Int.J.Curr.Microbiol.App.Sci (2016) *5*(8): 258-272

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 5 Number 8 (2016) pp. 258-272**
Journal homepage: http://www.ijcmas.com

Original Research Article http://dx.doi.org/10.20546/ijcmas.2016.508.027

Evaluation of Bioremediation Potential of Isolated Bacterial Culture YPAG-9 (*Pseudomonas aeruginosa*) for Decolorization of Sulfonated di-azodye Reactive Red HE8B under Optimized Culture Conditions

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Keywords

Reactive Red HE8B, decolorization, *Pseudomonas aeruginosa*, Optimization.

Article Info

Accepted:
12 July 2016
Available Online:
10 August 2016

A B S T R A C T

Wastewater from textile industries poses a high environmental impact and therefore needs to be treated before being discharged into the environment. The present study deals with the decolorization of sulfonated di-azo dye Reactive Red HE8B by different bacterial cultures isolated from a contaminated site. Amongst 19 cultures, the isolate YPAG-9 displayed 86% decolorization of Reactive Red HE8B (100 mg l^{-1}) in 48 h. Based on morphological, cultural, physiological and biochemical properties, the isolate YPAG-9 was identified as *Pseudomonas aeruginosa*. The color removal efficiency of the isolate was further improved by optimizing various physico-chemical parameters. The decolorization of the dye was 1.9 times higher under static condition as compared to shaking condition. The 10% (v/v) inoculum size, 7.0 pH and 30^{o}C temperature were found optimum for the decolorization of the dye. The isolate was able to decolorize the dye in the range of 50-300 mg l^{-1}. The decolorization of 11 different synthetic dyes was achieved by the isolate YPAG-9. The results suggest the potential application of the isolate YPAG-9 for the bio-treatment of dye containing industrial waste waters.

Introduction

In recent years textile and dyestuff industries are considered as one of the main sources of water pollution problems owing to discharge of large amount of highly colored effluents to neighboring water bodies (Przystas *et al.*, 2012). This negative anthropogenic impact on the environment is mainly associated with different dyes and their application to color synthetic and natural fabrics. Amongst different dye classes, azo dyes represent the largest class of dyes with diverse applicability in various industries namely paper, plastic, leather, food, pharmaceutical, cosmetics etc. (Liu *et al.*, 2004). Their presence in the effluents adversely affects water sources, soil fertility, aquatic life and ecosystem integrity (Chen *et al.*, 2011). Moreover, many dyes and their breakdown products cause significant human health problems due to toxigenic, mutagenic and

carcinogenic effects (Gnanapragasam *et al.*, 2010, Mangaiyarkarasi *et al.*, 2015). Therefore their release into surface water is aesthetically undesirable and has gained considerable attention of environmental regulatory agencies as well as strict governmental legislation to evaluate the fate of dyes from industrial wastewater as well as from the natural environment (Flores *et al.*, 2008; Liao *et al.*, 2013).

Various physico-chemical methods like filtration, coagulation-flocculation, use of activated carbon, ozonation, adsorption, ion exchange etc are available for the treatment of dye containing wastewaters (Saratale *et al.*, 2011; Ekambaram *et al.*, 2016). However, the use of such processes is associated with certain technical and economical downsides (Franciscon *et al.*, 2009; Lang *et al.*, 2014). Therefore, bioremediation using different microbial agents presents an effective, cheaper and environmentally begin alternative for the treatment of dye containing industrial effluents (Ali, 2010). Different types of microorganisms including bacteria, fungi, actinomycetes, yeasts, algae have been reported for their ability to decolorize and mineralize various dyes under certain environmental conditions (Machado *et al.*, 2006; Pajot *et al.*, 2011; Gahlout *et al.*, 2013; Rudakiya and Pawar 2014). In particular, the role of diverse groups of pure and mixed cultures of bacteria in the decolorization of textile dyes has been extensively investigated (Khouni *et al.*, 2011; Kadam *et al.*, 2013).

The use of pure culture of bacteria offers advantage of detailed knowledge of dye degradation pathways, exact enzymology involved in it, formation of catabolic end products and their toxicity under a given set of cultural conditions. Moreover, it provides reproducible data output, and thus interpretation of experimental observations becomes easier (Khalid *et al.*, 2012; Lalnunhlimi and Krishnaswamy, 2016). The present study deals with isolation, screening and identification of textile dye decolorizing bacterial cultures. The optimization of various physico-chemical parameters like inoculum size, pH, temperature, dye concentration for the enhanced decolorization of Reactive Red HE8B by selected bacterial culture YPAG-9 was performed. Furthermore, the ability of bacterial culture to decolorize different synthetic dyes was investigated.

