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# Treatment of pre-treated textile wastewater using Moving bed bio-film reactor

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**Abstract**

Control of water pollution is a very important scientific research area nowadays. Textile industry is one among the major pollution causing industry. The organic compounds which are coloured represent a minor fraction of the organic components of wastewater but their colour causes undesirable appearance. Treatment of textile wastewater using traditional physico-chemical methods are expensive, large quantities of sludge will be generated and usually it needs the addition of toxic chemicals. Textile effluents have high COD and low BOD. So it is not suitable to treat textile wastewater using a single physico-chemical or biological method. So a chemical pre-treatment followed by biological treatment is suitable for textile wastewater. Advanced oxidation process is chosen for pre-treatment. Among various advanced oxidation processes, fluidized bed Fenton process is chosen because sludge produced is less in this process. The efficiency of MBBR with carriers inoculated with Microbacterium marinilacus, isolated from textile sludge after fluidized bed Fenton pre-treatment is evaluated. Results are optimized using Box Behnken method. 86% COD removal, 81.5% BOD removal is observed.


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## 1.Introduction

Water pollution means a deviation from pure condition, partially or completely by human activity. Major

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industries like pulp and paper, chemical, petrochemical, refining, metal working, food processing, textile industries etc. are the major contributors of water pollution. Textile industry generates one of the most polluting effluent compared to other industrial effluents. Due to changes in the consumer's demand, effluent contents have a rapid change. Synthetic reactive dyes are used in great amounts nowadays. Textile, paper and printing industry generates large amount of dye effluents which affect the visibility and photosynthetic activity of the water bodies and also highly toxic to aquatic life. The production processes in textile industry not only utilizes large quantity of water and energy but also generate large amount of waste products. Many countries including India introduce strict environmental standards to minimize water pollution [1].

An important environmental issue related to textile industry is the production and discharge of big volumes of highly polluted wastewater, due to the consumption of about 100 to 200 litres of water per kilogram of textile product and the use of an immense range of materials and chemicals in the production chain [2].

Removal of dye from wastewater using traditional methods such as coagulation, adsorption, oxidation with ozone etc. are expensive, generate large quantities of sludge and also require the addition of hazardous chemicals. So microbial remediation techniques have greater attraction now. Decolourization and degradation using microbes is an environmental friendly and cost effective substitute to different traditional treatment methods [3].

Textile effluent has low BOD/COD ratio, hence it is necessary to give a pre-treatment before biological process. It was found that the use of Fenton's reagent for the treatment of textile wastewater was really efficient method for degradation of pollutants, so it can be used for the pre-treatment of textile wastewater prior to biological treatment [4].

Fenton process is very successful in the degradation of organic matter present in textile wastewater but the production of ferric hydroxide sludge is a great disadvantage because it requires further treatment and disposal [5].

Fenton process can be improved by using fluidized - bed Fenton reactor. A bed of solid particles with a stream of gas or liquid passing upward through the particles at a rate to keep them in motion is known as a fluidized bed. When the liquid or gas travels through the bed it gives unique characteristics to the bed i.e. the bed itself behaves as a liquid. Wave motion can be propagated which gives proper mixing. Sludge production is less in fluidized-bed Fenton process due to iron precipitation or crystallization [6].

The Moving Bed Biofilm Reactor (MBBR) can be used for the treatment of both industrial and municipal wastewater. This treatment process is suitable for wastewater treatment such as nitrogen reduction, high BOD or COD removal. MBBR process has the advantages of both activated sludge and bio-film systems. MBBR can be operated similar to activated sludge process with the addition of freely moving carrier media. Carrier elements provide a surface for bacterial growth. Carrier elements have lighter density than water so they continuously move along with water stream inside the reactor [7].

Bacteria from the textile sludge should be isolated by serial dilution plate count method and inoculated in the carrier elements of MBBR to increase the efficiency in treating textile wastewater. Bacteria have the ability for the aerobic degradation of textile dyes. Growths of recalcitrant organic degraders are necessary in biological treatment process for the removal of specific contaminants from wastewater. The bacterium exhibited a remarkable colour-removal capability over a wide range of dye concentrations (50–200 mg/l), pH (6–10) and temperatures (30–40°C).The bacterial strain can tolerate and decolourize azo dyes at high concentrations, making it an advantage for treatment of textile industry wastewaters[2].

There are many advantages for MBBR like smaller size, no sludge bulking, high concentration of biomass, tolerance to loading impact, high COD loading, no need of periodic backwashing etc. [8].

Minitab version 16 which is a Design – Expert software was used to design the number of experiments to be performed, for experimental data calculation and for the evaluation of experimental results. The Box –Behnken statistical design is used to find out the effects of significant factors and also to obtain optimum conditions [9].

## 2. Materials and methods

### *2.1. Sampling of real textile wastewater*

Real textile wastewaters were collected from Augustan Textile Colours Ltd. Palakkad. Three different samples were collected in a time interval of 10 days and were stored at 4°C.