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Research Article

Optimization of Physiochemical Parameters during Bioremediation of Synthetic Dye by *Marasmius cladophyllus* UMAS MS8 Using Statistical Approach

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In many industrial areas such as in food, pharmaceutical, cosmetic, printing, and textile, the use of synthetic dyes has been integral with products such as azo dye, anthrax, and dyestuffs. As such, these industries produce a lot of waste by-products that could contaminate the environment. Bioremediation, therefore, has become an important emerging technology due to its cost-sustainable, effective, natural approach to cleaning up contaminated groundwater and soil via the use of microorganisms. The use of microorganisms in bioremediation requires the optimisation of parameters used in cultivating the organism. Thus the aim of the work was to assess the degradation of Remazol Brilliant Blue R (RBBR) dye on soil using Plackett-Burman design by the basidiomycete, *M. cladophyllus* UMAS MS8. Biodegradation analyses were carried out on a soil spiked with RBBR and supplemented with rice husk as the fungus growth enhancer. A two-level Plackett-Burman design was used to screen the medium components for the effects on the decolourization of RBBR. For the analysis, eleven variables were selected and from these four parameters, dye concentration, yeast extract concentration, inoculum size, and incubation time, were found to be most effective to degrade RBBR with up to 91% RBBR removal in soil after 15 days.

1. Introduction

Synthetic dyes are chemicals that are important alternatives in many industries. Since 1856, synthetic dyes have been used as they are economical to produce and create brighter, more colour-fast, and easy applications. However, most industrial dye processes involve the dye solution to be released to the surrounding water and soils. It has been reported that about 10–15% of all dyestuff is directly lost to wastewater [1] because of inadequate treatment of wastewater and poor waste management. Thus, this will lead to dye contamination in soil and water bodies [2]. Azo, anthraquinone, and phthalocyanine are the most common groups of synthetic dyes used [3]. Remazol Brilliant Blue R (RBBR) is a compound that is normally used to analyse azo dye degradation in laboratory condition [4]. RBBR, or Reactive 19, is an anthraquinone-based dye [5] which is an important dye in textile industries. It also represents a class of toxic and recalcitrant organopollutants that has identical structure to some polycyclic aromatic hydrocarbons (PAH) [6]. RBBR, an anthraquinone-based dye, is not easily degraded even by bacteria due to the presence of the aromatic structure [7]. The chemical structure and specification of the RBBR dye are shown in Table 1 [5].

Among industrial effluents, wastewater from textile and dyestuff industries is one of the most difficult to be treated. This is because industrial textile dyes have been purposely designed to be highly resistant to washing, chemical agents,