Materials and Methods

Dyes and Chemicals

Different textile dyes Reactive RedM5B (C.I. Reactive Red 2), Reactive Brown GR (C.I. Reactive Brown 18), Acid Green GLW (C.I. Acid Green 27),Reactive Red HE8B (C.I. Reactive Red 152), Acid Red 3BN (C.I. Acid Red 131), Reactive Blue 3R (C.I. Reactive Blue 28), Acid Red BB (C.I. Acid Red 128),Reactive Yellow MERL (C.I. Reactive Yellow 145), Reactive Violet 5R (C.I. Reactive Violet 5), Acid Orange II (C.I. Acid Orange 7), Reactive Orange HER (C.I. Reactive Orange 84) and Acid Red F2R (C.I. Acid Red 151)used in the present study were procured from CAB chemicals, Ankleshwar, Gujarat, India. All the dyes were of different chemical structures and were used without further purification. The high molecular weight sulfonated di-azodye Reactive Red HE8B was used as model dye for present study (Fig. 1). Bushnell Haas Medium, Nutrient agar, glucose, yeast extract, Luria Bertani broth and agar agar were purchased from Himedia Laboratories, Mumbai, India. All other chemicals and reagents used in the present study were of analytical grade.

Culture Media

The isolation and dye decolorization experiments were performed using Bushnell Haas Medium (BHM) containing gl^{-1}:$MgSO_4.7H_2O$, 0.2., $CaCl_2.2H_20$, 0.02., KH_2PO_4, 1.0., K_2HPO_4, 1.0., $(NH_4)(NO_3)$, 1.0., $FeCl_3$, 0.05., and pH 7.0±0.2with glucose (0.5% w/v) and yeast extract (0.05% w/v). The bacterial inoculum was prepared in Luria Bertani (LB) broth containing g l^{-1}: casein enzymatic hydrolysates, 10.0,yeast extract, 5.0, NaCl, 5.0, and pH, 7.0±0.2. The bacterial cultures were routinely maintained on LB agar.

Isolation of dye decolorizing bacterial cultures

The dye decolorizing bacterial strains were isolated from contaminated soil samples obtained from different sites of common effluent treatment plant (CETP), Nandesari, Vadodara, Gujarat, India. The soil samples (1.0 g) were added to 250 ml Erlenmeyer flasks containing 100 ml BHM + glucose (0.5 % w/v) + yeast extract (0.05% w/v) and100 mg l^{-1} Reactive Red HE8B. All the flasks were incubated under static condition at 30^oC for 2 weeks. Five milliliter of enriched cultures showing decolorization of Reactive Red HE8Bwas transferred to 100 ml fresh BHM medium. Repeated transfers in fresh dye containing media were performed till stable dyedecolorizing bacterial cultures were obtained.

The final enriched cultures showing consistent growth and decolorization activity were serially diluted and plated on BHM agar plates containing Reactive Red HE8B (100 mg l^{-1}). After incubation, different bacterial colonies with distinct morphological characteristics were picked up and purified by regular subculture. The isolated pure bacterial strains were maintained on LB agar slants.

Screening of dye decolorizing bacterial cultures

The isolated bacterial cultures were screened for the decolorization of Reactive Red HE8B under submerged condition. Each bacterial culture was cultivated in LB broth for 24 h. A 10% (v/v) inoculum of individual bacterial strains with uniform cell density (OD_{600} 0.5) was transferred to respective 250 ml Erlenmeyer flasks containing 150 ml BHM + glucose (0.5% w/v) + yeast extract (0.05% w/v) and Reactive Red HE8B(100 mg l^{-1}). All the flasks were incubated under static condition at 30^oC for 72 h. The aliquots were withdrawn from different flasks at regular time intervals and analyzed for growth and decolorization. Based on percent decolorization, the potential bacterial cultures were selected for further dye decolorization experiments.

Identification of selected bacterial cultures

The potential bacterial cultures showing highest decolorization of the dyes were identified on the basis of morphological, cultural, physiological and biochemical characteristics. The morphological properties included cell size, shape, arrangement and staining reaction. The cultural properties considered were size, shape, margin, elevation, texture, color of isolated colonies on nutrient agar plate. The physiological and biochemical properties of selected bacterial cultures were evaluated by indole, methyl red, Voges–Proskauer, catalase, oxidase, urease, nitrate reduction test, citrate utilization test, H_2S production test, growth on triple sugar iron agar slant etc. The ability to ferment various sugars like dextrose, lactose, maltose, mannitol, xylose, sucrose, fructose, arabinose, galactose etc. was also assessed. Based on

comparative analysis of the observed characteristics with the standard description of bacterial strains in Bergey's Manual of Systematic Bacteriology, the bacterial cultures were identified upto species level.

