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Research Article

Decolourisation of Synthetic Dyes by Endophytic Fungal Flora Isolated from Senduduk Plant (*Melastoma malabathricum*)

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A total of twenty endophytic fungi successfully isolated from *Melastoma malabathricum* (Senduduk) were examined for their ability to decolourise azo dyes: Congo red, Orange G, and Methyl red and an anthraquinone dye, Remazol Brilliant Blue R. Initial screening on the glucose minimal media agar plates amended with 200 mg L^{-1} of each respective dye showed that only isolate MS8 was able to decolourise all of the four dyes. The isolate decolourised completely both the RBBR and Orange G in the agar medium within 8 days. Further quantitative analysis of the dye decolourisation by isolate MS8 in aqueous minimal medium showed that isolate MS8 was able to decolourise all the tested dyes at varying levels. Dye decolourisation by the isolate MS8 was determined to be 97% for RBBR, 33% for Orange G, 48% for Congo red, and 56% for Methyl red, respectively, within a period of 16 days. Molecular identification of the fungal isolate MS8 using primer ITS1 and ITS4 showed that isolate MS8 shared 99% sequence similarity with *Marasmius cladophyllus*, a Basidiomycete. The ability to decolourise different types of dyes by isolate MS8 thus suggested a possible application of this fungus in the decolourisation of dyestuff effluents.

1. Introduction

There are more than 100,000 colours of synthetic dyes produced commercially, and over 7×10^5 tons of dyes are produced annually worldwide [1]. Dyes are used throughout the world in textile, paper, cosmetic, pharmaceutical, and food industries and also used as additives in petroleum products [2]. Synthetic dyes are extensively used particularly in the textile and dyeing industries. In the process of dyeing, about 15–20% of the dyes used for dyeing do not bind to the fibres and are lost in the effluent [2]. It has been estimated that about 280,000 tons of textile dyes are discharged in such industrial effluents every year worldwide [3].

The discharge of textile dyes into rivers or lakes is the most visible sign of water pollution because several dyes are visible even at a low concentration of less than 1 ppm [4]. In addition to changing the colour of water, the presence of dye in the receiving water bodies also impedes sunlight penetration that in turn decreases photosynthetic activity, dissolved oxygen concentration, and water quality and causes acute toxic effects on aquatic flora and fauna [5]. Many synthetic dyes are also toxic and carcinogenic to aquatic and human lives because they are made from compounds such as benzidine and other aromatic compounds [6]. Reductive cleavage of azo dyes, which comprises about 70% of all dyes used, also resulted in the production of amines that are mutagenic to human and are also retained in the anaerobic compartment of the lower intestine by intestinal microflora after ingestion of azo dyes [7–9]. Therefore, industrial effluents containing dyes must be treated prior to their discharge into the environment.

Among industrial effluents, wastewater from textile and dyestuff industries is one of the most difficult to be treated since the dyes used are usually synthetic and contain complex aromatic molecular structures making them more stable and difficult to degrade [10]. Conventional wastewater treatment plants using activated sludge treatment are unable to treat dye-containing wastewater. It has been estimated that up to 90% of reactive textile dyes still persist even after the treatment [11]. Several physical and chemical methods including membrane filtration, adsorption, ion exchange, ozonation,