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# Decolourization of textile dyes and textile industry effluent in a fixed bed biofilm reactor using native microorganisms

Textile and apparel industry plays a huge role in the Sri Lankan industrial sector, accounting more than 40% of export earnings in the country. Textile wet processing produces large volumes of coloured effluents which have potential to cause negative impacts on environment and various adverse health effects if not properly treated [1]. Chemical and physical effluent decolourization techniques which are widely used in industry have major drawbacks such as high cost and generation of secondary sludge which require further treatments [2]. Therefore, textile dyeing industries face huge problems in achieving sustainability goals, due to this coloured textile effluents. In the recent past, biological treatment methods have captured attention as environmentally friendly and cost-effective techniques to remove colour from textile effluents.

This study focused on isolating native microorganisms with textile dye decolourization potential and investigated their applicability in textile wastewater decolourization. During the study, five bacterial strains with dye decolourization potential were isolated and identified using sequencing analysis of 16S rRNA gene. Bacterial consortium was developed by selecting the most effective isolates, and batch decolourization of individual dyes and dye mixtures were carried out in suspended cultures.

The study was further extended to investigate decolourization in a laboratory scale fixed bed biofilm reactor (FBBR) consisting of a developed bacterial consortium (Figure 1). A synthetic dye mixture (50 mg/l) was treated in the FBBR in batch mode with three different concentrations of yeast extract (YE) as the carbon source in the feed, and more than

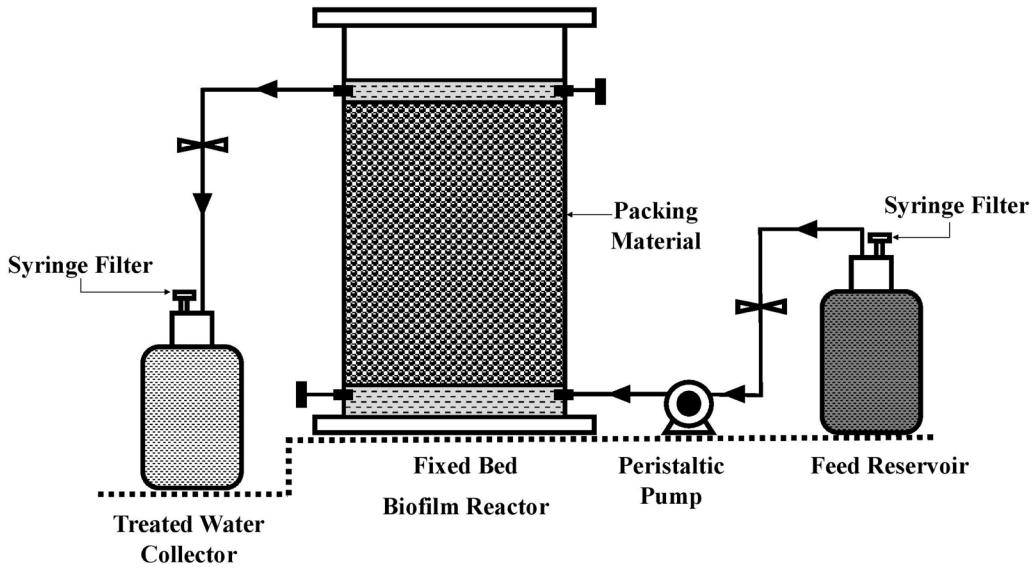


Figure1: Schemtic Diagram of the Reactor

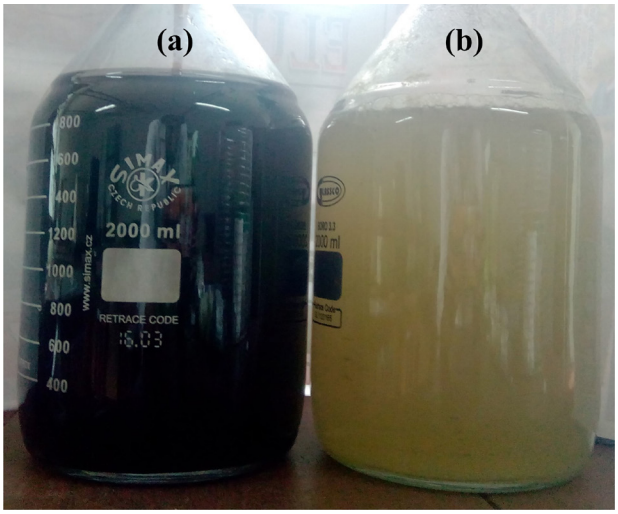


Figure 2: a). Influent (50ppm synthetic dye mixture containing medium), b). Treated water obtained fromcontinous FBBR

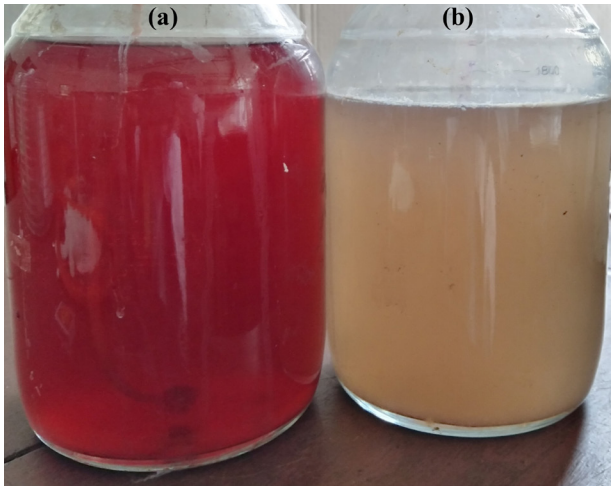


Figure 3: a). Feed (undiluted textile effluent containing medium, b). 48h treated water obtained from FBBR

90% decolourization was observed when the YE concentrations were 2 and 1 g/l.

When the same dye solution was treated in a continuous FBBR (1.9 d hydraulic retention time) up to 83% colour has been removed with 2 g/l YE. A considerable reduction in dye decolourization was not observed when the YE in the feed was reduced to 1 g/l and there was 85% mean decolourization of the synthetic dye mixture (50 mg/l) (Figure 2). When the concentration of YE in the feed was further reduced to 0.25 g/l, colour reduction was 75%, and the colour reduction achieved is very close to that in batch FBBR with the same dye and yeast extract concentrations. Furthermore, 70% of the colour was removed in 48 h when textile industry wastewater was treated in batch operated FBBR (Figure 3).

> “This study showed the ability of the developed bacterial consortium to endure in highly complex and toxic environment in the fixed bed biofilm reactor.”

Structural changes which occurred in dyes due to biological treatments were studied using ultraviolet-visible spectral and high-performance liquid chromatography analyses. Metabolites formed due to biological degradation were analyzed using gas chromatography-mass spectrophotometry and were found to be non-toxic and benign.

This study showed the ability of the developed bacterial consortium to endure in highly complex and toxic environment in the fixed bed biofilm reactor. Further, biological treatment can be considered as a highly promising alternative technique for the treatment of textile dye-containing wastewater in industry since treated water is nontoxic.

References

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