Exploration of promising dye decolorizing bacterial strains obtained from Erode and Tiruppur textile wastes

Palani Velan. R¹, Rajakumar. S², Ayyasamy. P.M¹
¹Assistant Professor, Department of Microbiology, Periyar University, Salem, India
²Department of Marine Biotechnology, Bharathidasan University, Tiruchirappalli, India
pmayyasamy@gmail.com
doi:10.6088/ijes.00202030128

ABSTRACT

The present research was carried out to explore potential dye decolorizing bacterial strains from the textile industry waste located in Erode and Tripur districts. Total heterophilic bacterial populations were confirmed and they were ranged from 2 x 10⁴ to 62 x 10⁶ CFU/gm. There was 96 morphologically distinct bacterial isolates were isolated from 12 different sludge, textile effluent and dye contaminated soil samples. Generic composition of the 96 isolates comprised of Bacillus sp., Enterobacteriaceae, Pseudomonas sp., Micrococcus sp., Alcaligenes sp., Aeromonas sp., Staphylococcus sp., and Lactobacillus sp. These bacterial strains were freshly screened by plate method on solid media containing Remazol golden yellow (RNL), Red (RGB) and Blue (RGB) for the detection of preliminary decolorization. Among 96 strains tested, 20 exhibited significant decolorization. Liquid culture method was adopted for secondary screening decolorization confirmed that 6 efficient strains decolorize the dye concentration within 24 hours under static condition. The strains utilized Remazol golden yellow dye as a carbon sources for their growth. RNL dye decolorization by 6 strains was attained and maximum of 84% decolorization was recorded at 48 hours in microaerophilic condition. Furthermore the mixed cultures of the potential strains were attributed to effectively decolorize the dye contaminated effluent along with RNL dye in the stimulated time period of 24-48 hours. These strains have the capability to withstand and tolerate the sodium chloride concentration up to 30g/l. This study clearly resulted selected potential dye decolorizing bacterial strains could be used for decolorization of textile effluent.

Key words: Azo dyes, textile effluent, bacteria, biodegradation, decolorization and Remazol golden yellow

1. Introduction

Environmental pollution creates a major threat today, due to rapid industrialization and urbanization leads to usage of chemicals including dyes, pigments, acids, bases and metals. This factor plays a vital role in causing pollution to the ecosystem through by water and soil contamination. Textile dyes are classified into azo, di-azo, cationic, basic, anthraquinone based and metal complex based, depending on the nature of their chemical structure. Also classified as reactive, disperse, vat, mordant etc based on their application (Rajendran, and Gunasekaran, 2007). There are more than 100,000 commercially available dyes with over 7 x 10⁵ tons of dyestuff produced annually (Zollinger et al., 1987; Robinson et al., 2001). There are more than 8000 chemical products associated with the dyeing process listed in the Colour Index. Chemical structure of the dyes is resistant to fading on exposure to light, water and many chemicals (Neill et al., 1999). Among the various chemical structure dyes, azo structured dyes are majority amounts found in the textile effluent. These are very toxic with xenobiotic in nature, and must be properly treated before disposing into the ecosystem. Azo
dyes represent the largest group of organic colorants listed the colour index (i.e., 60 - 70% of the total). They make up the vast majority of the dyes discharged into effluents (Van der Zee, 2005). They are characterized by the presence of one or more azo groups (-N=O-) which form bridges between two or more aromatic rings (monoazo, diazo, triazo and polyazo). Azo dyes are may be belonging to direct, acid, mordant or other disperses dyes. Presence of very low concentrations of dyes in effluent is highly visible and affects the aesthetic merit water transparency and gas solubility in lakes, rivers and other water bodies (Agarwal, 2001). Generally colors are visible at a dye concentration of more than 1 mg/l and an average concentration of 300 mg/l has been reported in effluents from textile manufacturing processes (Goncalves 2000).

