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Research article

BIOREMEDIATION OF SLAUGHTER HOUSE WASTE WATER BY *RHODOBACTER* SP. GSKRLMBKU-02

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ABSTRACT: Biological treatment of waste waters is a sustainable alternative for waste treatment to existing treatment methods. Microbial metabolism effects pH, BOD, COD, DO and concentration of suspended solids present in slaughter house waste water. *Rhodobacter* sp. GSKRLMBKU-02 from paper mill waste water was used in the present study to remediate slaughter house waste water. Treatment with this bacterium caused a significant decrease in some of the parameters tested for waste water. Remediation of slaughter house waste water of Warangal by *Rhodobacter* sp. GSKRLMBKU-02 showed a 28% decrease in DO, 52% decrease in BOD, 76% decrease in COD and organic matter decreased to the extent of 55%. Further a reduction in the levels of Chloride (68%), sulphates (69%) and bicarbonates (34%) were also noticed due to the growth of this bacterium.
Key Words: Remediation, *Rhodobacter* sp. GSKRLMBKU-02, slaughter house waste water

INTRODUCTION

Remediation of waste water using microorganisms is being exploited worldwide due to several advantages it has over other methods (Singleton, 1994). A lot of studies are being done for biodegradation of the organic pollutants. However, more efforts are need to be made to develop effective biodegradation processes in the environment and to optimize and predict the performance of degrading microorganisms. Several of environmental factors affect the metabolism rate of biochemical activities. pH, concentration of suspended solids, biological oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), number and species of microorganism present, nutrient contamination and bioavailability of the contaminants are of vital importance (Hamme *et al*., 2003). Aerobic and anaerobic microorganisms are used for treating waste waters. Anaerobic organisms especially anoxygenic phototrophic purple non-sulfur bacteria offer several advantages over an aerobic treatment for moderate to high strength wastes. These organisms have more advantages as they can grow at high BOD and need no dilution of waste water, require small treatment space, no sludge disposal problems, easy maintenance of treatment space, tolerance to cold and feasibility of nitrogen and grease removal and biomass rich in protein (60%) and vitamin (B12) production are ideal organisms for waste water treatment. Industrial discharges impart high BOD to the waste water (Panigrahi and Konar 1992). Application of photosynthetic bacteria for water purification in Japan was reported by Sasaki *et al*. (1998). Akcil, (2003) reported transformation of toxic compounds by bacteria into less toxic compounds. *Rhodovulum sulfidophilum* is being used for the treatment and utilization of sardine processing waste water (Azad *et al.*, 2003). Metal remediation using *Chromobacterium violaceium* was investigated by Marta *et al*. (2004). Buccolieri *et al*. (2006) reported metal tolerance of *Rhodobacter sphaeroides*. Livia *et al.* (2006) observed the resistance of *Rhodobacter sphaeroides* in heavy metal contaminated environments. Vasavi *et al*. (2008) and Ramchander *et al.* (2007) used photosynthetic bacteria for remediation of waste waters. Bioremediation potentials of phototrophic bacteria were investigated by Ramchander *et al.* (2008, 2010, 2011, 2012 and 2013) and Rajya Laxmi *et al*. (2015). Removal of heavy metals and sodium from contaminated shrimp ponds (Saijai *et al.*, 2010), treatment of pharmaceutical waste water (Madukasi *et al.*, 2010), microaerobic biodegradation of high organic load of waste water (Madukasi and Zhang 2010) have also been reported. Remediation of sewage waste waters by the phototrophic bacterial consortium isolated from sewage water was reported by Ramchander *et al.* (2015). The bioremediation potentials of the *Rhodobacter* sp. GSKRLMBKU-02 isolated from paper mill waste water was investigated and discussed in the present communication.

MATERIAL AND METHODS

All the chemicals used in the present investigations were purchased from Sigma Aldrich and Hi Media companies, Mumbai, India. Samples for isolation of *Rhodobacter* sp. GSKRLMBKU-02 was isolated from paper mill waste water at Chandrapoor District, Maharashtra. The anoxygenic phototrophic bacterium *Rhodobacter* sp. strain GSKRLMBKU-02 was isolated by enrichment technique (Biebl and Pfennig, 1981) by inoculating the collected sample into the 15 ml medium containing screw capped tubes. Anaerobic conditions were maintained and incubated under 2000 lux light. The cultures thus obtained by enrichment technique were streaked on the solid enriched medium repeatedly by paired petriplate method and flushed with nitrogen gas to maintain the anaerobic condition. The isolated bacterium was identified as *Rhodobacter* sp. with the help of Bergey's Manual of Systematic Bacteriology (1994) and confirmed by precise molecular identification using 16S rRNA sequencing analysis. This sequence was submitted in National Centre for Biotechnology Information (GenBank Accession Number HG971782.1). Estimation of various parameters during bioremediation of slaughter house waste water were adopted from standard methods of APHA (1985).