Establishment of optimum conditions for decolorization

Optimization of various physico-chemical parameters (pH, temperature, inoculum size, dye concentration) for maximum color removal was performed using single factor at a time methodology. The decolorization studies were performed using various inoculums size (1, 2, 5, 7, 10, 12, 15% (v/v)), different dye concentration (50, 100, 150, 200, 250, 300mg l^{-1}),pH values (4, 5, 6, 7, 8, 9, 10) and temperature (15, 20, 30, 37, 42, 50^{o}C). The decolorization of various textile dyes by selected bacterial cultures was studied under optimum culture condition.

Decolorization analysis

The decolorized samples (2 ml) collected at regular time intervals were centrifuged at 10,000 rpm for 10 min. The cell free supernatants were scanned in the range of 200 to 800 nm using UV-Visible spectrophotometer (SHIMADZU UV-1800, Japan).

The residual dye concentration in the sample was determined from the absorbance values using the calibration curve for absorbance versus dye concentration obtained by plotting the corresponding maximum absorbance in the UV-visible spectra at different concentrations of dye. Dye concentration of decolorized sample was quantified by comparing its absorbance with the absorbance of known concentrations and this was used to calculate percentage decolorization using the following formula:

Decolorization (%) = $(A_I-A_F/A_I) \times 100$
where, A_I = Initial absorbance, A_F=Final absorbance.

Data analysis

All the experiments were performed in triplicates and the data presented is in the form of mean value. The standard deviation was calculated using the mean values and remained within the range of ±10%.

Results and Discussion

Isolation, screening and identification of dye decolorizing bacterial cultures

The bacterial cultures with an efficient color removal potential of textile azo dyes were isolated from soil samples contaminated with dyes. It is expected that site snear the CETP harbor several microorganisms which are capable to co-exist with higher toxic levels of pollution. The enrichment culture technique led to the isolation of 19 bacterial strains showing morphologically distinct colony characteristics on BHM agar plates containing100 mg l^{-1}Reactive Red HE8B. These bacterial isolates were designated as YPAG-1 to YPAG-19. The isolated bacterial strains were screened for the decolorization of dye Reactive Red HE8B (100mg l^{-1}) in submerged condition. The color removal efficiency in terms of percent decolorization by isolates is depicted in Table 1. The isolate YPAG-9 showed highest decolorization of Reactive Red HE8B (86.36 ± 1.3%) in 48 h. The isolate YPAG-17 was found to be second most efficient culture showing 66.51 ± 0.4% decolorization followed by isolates YPAG-3 (64.18 ± 1.3%), YPAG-7(62.67 ± 1.7%) and YPAG-14 (61.70 ± 0.9%).Nevertheless the isolates YPAG-2, YPAG-4, YPAG-10 and YPAG-16 exhibited lesser color removal efficiency in the range of 17.12 ± 0.7% to 35.60 ±

0.9%. The isolation of dye decolorizing bacterial cultures from dye contaminated soil, sludge and an industrial effluent is reported by many researchers (Wang *et al.*, 2009; Mohamed 2016). The potential dye decolorizing bacterial isolate YPAG-9 was identified on the basis of morphological, cultural, physiological and biochemical properties. The isolate YPAG-9 was Gram negative, motile, non endospore forming rods. The isolate YPAG-9 was able to grow on basal medium such as Nutrient agar to form medium to large sized, irregular, slightly raised colonies with irregular margins. The colonies were smooth with greenish colored pigmentation. Different physiological and biochemical propertiesof isolate YPAG-9 used for identification are listed in Table 2.

By comparing above results with the standard results of bacteria in Bergey's Manual of Systematic Bacteriology, the isolate YPAG-9 was identified as *Pseudomonas aeruginosa* and its taxonomical classification listed in Table 3.