The presence of azo dyes or their degraded products in water can also cause human health disorders such as cancer, hemorrhage, ulceration of skin and mucous membranes and the presence of such toxic compounds also resulted into severe damage to the kidney, reproductive system, liver, brain and central nervous system in life forms (Sweeney and Chipman, 1994). Various techniques have been employed for the treatment of azo dye bearing industrial effluents, which usually come under two broad divisions: abiotic and biotic methods. Physical and chemical methods such as flocculation, electrochemistry, ozonation, bleaching, membrane filtration, irradiation and adsorption to activated carbon are commonly used for the treatment of dye containing textile effluents. Conventional waste water treatment facilities are often unable to remove commercial dyestuffs, including azo dye and this effluent contaminates aqueous habitats which are significantly different in color removal, volume capability, operating speeds and capital costs (Micheals and Lewis, 1985). Biodegradation of azo dye through the physical and chemical method is not significant. Biological methods include bacterial and fungal biosorption and biodegradation includes bacterial and fungal biosorption and biodegradation in aerobic, anaerobic, anaerobic/aerobic (sequential) treatment processes.

Bacterial degradation of azo dyes is often mediated by azoreductases, which are more efficient under static and anoxic conditions. Similarly lignolytic enzymes selected extracellularly by micro organism also produce higher decolorization in static condition (Kilic, 2007). Textile effluents not only contains dye stuffs, also it contains toxic substances such as additives, acids, salts, bases, detergents, surfactants and exhibit large fluctuations in term of quantities, pollution level, pH and temperature. Hence, it is outstanding interest to improve effective and cost limited methods for the decolorization and degradation of dyes present in textile effluents, dye contaminated soil and sludge. The present study aims that to isolate a local efficient extremophilic bacterial strains to decolorize the azo dyes with an efficient rate in the presence of heavy concentration of dye stuffs and also to evaluate decolorize performance in microcosm experiment.

2. Materials and materials

2.1 Collection of samples / sampling area

India was one of the leading countries and has more than 1, 00,000 garments, dyeing and bleaching units. About 14-20% of textile field productions contribute India’s industrial production. Majority were concentrated at Erode and Tripur districts of Tamil Nadu. More than 900 dyeing and bleaching units were present and discharging nearly 80 million liters of effluents per day. Hence textile effluents, sludge and dye contaminated soil samples from effluent sites were collected in sterile sampling carriers from different sites of Erode and Tripur district.
2.1.1 Dyes

The dyes used in this study were industrial grade and procured from dyeing industry market. Remazol golden yellow, Red RGB and Blue RGB were used for the bacterial screening and all the dyes were procured from dyeing industry market.

2.1.2 Preparation of dye solution

The reactive dyes used in this study were Remazol golden yellow, Red RGB and Blue RGB collected from dyeing industry market without further purification. The chemical structures and general data of these dyes were displayed in table 1 respectively. The dye stock solutions were prepared by dissolving accurately weighed dyes in distilled water to the concentration of 1000 mg/l and the experimental solution concentrations were obtained by dilution.

Table 1: Commercial name of various dyes and its functional group used in this study

<table>
<thead>
<tr>
<th>S. No</th>
<th>Dye</th>
<th>C.I. Name</th>
<th>Commercial Name</th>
<th>Type</th>
<th>Chromophore</th>
<th>Chemical structure/ Functional group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>RNL</td>
<td>Reactive</td>
<td>Remazol golden yellow</td>
<td>Reactive</td>
<td>Monoazo</td>
<td>Vinylsulfone (anionic)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orange 107</td>
<td>(22910)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Red</td>
<td>-</td>
<td>Red RGB</td>
<td>Reactive</td>
<td>Monoazo</td>
<td>Vinyl sulfone/ Monochloro triazine bifunctional dye</td>
</tr>
<tr>
<td>RGB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Blue</td>
<td>-</td>
<td>Blue RGB</td>
<td>Reactive</td>
<td>Monoazo</td>
<td>-</td>
</tr>
<tr>
<td>RGB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.1.3 Medium

Chemicals and medium ingredients used for this study were of analytical grade; purchased from Himedia laboratories (Mumbai, MH, India) Luria Bertani Agar (gram/liter) containing Casein enzymic hydrolysate 10g, yeast extract 5g, sodium chloride 10g, agar 15g, Bushnell and Hass broth (BHB) containing magnesium sulphate 0.2g, dipotassium hydrogen phosphate 1.0g, calcium chloride 0.02g, ferric chloride 0.05g, ammonium nitrate 1.0g, with or without glucose (0.1% W/V), yeast extract (1% W/V) and nutrient agar was used in this study.

