IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# Bioremediation of Textile dye Blue RGB by Bacteria

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**Abstract:**

The current research work had been undertaken to bioremdiate harmful and toxic textile dye Blue RGB by using bacterial species isolated from acclimatized samples. In this present research work the isolation of bacterial species was carried out by using nutrient medium from acclimatized samples. The efficiency of isolated bacteria was carried out by testing them against dye Blue RGB. Among all isolated bacterial species total 5 bacterial isolates were having extraordinary capacity for decolorization and degradation of Blue RGB. These bacteria were further checked for their maximum ability for dye decolorization in Nutrient, Half strength (1/2) Nutrient broth and Cell-free extract. It was observed that all these bacteria were able to decolorize 98.76% of dye in nutrient broth, 80.60% decolorization in half strength nutrient broth and 84.45% in cell-free extract. The effect of various Carbon and Nitrogen sources was also studied. It was observed that all the isolates were able decolorize dye in presence of Glucose and Peptone. The decolorization of Blue RGB was monitored by spectrophotometer at λ max 650nm. The percent COD reduction studies showed 93.06% COD reduction.

**Key words:** Blue RGB, Bioremediation, textile dyes.

## 1. INTRODUCTION:

Water is most important for the life of every living thing. Water which is used for domestic and industrial purpose if get contaminated with dyes or pigments it cannot be utilized (Kiran *et al.*, 2012). Among the various processes carried out in textile industry, the dyeing process loses about 10-15% of unused dye along with textile waste water due to inefficient dyeing process (Dwivedi *et al.*, 2012). The textile effluent is composed of high values of COD (Chemical Oxygen Demand), BOD (Biological Oxygen Demand), various organic and inorganic chemicals, harmful and toxic dyes which are mutagenic and carcinogenic to living life (Palamthodi

*et al.*,2011). All of the textile industries utilize enormous amount of water for mainly dyeing process which release large volume of unused dyes along with effluent. If this type of effluent is not treated before discharge into environment it causes obvious threat to the environment hence it has to be treated safely before liberation (Rezaee *et al.*, 2008). If this kind of textile waste water is not treated properly then it persists in environment for a long time (Olukanni *et al.*, 2006). The inefficient treatment to such effluent produces colorless aromatic amines after degradation of dyes which again persist into environment and affects badly on environment hence a suitable method for the treatment of dyes should be applied (Celik *et al.*, 2012). Different types of Biological, physical and chemical methods are used for the removal of these dyes from environment. The Chemical and Biological methods carry out destruction of dye molecule however physical methods carry out transformation of dye molecule into different phase (Ramalho, 2005). The unique nature of microorganisms could be exploited for the remediation of harmful dyes from textile effluent. Wide variety of pollutants can be removed by using various Actinomycetes, Bacteria, Algae and Fungi (Chandra *et al.*, 2012; Pandey *et al.*, 2011). Moreover, the textile dyes can be decolorized by using different types of Plants, Bacteria and Fungi (Khandare *et al.*, 2013; Lade *et al.*, 2012).

The present research work was undertaken isolation of efficient bacteria and exploitation of them for the bioremediation of harmful textile dye Blue RGB.

## 2. MATERIALS AND METHODS:

### 2.1. Collection of samples:

The soil and water samples were collected from the waste discharge area of textile industries at Solapur. Also, samples were collected from the ETP plant of textile industries, compost, manure etc. All these samples were brought to laboratory by using sterile polythene bags and bottles.

**Dye:** Blue RGB having λ max 650nm.

### 2.2. Acclimatization of microflora:

The collected soil and water samples were mixed and homogenized properly. Then these samples were acclimatized by adding increasing concentration of dye Blue RGB for one month daily to get efficient dye decolorizing microbes.

### 2.3. Isolation and Screening of dye decolorizing bacteria:

For the isolation of bacteria, the Nutrient agar was used. One gram of acclimatized soil was serially diluted and spreaded on nutrient agar plates. Plates were kept for incubation for 24 hours at ambient temperature. After incubation period well grown isolated colonies were selected for screening.

The screening was carried out on nutrient agar containing 100 ppm of dye concentration. Each of the isolated colonies was tested against dye. The colonies showing maximum zone of decolorization around them were selected for further studies.

### 2.4. Decolorization of dye in different nutrient broth:

#### 2.4.1. Percent dye decolorization in nutrient broth:

The efficient bacterial isolates were inoculated in 30 ml nutrient broth containing 100 ppm dye concentration. Tubes were kept for incubation at ambient temperature for 24 hours. Decolorization was determined by spectrophotometer.

#### 2.4.2. Percent dye decolorization in Half (1/2) strength nutrient broth:

The promising isolates were inoculated in 30 ml Half (1/2) strength nutrient broth having 100 ppm dye concentration. Tubes were incubated at ambient temperature for 24 hours. Decolorization was determined by spectrophotometer.