Establishment of optimum operational conditions for decolorization of RR HE8B

Effect of static and shaking condition

The present study was conducted to evaluate the effect of incubation conditions on decolorization of Reactive Red HE8B by the isolate YPAG-9. The isolate exhibited effective color removal activity under static condition than shaking condition (Fig. 3). Under static condition, 87.63±2.1% decolorization of Reactive Red HE8B was obtained, whereas shaking condition showed only 46.12±1.9% color removal by the isolate YPAG-9 in 48 h (Fig. 4).The decolorization efficiency of isolate YPAG-9 was 1.9 times higher in static condition as compared to shaking condition. The obtained results suggested that the decolorization of the dye was significantly correlated with dissolved oxygen content; lesser the amount of dissolved oxygen, faster the color removal of the dye. Therefore, the facultative anaerobic condition was found to be more appropriate for the decolorization enhancing color removal performance of the isolate YPAG-9. Many reports suggested that the reductive cleavage of azo bond is inhibited in the presence of dissolved oxygen primarily owing to the competition in the oxidation of reduced electron carriers like NADH between oxygen and azo group as electron acceptor (Asad *et al.*, 2007; Wang *et al.*, 2009).

In aerobic condition, the presence of high-redox-potential electron acceptor oxygen may lead to the inhibition of dye reduction mechanism (Pearce *et al.*, 2003). In support to our findings, similar results have been reported by Ghodake *et al.*, (2011), wherein they showed that the decolorization of mono-azo dye Amaranth by *Acinetobacter calcoaceticus* NCIM 2890 was faster in static condition compared to shaking condition.

Effect of inoculum size

The decolorization efficiency of the isolate YPAG-9 was monitored at different inoculum concentrations ranging from 1.0 to 15.0% (v/v). The decolorization of Reactive Red HE8B was 17.10±1.5% at 1.0% inoculum sizein 48 h. A positive trend of decolorization of the dye with inoculum size was observed in the range of 1.0-10.0% with maximum decolorization (88.54±2.4%) at 10.0% inoculum size (Fig. 5). Any further increase in inoculum size did not affect the decolorization performance of the isolate YPAG-9. The removal of Reactive Red HE8B was 85.35±1.9% and 84.14±2.6% at 12.0% and 15.0% inoculum size respectively.

Since the bacterial number is a critical parameter for biological decolorization process, decline in bacterial population results in low decolorization rate along and prolonged decolorization time. An excess inoculum on the other hand leads to rapid depletion of nutrients and accumulation of toxic wastes which adversely affect bacterial growth and decolorizing activity (Moosvi *et al.,* 2005). The decolorization of 50 mg l^{-1} Malachite Green was highest at 10% inoculum of *Kocuriarosea* MTCC 1532 (Parshetti *et al.,* 2006). In the present study, the decolorization efficiency of the isolate YPAG-9 increased 3.27 folds at 10.0% inoculum as compared to 1.0% inoculum size, suggesting an optimum biomass requirement for effective decolorization of Reactive Red HE8B.

Effect of pH

In order to assess the effect of pH, the decolorization of Reactive Red HE8B by the isolate YPAG-9 was performed in the range of pH 4.0–10.0. The highest decolorization of the dye (86.19±1.2%) was achieved at pH 7.0 in 48 h (Fig. 6). The dye removal capacity of the isolate was 68.52±2.3% and 74.25±1.4% at pH 6.0 and 9.0 respectively. Nevertheless, the decrease in the decolorization of Reactive Red HE8B was evident at pH 4.0 (28.14±2.3%) and pH 10.0 (33.75±1.4%). However, the color removal performance increased 2.12 fold as the pH of the medium was raised from 5.0 to 7.0.

Similarly, Chang *et al.*, (2001) also reported 2.5 times increment in decolorization rate with a rise of pH from 5.0 to 7.0 using *Pseudomonas luteola*. Since various biological activities of the organisms are affected by hydrogen ion concentration, the major effect of pH on the decolorization of dye may be attributed to the transport of dye molecules across the cell membrane influencing overall color removal performance (Kodam *et al.,* 2005). The previous reports exist showing higher decolorization of Direct Brown II and Alizarin Red S by different bacterial strains at optimum pH of 7.0 (Illanjiam and Arunachalam, 2011; Illakkiam *et al.,* 2016).

Effect of temperature

The temperature is a factor of paramount importance for all processes associated with microbial viability, including the remediation of water and soil (Saratale *et al.,* 2011). In the present study, the decolorization of Reactive Red HE8B by the isolate YPAG-9 was studied in the range of 15-50^{o}C. As shown in Fig. 7 the obtained decolorization at 15^{o}C incubation was 28.63±2.7%. The linear relationship between incubation temperature and color removal was observed in the temperature range of 15 to 30^{o}C with a maximum decolorization 87.32±1.1%. However, further increase in temperature resulted in the reduction of decolorization activity of isolate YPAG-9. The decolorization of the dye was 48.14±1.6% and 20.75±2.1% at 45^{o}C and 50^{o}C respectively.