RESULTS AND DISCUSSION

The quality of water is of vital concern for mankind since it is directly linked with human health. Contamination of natural water may result in an increased risk of disease transmission to man who consumes it. Deaths of animals including man are reported from different parts of the world due to microbial diseases transmitted by water. Natural processes and anthropogenic activities (Shrestha and Kazama, 2007 and Mukherjee *et al.*, 2009) influence the quality of water. Phototrophic bacteria are versatile and have diverse metabolic activity as they can use various carbon and nitrogen sources. Different researchers have reported the potentials of anoxygenic phototrophic bacteria in remediation of waste waters (Kim *et al*., 2004, Takeno *et al.*, 2005, Vijay *et al*., 2006, Livia *et al*., 2006 and Ramchander *et al.*, 2014 and 2015). Remediation of slaughter house waste water of Warangal by *Rhodobacter* sp. GSKRLMBKU-02 resulted in decrease in DO (28%), BOD (52%) and COD (76%) which was highly significant (Table 1 and Figure 1). Change in bicarbonates (34%), chlorides (68%), organic matter (55%) and sulphates (69%) were also noticed due to the growth of *Rhodobacter* sp. GSKRLMBKU-02. No carbonates were recorded both in untreated and treated water. These results are in agreement with earlier works of Ramchander *et al.* (2014 and 2015). The colour of the slaughter house waste water sample changed to dark red due to carotenoids which are produced during their metabolism. During the remediation of slaughter house waste water which was either acidic or neutral shifted towards alkaline due to the growth of *Rhodobacter* sp. GSKRLMBKU-02.

CONCLUSION

The present investigation revealed that *Rhodobacter* sp. GSKRLMBKU-02 isolated from paper mill waste was found to be efficient for remediation of slaughter house waste water as this bacterium has the ability to use different carbon and nitrogen source for its growth. The reduction of COD value up to 76 % of effluent generated from slaughter house waste water within 10 days of incubation. In comparison with results from previous studies, COD reduction was more.

Table 1: Remediation of slaughter house waste water by *Rhodobacter* sp. GSKRLMBKU-02

Parameters	Before Incubation			After incubation of 10 days		% of reduction
	Sample undiluted	Sample + Medium + Distilled water	Sample + Medium + Inoculum	Sample + Medium + Distilled water	Sample + Medium + Inoculum	
Colour	Dirty-white	Dirty-yellow	Yellowish red	Dirty- yellow	Dark- red	-
pH	6.5	7.0	7.2	7.2	8.2	-
Temperature (^{o}C)	35	37	37	32	32	-
DO (in mg/litre)	3.98	3.82	4.25	3.15	2.65	28
BOD (in mg/lit)	5.42	6.28	6.86	5.61	3.45	52
CO_2 (mg/lit)	-	-	-	-	-	-
Carbonates (mg/lit)	-	-	-	-	-	-
Bicarbonates (mg/lit)	176	189	226	138	133	34
Chlorides (mg/lit)	462	438	472	3.42	159	68
Organic matter (%)	0.38	0.41	0.46	0.35	0.21	55
Sulphates (mg/lit)	352	321	385	254	129	69
COD (mg/lit)	21.2	18.5	17.8	8.26	6.10	76

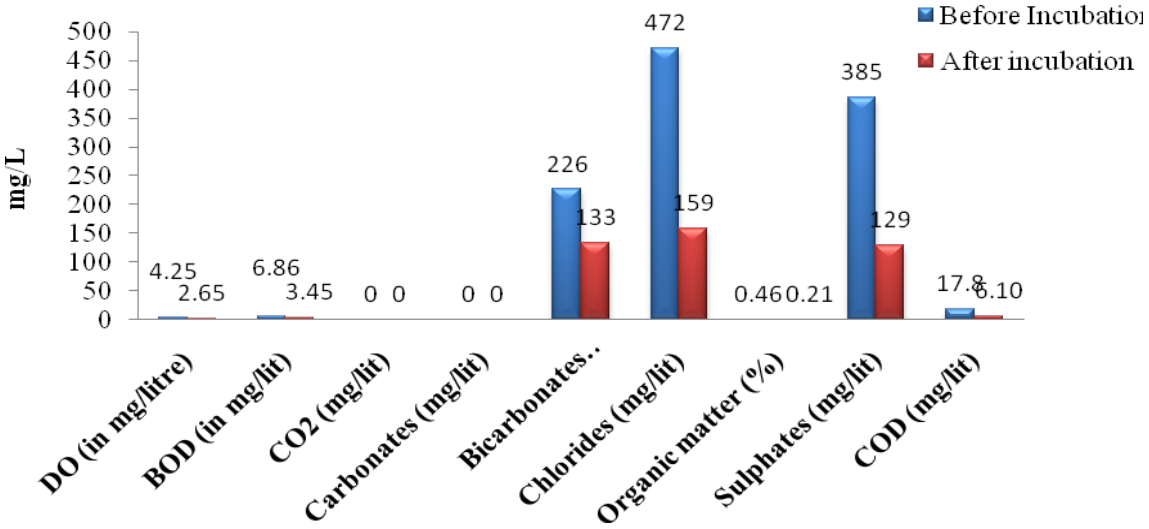

Figure-1: Remediation of slaughter house waste water by *Rhodobacter* sp. GSKRLMBKU-02

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