2.2 Enumeration and isolation of bacterial strains

Distinct bacterial colonies, which developed on the plates were isolated and purified by repeated streaking on nutrient agar. Individual colonies were transferred into nutrient agar slants and stored at 4°C for further studies. All the strains were identified based on the morphology and biochemical characteristics as given in Berge’s Manual of systematic Bacteriology (Holt et al., 1994).

2.3 Preliminary screening by plate assay

Plate assay was performed for the detection of decolorizing activity of bacteria. Luria Bertani agar (Casein enzymic hydrolysate 10g, Yeast extract 5g and Sodium chloride 10g) amended with various concentration (50, 100, 150, 200 and 250 mg/l) of Remazol golden yellow
Exploration of promising dye decolorizing bacterial strains obtained from Erode and Tripur textile wastes


International Journal of Environmental Sciences Volume 2 No.4, 2012

2473

(RNL), Red (RGB) and Blue (RGB) was prepared and autoclaved at 121°C for 30 minutes. Bacterial isolates were inoculated by spot inoculation on Luria Bertani agar plates containing dyes. The plates were incubated at 37°C for 4 days. The plates were observed for zones around the colonies (Kumar et al., 2007).

2.4 Secondary screening by liquid culture assay

Liquid culture assay was performed for detecting decolorizing activity of bacteria. The liquid medium for decolourisation experiment was Luria Bertani broth (Kumar et al., 2007). The dye solution were prepared and sterilized prior to addition to the sterile culture medium, a loop full of culture taken and was inoculated into the test tube containing 10 ml sterilized screening liquid medium supplemented with Remazol golden yellow (RNL), Red (RGB) and Blue (RGB) respectively. The tubes were incubated under static condition at 37°C for 48 hrs. Control was also used with the same medium without bacterial isolates. After 48 hours of incubation, the culture broths were withdrawn aseptically and centrifuged at 3000 rpm for 15 minutes. The cell free supernatant was used to determine the percentage of decolourisation using 595 nm for Remazol golden yellow, 435 nm for Blue RGB and 610 nm for Red RGB. Colorimetric analysis was employed for monitoring dye decolourization by the bacterial isolates in broth culture (Sani and Banerjee, 1999)

2.5 Effect of carbon and nitrogen source in dye decolorization

Bushnell and Hass medium along with glucose (0.1% W/V) and yeast extract (1% W/V) amended with 100 mg/l concentration of RNL dye was prepared and inoculated with potential bacterial strains such as Bacillus sp., Pseudomonas sp., Micrococcus sp., Lactobacillus sp., and Staphylococcus sp., (5% W/V) in 250 ml Erlemeyer conical flask and incubated at 37°C for 48 hours under static condition. At the end of incubation period, samples were withdrawn and centrifuged at 3000 rpm for 15 minutes. Decolorization was determined by measuring absorbance of culture supernatants at 595 nm absorbance maxima of Remazol golden yellow dye. The Percentage of decolorization was calculated by using the above mentioned formula (Masoovi et al., 2007).

2.6 Effect of oxygen requirement in dye decolorization

Stab culture method was adapted to determine the requirements of oxygen conditions for dye decolorizing bacterial isolates. A loop full of selected bacterial isolates were inoculated by stab inoculation into test tubes containing the screening medium (Luria Bertani Agar) in semisolid condition with 100 mg/l concentration of Remazol golden yellow dye. The inoculated test tubes were incubated at ambient temperature for 48 hours with control. At the end of incubation period colour changes were qualitatively observed and it was compared with uninoculated test tubes (Syed et al., 2009).