Maximum color removal activity of the isolate at 30^{o}C may be owing to higher bacterial growth along with larger production and activity of enzymes associated with color removal. Moreover, higher respiration and substrate metabolism at optimum temperature could result into faster decolorization rate. The decline in decolorization rate at higher temperature (37-50^{o}C) can be attributed to the loss of cell viability or to the denaturation of dye decolorizing enzyme such as azoreductase (Mate and Pathade, 2012). Our findings are in accordance with previously reported literature (Guo *et al.,* 2008) explaining better decolorization of Reactive Brilliant Red K-2BP by *Halomonas* GTW at 30^{o}C.

Effect of initial dye concentration

The decolorization of Reactive Red HE8B by the isolate YPAG-9 was investigated in the range of initial dye concentration (50-300 mgl^{-1}) under static incubation condition. The results depicted in Figure 8 demonstrated that maximum decolorization of the dye (87.64±2.1%) was obtained at 100 mg l^{-1}concentration in 48 h. The color removal performance of the isolate decreased with the increase in dye concentration thereafter; 55.41±2.6% decolorization of the dye was observed at 300 mg l^{-1}. However, the decolorization rate increased from 0.9 to 3.46 $mgdyel^{-1}$ h^{-1} with the increase in initial dye concentration from 50 to 300 mg l^{-1} indicating the stability and color removal capacity of isolate YPAG-9 at higher dye concentrations. This finding was consistent with previous studies reported by Khalid *et al.*, (2008) wherein an inverse relationship between the decolorization by *Shewanella putrefaciens* and the initial dye concentrations was observed.Higher toxicity of dye to viable cells, inadequate biomass population for the uptake of higher concentrations of dye and blockage of active sites of enzymes by dye molecule may be the probable reasons for decrease in decolorization performance of microorganisms at higher dye concentrations.

Table.1 Decolorization of Reactive Red HE8B (100 mg l^{-1}) by isolated bacterial cultures under submerged condition

Bacterial isolate	% Decolorization
YPAG-1	45.90 ± 0.8
YPAG-2	17.12 ± 0.7
YPAG-3	64.18 ± 1.3
YPAG-4	30.78 ± 1.1
YPAG-5	49.76 ± 0.6
YPAG-6	53.71 ± 2.2
YPAG-7	62.67 ± 1.7
YPAG-8	59.48 ± 0.7
YPAG-9	86.36 ± 1.3
YPAG-10	35.60 ± 0.9
YPAG-11	52.68 ± 0.8
YPAG-12	57.34 ± 2.1
YPAG-13	50.07 ± 2.1
YPAG-14	61.70 ± 0.9
YPAG-15	42.82 ± 1.5
YPAG-16	34.62 ± 2.3
YPAG-17	66.51 ± 0.4
YPAG-18	70.01 ± 1.2
YPAG-19	58.46 ± 1.6

Table.2 Identification characteristics of bacterial isolate YPAG-9

Characteristics	Result
Gram stain reaction	Gram – ve
Shape	Rod
Motility	+
Endospore formation	-
Indole production	-
Methyl Red Test	-
Voges-ProskauerTest	-
Citrate utilization	+
Lysine decarboxylase	+
Ornithine decarboxylase	+
Urease	-
Catalase	+
Oxidase	+
Phenylalanine deamination	-
Nitrate reduction	+
H_2S production	-
Esculin hydrolysis	-
Starch hydrolysis	-
Gelatin hydrolysis	-
Acid from	
Glucose	+
Adonitol	-
Lactose	-
Maltose	-
Mannitol	-
Sucrose	-
Xylose	-
Arabinose	+
Sorbitol	-
Rafifinose	-
D- Fructose	-
Galactose	-
TSI Test Slant Butt Gas production H_2S production	 Alkaline (Pink) Acidic (yellow) - -
Growth on Mac Conkey's agar	Pale yellow lactose non-fermenting colony

+ indicates positive growth/ present; - indicates no growth/absent

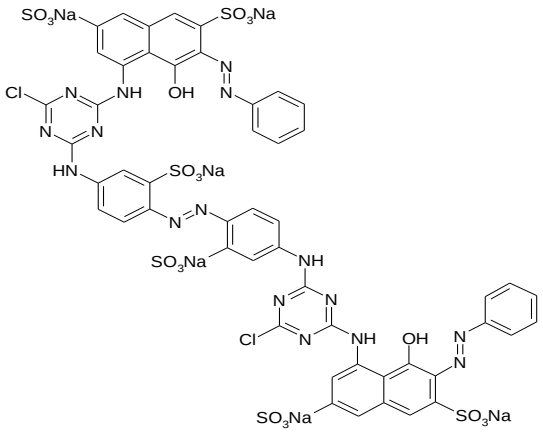
Table.3 Taxonomical classification of bacterial isolate YPAG-9

