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Revolutionizing Industrial Wastewater Treatment: Harnessing the Power of Purely Biological Methods

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ABSTRACT

In recent years, the textile industry has experienced significant economic growth and growing consumer demand. The textile industry is one of the biggest consumers of water and producers of wastewater, which unfortunately makes it one of the main contributors to environmental pollution worldwide. The main objective of the present study is to explore the capacity of newly isolated actinobacterial strains in the treatment of industrial textile wastewater, the results indicated that the isolates S30, S98, and S150 appeared to have the highest ability to decolorize Congo red dye reaching 96.35%, 90.63%, and 97.12% respectively after 48h. whereas, tyrosinase and azoreductase were the main activities who intervene in the dye degradation. Dye degradation metabolites were identified using FTIR and GC-MS analysis. Through this investigation we can confirm that the aforementioned strains are good candidate for treatment of highly colored textile wastewater.

1 Introduction

Inappropriate disposal and dumping of textile waste, which contains harmful chemicals, is detrimental to air, water and soil quality[1]. Synthetic dyes are used excessively in various sectors, including the textile, pharmaceutical, food, paper and cosmetics industries[2][3] . Their reduction through the process of degradation before being eliminated deserves the attention of scientists and the public alike, as most of them are carcinogenic or mutagenic[2]. The biological approach via microorganisms will be privileged in favor of their biodegradation and bioremediation potential, and investment in the treatment of these effluents by a purely biological pathway presents a sheep and prominent alternative to the physical-chemical treatments[4]. Actinobacteria are targeted as they are particularly well-suited to wastewater treatment as well, due to their different metabolic pathways that function under a wide range of extreme conditions[5].

2 Experimental

Soil and textile effluent sampling was carried out at a textile industry in the Bejaia region, isolation was carried out using two types of pretreatment: chemical and thermal, and without pretreatment. The study focused on the dye classes most widely used in Algeria, namely reactive dyes. The activities of laccase, lignin/manganese peroxidase and azoreductase were studied and highlighted by qualitative and quantitative tests in batch systems. Degradation of the tested dyes was assisted with UV-VIS spectrophotometry and dye degradation metabolites were identified by FTIR and GC-MS analysis.

3 Results and Discussion

Decolorization test results ranged from 97.12% to 99.6% between 48h and 168h. three actinobacteria out of a total of 27 isolates showed a high percentage of decolorization. Both bio adsorption and decolorization are implicated, tyrosinase and azoreductase are the main activities who intervene in the dye degradation.

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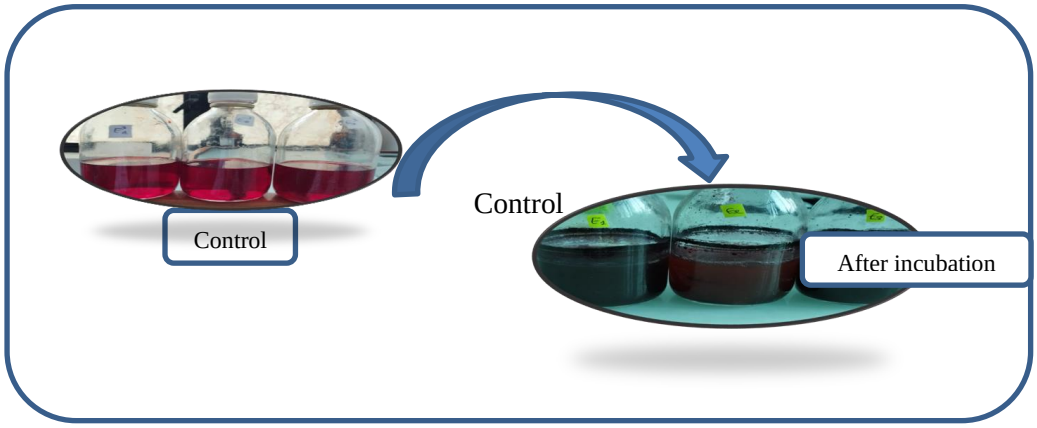

Figure 1: Degaration of congo red dye in batch system

4 Conclusions

The present study aims to explore purified actinobacterial isolates in the detoxification and bleaching of real textile effluents in a green and economical approach.

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