2.7 Effect of salt on the growth of bacterial strains

Bacterial isolates vary widely in their salt tolerance (Nacl), and it was tested for their capability of growth at different salt concentration (10, 20 and 30 g/l) amended with nutrient agar medium. Nutrient agar plates were prepared with different concentrations of sodium chloride and the Bacillus sp., Pseudomonas sp., Micrococcus sp., Lactobacillus sp., and Staphylococcus sp., isolates inoculated by making a single line loop inoculation. Plates were incubated at 30°C in for 48 hours. At the end of incubation the growth was observed as salt tolerant.
2.8 Microcosm experiment

Polluted water was collected from the portion of the kavery river near Erode district because that part of the river was much polluted with effluents coming from the leather industry as well as dyeing industry effluents from different sites. The water had a pH of 8-9, clean water collected near well and the pH was 7-8.5 ml of polluted water as well as clean waters were incubated with 100 mg/l concentration of RNL dye. The screened bacterial cultures were grown in nutrient agar for 24 hours. After 24 hours, the screened bacterial isolates were transferred into test tubes containing both waters. The experimental test tubes were incubated statically at 28-30°C till disappearance of colour was observed (Jalandoni – Buan et al., 2009).

3. Results and discussion

3.1 Total bacterial population

Azo dyes were selected from the list of dyes particularly reactive dyes were used for this decolorization activity because the reactive dyes was widely used in the textile industry of Tripur, Erode, Tamil Nadu. Reactive dyes which were the only textile colorants designed to bond covalently with cellulosic fibers are extensively used in the textile industry because of their wide variety of color shades high wet fastness profiles, ease of application brilliant colors and minimal energy consumption (Aspland et al., 1997). Reactive dyes was developed to resist fading on exposure to sweat, soap, water, light or oxidizing agents making them stable and resistant to degradation (Seshadri et al., 1994).

<table>
<thead>
<tr>
<th>S. No</th>
<th>Type of Sample / Textile wastes</th>
<th>Average number of CFU (CFUs / gm / ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Textile Effluent Sample (Erode)</td>
<td>$2 \times 10^4$ CFU/ml</td>
</tr>
<tr>
<td>2</td>
<td>Textile Effluent Sample (Erode)</td>
<td>$12 \times 10^6$ CFU/ml</td>
</tr>
<tr>
<td>3</td>
<td>Textile Effluent Sample (Erode)</td>
<td>$5 \times 10^6$ CFU/ml</td>
</tr>
<tr>
<td>4</td>
<td>Textile Effluent Sample (Erode)</td>
<td>$8 \times 10^5$ CFU/ml</td>
</tr>
<tr>
<td>5</td>
<td>Textile Effluent Sample (Erode)</td>
<td>$7 \times 10^6$ CFU/ml</td>
</tr>
<tr>
<td>6</td>
<td>Textile Effluent Sample (Tripur)</td>
<td>$9 \times 10^6$ CFU/ml</td>
</tr>
<tr>
<td>7</td>
<td>Textile dye contaminated Soil (Erode)</td>
<td>$9 \times 10^6$ CFU/gm</td>
</tr>
<tr>
<td>8</td>
<td>Textile dye contaminated Soil (Erode)</td>
<td>$8 \times 10^6$ CFU/gm</td>
</tr>
<tr>
<td>9</td>
<td>Textile dye contaminated Soil (Erode)</td>
<td>$9 \times 10^6$ CFU/gm</td>
</tr>
<tr>
<td>10</td>
<td>Textile dye contaminated Soil (Tripur)</td>
<td>$7 \times 10^6$ CFU/gm</td>
</tr>
<tr>
<td>11</td>
<td>Textile Sludge Sample (Erode)</td>
<td>$9 \times 10^4$ CFU/gm</td>
</tr>
<tr>
<td>12</td>
<td>Textile Sludge Sample (Tripur)</td>
<td>$7 \times 10^6$ CFU/gm</td>
</tr>
</tbody>
</table>