Classification	Isolate YPAG-9
Kingdom	Bacteria
Phylum	Proteobacteria
Class	Gamma Proteobacteria
Order	Pseudomonadales
Family	Pseudomonadaceae
Genus	*Pseudomonas*
Species	*aeruginosa*

Table.4 Decolorization of different azo dyes by isolate YPAG-9

Dye	λ max (nm)	% Decolorization	Time (h)
Acid Orange II	484	46.24±2.6	60
Acid Red BB	532	61.16 ± 2.1	48
Reactive Red M5B	538	37.45 ± 1.6	48
Reactive Orange HER	496	34.33 ± 2.3	60
Acid Red 3BN	551	76.19 ± 1.4	48
Reactive Violet 5R	560	80.64 ± 1.2	48
Reactive Yellow MERL	410	28.07 ± 2.3	60
Acid Red F2R	510	44.71 ± 3.5	48
Reactive Brown GR	475	59.52 ± 2.4	60
Acid Green GLW	617	69.41 ± 3.3	60
Reactive Blue 3R	577	82.15± 1.9	48

Fig.1 Model dye Reactive Red HE8B used in present study



C.I. Name: Reactive Red 152

Molecular weight: 1752.11

Molecular formula: $C_{52}H_{30}Cl_2N_{14}Na_6O_{20}S_6$

CAS No: 71870-80-5

Maximum absorbance (λ_{max}): 548

Fig.2 Growth characteristics of isolate YPAG-9 on Nutrient agar medium

Fig.3 Decolorization of Reactive Red HE8B by isolate YPAG-9 (A) control and (B) decolorized dye sample after 48 h static incubation

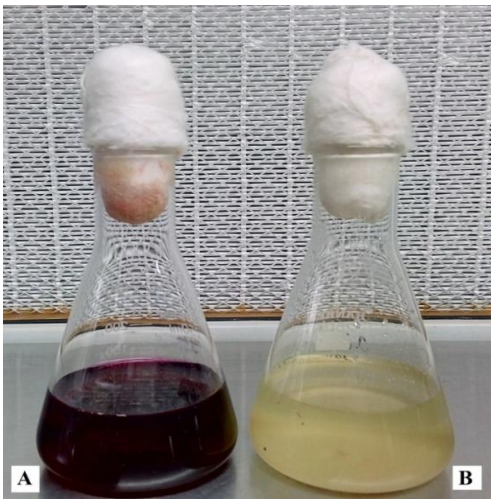


Fig.4 Decolorization of Reactive Red HE8B by isolate YPAG-9 under static and shaking incubation conditions

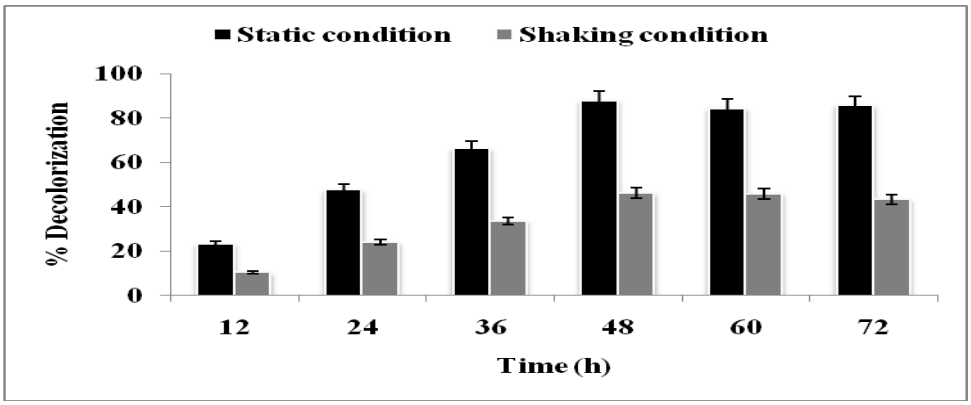


Fig.5 Effect of inoculum size on decolorization of Reactive Red HE8B by isolate YPAG-9.