#### 2.4.3. Percent decolorization using cell-free extract:

Promising isolates were grown in nutrient broth having 100 ppm dye concentration. These cells were further lysed with sonicator (Vibra Cell System) and further centrifuged by using cooling centrifuge for 20 minutes at 10000 rpm. After that the supernatant was inoculated in 30 ml nutrient broth having 100 ppm dye concentration. Tubes were kept for incubation at ambient temperature for 24 hours. Decolorization was determined by spectrophotometer.

### 2.5. Effect of Carbon and Nitrogen sources ondye decolorization:

The effect of Carbon and Nitrogen sources on dye decolorization was examined by inoculating the promising bacterial isolates in 30 ml sterile Minimal medium having 100 ppm of dye concentration and 1% of different Carbon and Nitrogen sources such as Glucose, Sucrose, Starch, Peptone, Yeast extract and Meat extract. The tubes were kept for incubation at ambient temperature for 24 hours. Decolorization was determined by spectrophotometer.

The percent dye decolorization was determined by following formula:

$$\textbf{Percent decolorization} = \frac{\text{Initial Absorbance} - \text{Final Absorbance}}{\text{Initial Absorbance}} \times 100$$

### 2.6. Percent COD reduction:

The examination of percent COD reduction was carried out by using $K_2Cr_2O_7$ as strong oxidizing agent.

## 3. RESULTS:

### 3.1. Isolation and Screening of dye decolorizing bacteria:

Totally 17 different isolates were isolated from the acclimatized samples by using nutrient broth. The screening of all these isolates was carried out against Blue RGB. It was observed that among all isolates total 5 isolates were having excellent ability for decolorization of Blue RGB. Hence they were selected for further study. The isolates BRG-1 and BRG-5 showed maximum decolorization of Blue RGB.

### 3.2. Decolorization of dye in different nutrient broth:

#### 3.2.1. Percent dye decolorization in nutrient broth:

Decolorization of Blue RGB was carried out in Nutrient broth. Decolorization was monitored spectrophotometrically. The results are shown in **Figure 1.**

#### 3.2.2. Percent dye decolorization in Half (1/2) strength nutrient broth:

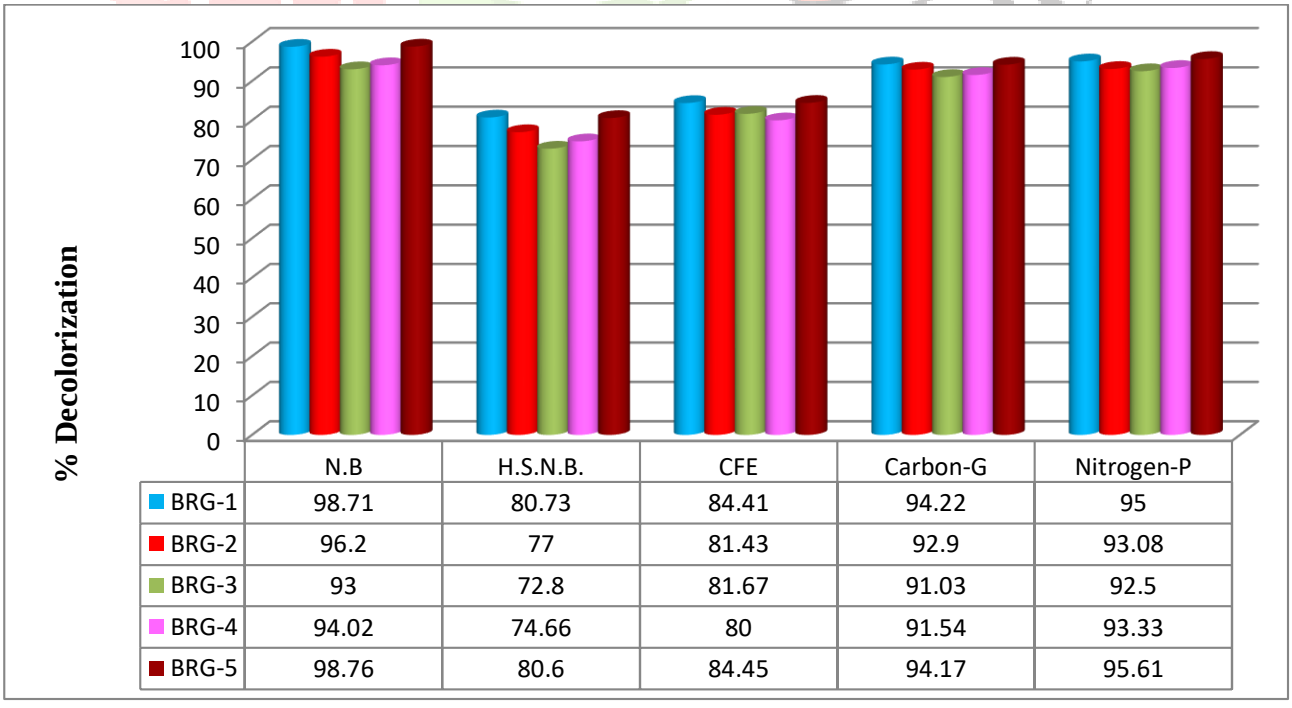
Half (1/2) strength nutrient broth was used to examine the efficiency of promising isolates for dye decolorization. The results are shown in **Figure 1.**