The total heterotrophic bacterial population of the textile waste such as effluent, sludge and dye contaminated soil collected from Tripur, Erode district, Tamil Nadu was reported in the table 2. Total heterotrophic population results reveals that the bacteria in the soil were $62 \times 10^6$ CFU/gm much higher in the contaminated soil samples. The microbial diversity of the
dye effluent contaminated soil was observed to be highly restricted. Fungal diversity was not observed when compared to bacterial diversity because the fungal strain require acidic pH, but the most of the dye contaminated soil, effluent and sludge contains alkali pH due to usage of wide range of chemicals, surfactants, salts, dyes was used in the dyeing industry that impacts the bacterial diversity in the contaminated soil.

3.2 Generic identification of the bacterial isolates

Well grown morphologically distinct bacterial colony was selected and identified up to generic level. There are 96 bacterial populations were observed and they were represented as genera as shown in the figure 1. The majority of the bacterial genera in the azo dye contaminated soil belongs to Bacillus sp., (47.91%) and Enterobactericeae (17.70%) followed by Lactobacillus sp., (4.16%), Pseudomonas sp., (6.25%), Alcaligenes sp., (10.41%), Aeromonas sp., (3.12%), Staphylococcus sp., (4.16%) and Micrococcus sp., (6.25%) also found to resist azo dyes which was in accordance with the works of (Sudhakar et al., 2002).

![Figure 1: Bacterial genera in textile wastes collected from Erode and Tripur district](attachment:image)

3.3 Preliminary screening by plate assay

Decolorization activity of bacterial strains was detected by plate assay. A total of 96 bacterial isolates were tested for their dye degradation against three dyes at different concentration (50 – 250 mg/l). Most of the strains shows clearing zone is formed surrounding the bacterial culture which grown on LB agar plates for dye concentration of 100 mg/l. The twenty bacterial isolates selected on the basis of its ability to form zone of clearance around the colonies at dye concentration of 250 mg/l are selected for further studies. The decolorization ability of strains was given in the figure 2.
Figure 2: Decolorization of blue RGB dye at 100 mg/l by plate assay

3.4 Secondary screening by liquid culture assay

Secondary screening was carried out through the liquid culture method for three dyes (RNL, Red RGB and Blue RGB with concentration of 100 mg/l) were represented in figure 3, 4 and 5. Three dyes such as Remazol golden yellow, Red RGB and Blue RGB was selected for the current study based on (Arun Prasad et al., 2010) reported that to obtain the target colour, normally a mixture of red, yellow and blue dyes were applied in the dye baths. In the present study twenty isolates was selected for the secondary screening from the ninety six strains. Based on the zone formation in the primary screening 20 potential strains comprised of 8 Bacillus sp., 2 Staphylococcus sp., 2 Micrococcus sp., 2 Lactobacillus sp., 3 Aeromonas sp., and 3 Pseudomonas sp., were selected for secondary screening. Figure 3, 4 and 5 shows the results for decolorization of three dyes by twenty strains under anoxic condition. All the strains exhibit complete decolorization at 24 hours. Six isolates (ES37, ESL52, TSL9, TSL7, TS5 and M1) showed maximum decolorization against three dyes were selected for decolorization experiment. (Zhou et al., 1993) already suggest that the ability of the isolates to decolorize textile dyes was also been attributed to their adaptability to the xenobiotic compounds by their biological activity and depend upon the chemical structure of the dye.

Figure 3: Percentage decolorization of Blue RGB for selected strains
Six potential isolates Bacillus sp., Pseudomonas sp., Micrococcus sp., Lactobacillus sp., and Staphyloccocus sp., was selected for secondary screening of three dyes from the twenty bacterial isolates. The differential rate of decolorization with all the six strains shows that the rate of reduction of dye markedly. Similarly (Learoyd et al., 1992) found dye degradation varies among dye/organism pairs, proving the different reduction capacity of bacteria and the different sensitivity of dye to reductases.