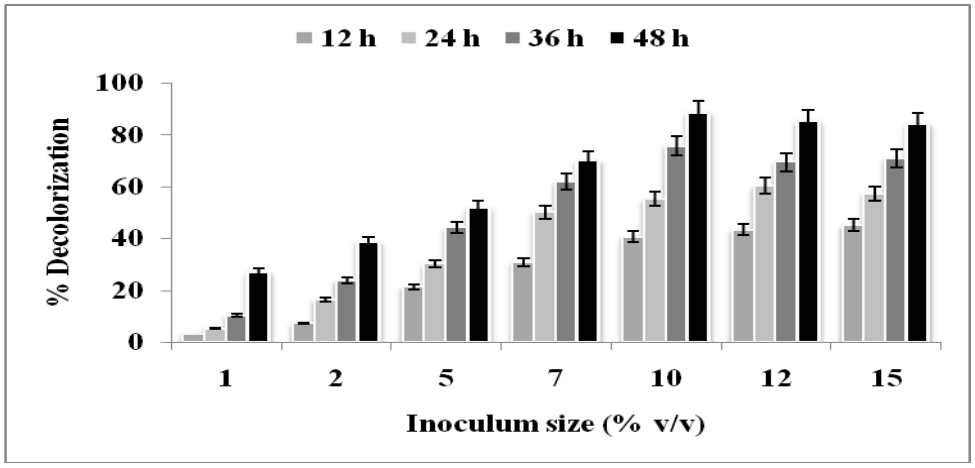


Fig.6 Effect of pH on decolorization of Reactive Red HE8B by isolate YPAG-9

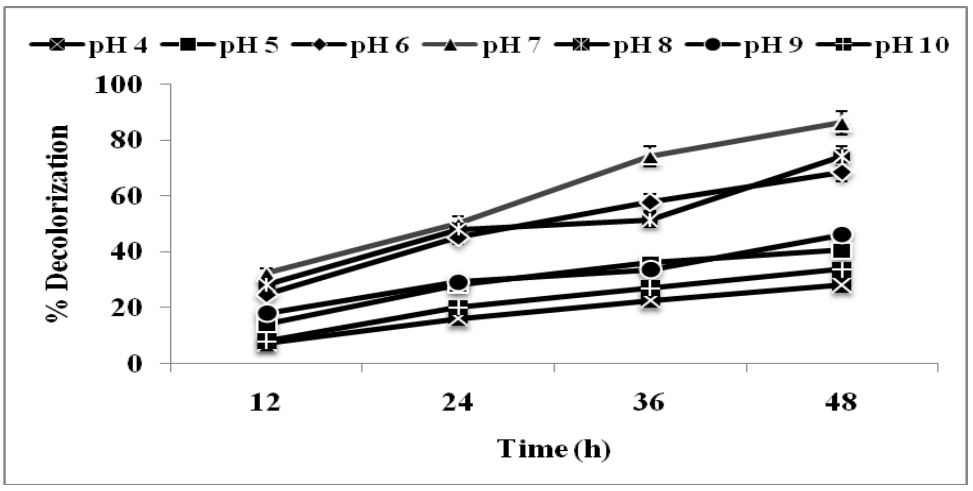


Fig.7 Effect of temperature on decolorization of Reactive Red HE8B by isolate YPAG-9

