially suited to wastewater treatment because they can convert organic material directly into proteins, carbohydrates, and valuable byproducts in accordance with circular economy principles. Lifecycle assessments are critical in determining the economic and environmental impacts of fungal-based remediation, mainly when fungi are grown on wastewater for food and feed purposes. Compliance with regulations is important in ensuring the safety and acceptability of products derived from fungi, especially regarding food and agricultural applications. The greatest challenge is still to public perception, and hence education and transparency will be critical to achieve more general acceptance. Market trends indicate massive growth in fungal bioremediation due to tighter environmental regulations, the social responsibility of companies, and increased demand for sustainable technologies. China, the United States, and Europe dominate patents and innovation in this area. Although fungal bioremediation still holds much promise, it still holds hurdles such as scale in operation, significant capital investment, the regulatory barrier, and the variability of environments. Innovations in omics technologies and hybrid remediation models are in process to overcome this limitation. Fungal bioremediation mitigates hazards caused by environment without producing unwanted economically non-viable by-products as it produces value adding byproducts of enzymes, biofertilizers and bio-energy for the mitigation of global environmental challenges.

S. P. Kushwaha · P. Soni · S. M. Hasan (✉) · A. Bano · A. A. Khan
Faculty of Pharmacy, Integral University, Lucknow, Uttar Pradesh, India
e-mail: deanphar@iul.ac.in

K. Mishra
Hygia Institute of Pharmaceutical Education and Research, Lucknow, Uttar Pradesh, India


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## 17.1 Introduction

Fungi are eukaryotic microorganisms with heterotrophic mode of nutrition. Certain fungi are very useful for us as they can produce important chemicals like antibiotics. Fungi have a power to change nutrients so that plants can use them. As decomposers, certain fungi recycle nutrients and increase their availability in the soil by breaking down plant and animal waste. Eukaryotic microorganisms include fungi. Moulds, yeasts, or a mix of the two can be considered fungi. Certain fungus can cause allergic, systemic, cutaneous, subcutaneous, and superficial illnesses. Yeasts are tiny fungi made up of single cells that procreate by budding. In contrast, moulds grow by apical extension and form long filaments called hyphae (Fig. 17.1). Large amounts of sludge are produced during wastewater treatment, which must be cleaned, reused, or disposed of to protect the environment and reap the greatest possible advantages. Along with organic materials, the raw wastewater sludge contains a significant amount of water (over 90%), which makes transportation, treatment,

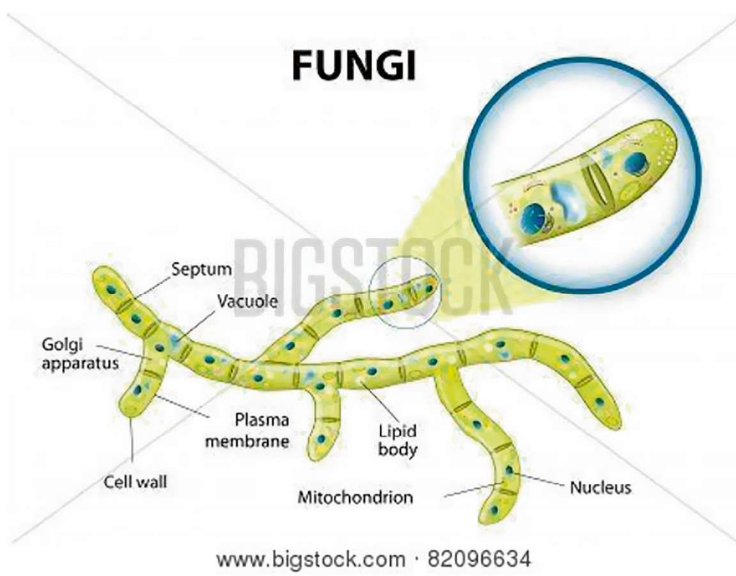


**Fig. 17.1** Structure of a fungal mycelium bioremediation