3.5 Effect of carbon and nitrogen source in dye decolorization

Decolorization experiment was carried out in 250 ml Erlenmeyer flask containing 100ml of BH broth with RNL dye concentration (100 mg/l) for the six strains (ES37, ESL52, TSL9, TSL7, TS5 and M1) were represented in table 3. Remazol golden yellow decolorization reports literature was very least only. Remazol golden yellow was conserved or concentrated decolorization experiment. The results were presented in table showing that Pseudomonas sp., M1 have the ability to decolorize Remazol golden yellow (RNL) about 84% decolorization is observed by Pseudomonas sp., followed by Lactobacillus sp., (81%), Bacillus sp., (81%), Bacillus sp., (80%), Micrococcus sp., (78%) and Staphylococcus sp., (72%). Previously Tony et al., 2009 reported that decolorization of Remazol golden yellow dye by different Bacillus sp., Interestingly least decolorization was observed with Remazol golden yellow
concentration 10 mg/l upto 9.8% decolorization at the end of 96 hours showed moderate growth in the presence of Remazol golden yellow dye in basal medium indicating that they were not toxic to the culture compared to the above reports. *Pseudomonas* sp., Produces good decolorization upto 92% of dye concentration of 100 mg/ l at 48 hours. Similarly padhamavathi *et al.*, 2003 reported that the Remazol golden yellow decolorization by *Pseudomonas* sp., Upto 77% with dye concentration of 250 mg/l this was the only report support to the current study.

### Table 3: Result for effect of carbon and nitrogen source for RNL dye decolorization

<table>
<thead>
<tr>
<th>Strains</th>
<th>Tentative Genus</th>
<th>Optical Density Value(Triplicate)</th>
<th>Percentage of Decolorization (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial 1st 2nd 3rd</td>
<td></td>
</tr>
<tr>
<td>ES37</td>
<td>Staphylococcus sp.,</td>
<td>0.75 0.18 0.25 0.20</td>
<td>72</td>
</tr>
<tr>
<td>ESL52</td>
<td>Bacillus sp.,</td>
<td>0.75 0.12 0.15 0.17</td>
<td>81</td>
</tr>
<tr>
<td>TSL9</td>
<td>Bacillus sp.,</td>
<td>0.75 0.15 0.13 0.15</td>
<td>80</td>
</tr>
<tr>
<td>TSL7</td>
<td>Micrococcus sp.,</td>
<td>0.75 0.17 0.17 0.15</td>
<td>78</td>
</tr>
<tr>
<td>TS5</td>
<td>Lactobacillus sp.,</td>
<td>0.75 0.14 0.16 0.14</td>
<td>81</td>
</tr>
<tr>
<td>M1</td>
<td>Pseudomonas sp.,</td>
<td>0.75 0.12 0.11 0.13</td>
<td>84</td>
</tr>
</tbody>
</table>

Microorganism capable of utilizing a variety of complex chemicals including dye as their sole carbon source or either nitrogen source. Only few researches were successful in isolating culture capable of utilizing dyes as sole source as carbon (Sarnaik *et al.*, 1999). Microorganism require organic carbon sources without any extra carbon source the biodegradation of dye was very difficult because as they cannot utilize dye as the growth substrate. However, the aerobic decolorization of azo dyes can also be carried out in the presence of external carbon source and presumably does not use azo dyes as the sole carbon source or energy source (Padmavathy *et al.*, 2003). In the present study, six strains *Bacillus* sp., *Micrococcus* sp., *Staphylococcus* sp., *Pseudomonas* sp., and *Lactobacillus* sp., have capability to utilize the dye as a sole carbon source without any external carbon in the presence of nitrogen source under anoxic condition was found. This reports was contrast with the previous reports that under aerobic condition, the azo dyes were non degradable by most of the bacteria which use dye as sole source of carbon was proved to be difficult (Zimmermann *et al.*, 1982).

