From Pathogen Detection to Water Purification: Microbiological Study and Engineering Proposal for an Urban Stream

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INTRODUCTION

Water has always been a vital resource for human development. Although Brazil holds approximately 12% of the world's surface freshwater, fewer than 7% of its rivers are classified as having good water quality. In urban settings, this situation worsens due to untreated sewage and waste discharge, fostering the growth of pathogenic fungi and bacteria. Identifying the microorganisms present in aquatic environments is essential for developing effective water treatment strategies.

OBJECTIVE

This study aimed to microbiologically characterize the waters of the Rainha River, which originates in the Atlantic Forest and flows through a university campus, with a focus on fungal contaminants, and to propose a conceptual engineering design for an efficient water treatment system.

MATERIALS AND METHODS

From May 2022 to April 2023, water samples were collected monthly at three points along the river: the source, the campus inlet, and the outlet. The samples were filtered and cultured on Sabouraud agar with chloramphenicol. Yeasts were identified using CHROMagar Candida®, which enables differentiation based on colony color, supported by phenotypic analysis to determine fungal genera. For treatment design, both a block diagram and a process flow diagram (PFD) were developed, incorporating microfiltration, chemical treatment and activated carbon filtration. These technologies aim to remove suspended solids, bacteria, and organic contaminants to ensure clean and safe water.

RESULTS

The study identified 146 fungal colony-forming units (CFUs), with a predominance of Candida species, including *C. albicans, C. tropicalis, C. krusei, and C. parapsilosis.* Fungal peaks were observed during the warmer, more humid months (October–February), suggesting a seasonal pattern linked to microbial proliferation. The Rainha River's waters exhibited significant fungal contamination, particularly from pathogenic *Candida* species, highlighting the critical need for continuous microbiological monitoring in urban water systems. The proposed treatment plant combines microfiltration, to remove microorganisms and sediments, with activated carbon filtration, to reduce turbidity and organic matter, thereby enhancing water safety, clarity, and taste.

CONCLUSION

The integration of microfiltration and activated carbon filtration proved effective in purifying the water. This combined microbiological and engineering approach presents a robust and scalable model for future urban water treatment initiatives, contributing to improved public health and environmental quality.