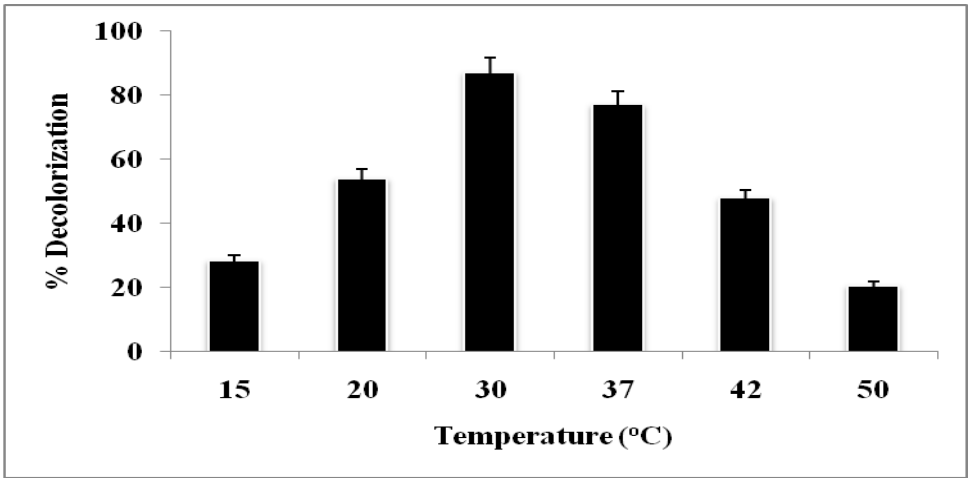
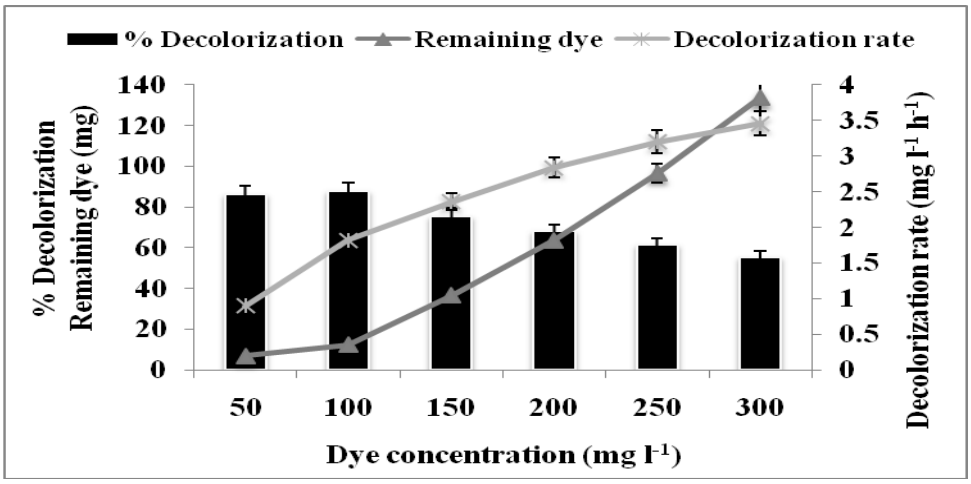


Fig.8 Effect of initial dye concentration on decolorization of Reactive Red HE8B by isolate YPAG-9



Moreover, the presence of sulfonic acid (SO_3H) groups, which might acts as detergent inhibiting the growth and overall dye decolorization performance of bacteria (Tony *et al.*, 2009). In contrast, very dilute dye solutions led to lower rate of dye decolorization probably owing to insufficient dye molecules that would be recognized by the dye reductase enzymes inside the cells (Pearce, 2003).

Spectrum of dyes decolorized by isolate YPAG-9

Large varieties of synthetic dyes are released in the industrial effluent. The ability of isolate YPAG-9 to decolorize different textile dyes was studied under submerged condition. The results presented in Table 4 indicated that the isolate decolorized dyes in varying extent. The considerable decolorization of Reactive Blue 3R and Reactive Violet 5R was achieved by the isolate in 48 h. However, Reactive Yellow MERL was found to be most resistant for the decolorization followed by Reactive Orange HER and Reactive Red M5B with decolorization between 28 and 37% in 60 h. This difference in decolorization pattern may be due to structural diversity of various dyes. Reports suggest that faster decolorization of dyes is obtained which chemical structure is simple as well as of low molecular weight. Whereas, highly substituted, high molecular weight dyes are hard to decolorize by microorganisms. Moreover, the extent of color removal is highly influenced by number of azo bonds and substitution of electron withdrawing groups ($-SO_3H$, $-SO_2NH_2$) in dye molecules (Sani and Banerjee 1999). The results thus indicate the capability of the isolate YPAG-9 to decolorize different dyes and hence, its potential use in the treatment of multiple dye containing industrial effluents.

In conclusion, the present study portrays the potential of bacterial isolate YPAG-9 to decolorize sulfonated di-azodye Reactive Red HE8B. The isolate was identified as *Pseudomonas aeruginosa*. Maximum decolorization of the dye was achieved with 10% inoculum size at pH 7.0 and 30^{o}C under static incubation condition. The isolate YPAG-9 was able to decolorize higher concentrations of the dye as well as displayed the competency for effective decolorization of different textile dyes. Therefore, it is concluded that the isolate YPAG-9 holds good potential for the

decolorization of dyes; further research could explore the ability of the isolate to develop viable and eco-friendly strategies for bioremediation of synthetic dyes from industrial waste water.

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How to cite this article:

Yogesh Patel and Akshaya Gupte. 2016. Evaluation of Bioremediation Potential of Isolated Bacterial Culture YPAG-9 (*Pseudomonas aeruginosa*) for Decolorization of Sulfonated di-azodye Reactive Red HE8B under Optimized Culture Conditions. *Int.J.Curr.Microbiol.App.Sci.* 5(8): 258-272. doi: http://dx.doi.org/10.20546/ijcmas.2016.508.027