### 3.6 Effect of oxygen requirement in dye decolorization

Typical microbial oxygen requirement mechanism was studied by stab culture method. Screening result using the stab culture method shows that all the six strains (ES37, ESL52, TSL9, TSL7, TS5 and M1) showed the ability to decolorize Remazol golden yellow after 24 hours of incubation at room temperature. The place of the decolorization was present only in the inside of the tube indicate the oxygen requirement for the six strains is anoxic or microaerophilic state of affairs only.

### 3.7 Effect of salt on bacterial growth

Screening of dye decolorizing bacteria for salt tolerance results showed that all the six strains (ES37, ESL52, TSL9, TSL7, TS5 and M1) showed growth at 10 to 30g/l Sodium chloride concentration. Overall the growth rate of dye decolorizing bacteria increases with the increase in the concentration of Sodium chloride up to 30g/l and then decreased with further increase in the salt tolerance. Textile dye effluents have a high salt concentration as their constituent. Effect of salt tolerance on the bacteria for dye decolorization suggests, there was a steady increase in the rate of decolorization but excess salt in the medium inhibit the micro...
organism ability to decolorize the dye. This result was supported by (Mathew and Madamwar, 2004) that salt tolerance on the bacterial consortium for the dye decolorization was tested up to 5.0% (w/v).

3.8 Microcosm experiment

Microcosm experiment will help to know bacterial isolates adapting ability into the natural environment and their dye decolorizing efficiency with relationship to natural ecosystem. Dye contaminated effluent and clean water (unpolluted water) were inoculated using the twenty monocultures and mixed culture contained with Remazol golden yellow dye concentration (100 mg/l) and incubated statically for 28 – 30°C (ambient temperature). Both the monoculture and mixed culture was able to decolorize the polluted water with the dye, mixed culture were efficiently decolorize the polluted water with the dye compare to monoculture in the stimulated time period (24 – 48 hours). Uninoculated polluted water was not decolorized even if resident organism in the polluted water was present. Mixed culture efficiently decolorized the dye due to the presence of resident micro organism and other organic matter in the polluted water could have helped in the degradation of the dye. In the present study natural organic matters, resident in micro organism drastically influenced in dye decolorizing activity compared with control. This report was supported by (Jalandani Buan et al., 2009) explained that resident micro organism alone could not have decolorized the dye by themselves. The reason behind was microorganism present in the polluted water do not produce the enzymes to reduce azo dyes. Another explanation was the organism were not exposed to azo dyes prior to the experiment and not adapted to the presence of dyes. Bacteria need to be adapted to the pollutant before they can degrade it (Backer and Herson, 1984). The environment condition must be favorable for the degradation of certain compounds include pH, electron acceptor, organic materials, inorganic materials, nitrogen and phosphorus are essential to carry out perspective of bioremediation.

4. Conclusion

The ever increasing problem in the effluent discharge combined with their toxicity, structure complexity of the dye, effluent, sludge create the environmental problem as well as public health impacts. We are in the urge to find a new potential strain to withstand high pH, temperature, toxicity, salt tolerance, degrade and decolorize a continuous process. The screening of the microbial population from the collected effluent, dye contaminated soil samples led to the isolation of twenty morphologically distinct bacterial and seven fungal isolates responsible of the decolorization of the dye. The higher decolorizing and degrading activity was obtained for six strains. These bacterial genus reports for the decolorization of Remazol golden yellow dye so far to our knowledge for dye decolorization was very least only. Also strains have capability to utilize dye as a carbon source, tolerate the sodium chloride upto 30% and adapt to natural ecosystem. This study clearly reinforces the relevance of indigenous bacterial isolates in bioremediation it might be a promising candidates for the biological treatment of textile industry effluent.

Acknowledgement

The authors sincerely thank to the Head of the Department in Microbiology, Periyar University, Salem for his encouragement and also thank management authorities for providing the research facilities to complete this work.
5. References