#### 3.2.3. Percent decolorization using cell-free extract:

The cell-free extract was prepared using Sonicator and supernatant was inoculated in nutrient broth. The results are shown in **Figure 1.**

### 3.3. Effect of Carbon and Nitrogen sources ondye decolorization:

Various carbon and Nitrogen sources were added to carry out optimum decolorization of dye. It was observed that all promising isolates were able for highest dye decolorization when medium was added with Glucose as Carbon source and Peptone as Nitrogen source. The results are shown in **Figure 1.**




| | N.B | H.S.N.B. | CFE | Carbon-G | Nitrogen-P |
|---|---|---|---|---|---|
| BRG-1 | 98.71 | 80.73 | 84.41 | 94.22 | 95 |
| BRG-2 | 96.2 | 77 | 81.43 | 92.9 | 93.08 |
| BRG-3 | 93 | 72.8 | 81.67 | 91.03 | 92.5 |
| BRG-4 | 94.02 | 74.66 | 80 | 91.54 | 93.33 |
| BRG-5 | 98.76 | 80.6 | 84.45 | 94.17 | 95.61 |

**Figure 1: Percent dye decolorization in different medium in 24 hours.**

**Where: N.B.**-Nutrient Broth, **H.S.N.B.**-Half Strength Nutrient Broth, **CFE**- Cell Free Extract, **G**- Glucose, **P**- Peptone.

### 3.4. Percent COD reduction:

The determination of percent COD reduction was given in **Figure 2.**

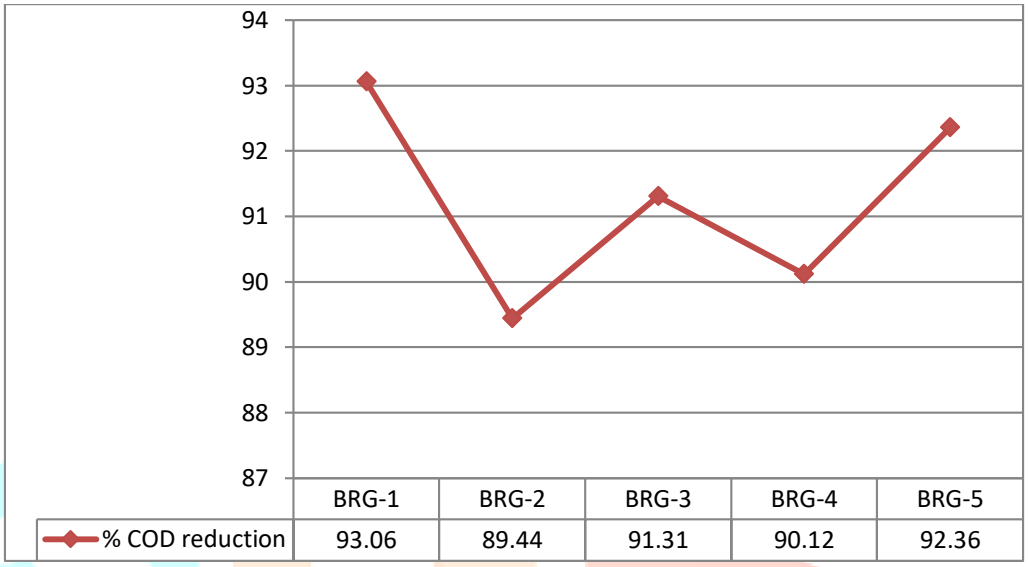



**Figure 2: Percent COD reduction after 24 hours by promising isolates.**

## 4. DISCUSSION:

The current research work reveals that the promising bacterial isolates were able to decolorize the dye Blue RGB very efficiently within 24 hours. These isolates utilized dye as substrate and the decolorization of dye was due to only growth and metabolic activities of isolates. However, no growth was noticed in control tube. The highest decolorization was observed when medium was added with Glucose and Peptone as carbon and nitrogen source. These results were exactly similar with Geetha et al. (2016) who suggested that decolorization of Alizarin red S by *Escherichia coli* (78.04%) and *Pseudomonas sp.* (69.17%) in presence of 1% Glucose and 1% Peptone. It was reported earlier by Sharma et al. in 2014 that the textile waste water is composed of high values of COD. But after the bacterial treatment the COD get reduced. Similar results were observed in current study. The COD of untreated textile effluent was very high but the values get reduced upto 93.06% after bacterial treatment. This was also revealed by Paul *et al.*, 2012 and Goyal *et al.*, 2013. All the promising isolates were efficiently bioremdiate the textile dye Blue RGB.

## 5. CONCLUSION:

From the above research work it was seen that the promising isolates were having extraordinary efficiency for decolorization and degradation of textile dye Blue RGB. Hence these all isolates can be exploited for bioremediation of harmful and toxic textile dye Blue RGB which is very cost effective and ecofriendly approach.

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