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Research article

BIOREMEDIATION OF SEWAGE WASTE WATERS BY THE PHOTOTROPHIC BACTERIAL CONSORTIUM ISOLATED FROM SEWAGE WATER

Ramchander Merugu[1], V.Namratha[2], Nagaraju Devanuri[3]*

[1]University College of Science and Informatics, Mahatma Gandhi University, Nalgonda-508254
[2] University College of Science, Satavahana University, Karimnagar-505001
[3] Department of Chemistry, Vignan's University, Guntur
*Corresponding author: naag1977@gmail.com

ABSTRACT: Microbial based treatments are more economical, ecofriendly and sustainable alternative for waste treatment to existing chemical or physical treatment methods. The metabolic rate of microorganisms effect pH, BOD, COD, DO, concentration of suspended solids present in waste waters. Phototrophic consortium from sewage water was used in the present study to remediate sewage water. Treatment with bacteria caused a significant decrease in some of the parameters tested for waste water. Remediation of sewage water of Panagal by photosynthetic bacteria showed a 23% decrease in DO and 64% decrease in BOD was observed which was significant. COD and organic matter decreased to the extent of 32% and 75% respectively. Chloride levels (6%), bicarbonates (32%) and sulphates (19%) were also decreased. Remediation of sewage water of Prakasam bazaar by photosynthetic bacteria showed a decrease in DO by 22%. Chemical oxygen demand and Biological oxygen demand decreases were significant and were to the extent of 60% and 38% respectively. Bicarbonates (45%), chlorides (35%), sulphates (16%) and organic matter (28%) also decreased significantly.

Key Words: remediation, sewage water, phototrophic bacteria

INTRODUCTION

Waste water remediation using microorganisms is being exploited world wide as it is economical, environmental friendly and sustainable. Aerobic and anaerobic microorganisms are used for treating waste waters. Among Anaerobic microorganisms photosynthetic bacteria have more advantages when compared to other anaerobes as the process not only remediates as well as produce hydrogen. Since both of the processes can be coupled as they are primarily hydrogen producers, it can be exploited. But the process has to be optimized to enhance the remediation of waste water. Industrial discharges impart high BOD to the waste water (Panigrahi, A.K and S.K.Konar.1992). Transformation of toxic compounds into other less toxic compounds is possible by bacteria (Akcil, A., 2003). Marta *et al*. (2004) have used *Chromobacterium violaceium* for metal remediation. Application of Photosynthetic bacteria for water purification in Japan was investigated by Sasaki et al (1998). Vasavi *et al*. 2007, 2008) and Ramchander *et al.* (2007) used photosynthetic bacteria for remediation of waste waters. (Buccolieri *et al*. 2006) studied metal tolerance of *Rhodobacter sphaeroides*. Livia *et al.* (2006) observed resistance of *Rhodobacter sphaeroides* in heavy metal contaminated environments. Biotechnological applications of phototrophic bacteria were investigated and presented in our earlier work (Ram C. Merugu et al, 2010, Ramchander Merugu et al, 2008, 2010, 2011, 2012). The bioremediation potentials of the consortium isolated from sewage water was investigated and discussed in the present communication.

MATERIAL AND METHODS

The Phototrophic bacteria were isolated from the effluent samples by enrichment techniques by inoculating into the medium and incubated anaerobically in the light (2000 lux). Bacteria thus isolated were identified with the help of colour, size, shape, carbon and nitrogen requirement, absorption spectra analysis, vitamin requirements, carotenoids and bacteriochlorophylls. Bergey's manual of Systematic bacteriology (1994) was adopted for identification. Methods for the estimation of various parameters were adopted from APHA (1995).

RESULTS AND DISCUSSION

Contamination of natural water results in pollution and increased risk of disease transmission. Phototrophic bacteria are versatile and have diverse metabolic activity as they can use various carbon and nitrogen sources. Nagadomi *et al*. (1999) Vincenzeni et al (1982), Kobayashi *et al*. (1995), David and Ensign (2005), Livia *et al*. (2006) and Vijay *et al*. (2006) have reported the potential of anoxygenic phototrophic bacteria in bioremediation of waste waters. Remediation of sewage water of Panagal by photosynthetic bacteria showed a 23% decrease in DO and 64% decrease in BOD was observed which was significant. COD and organic matter decreased to the extent of 32% and 75% respectively.

Table 1: Remediation of sewage water (Panagal) by phototrophic bacterial consortium

Parameters	Before Incubation			After Incubation of 10 days		
	Sample undiluted	Sample + Medium + Distilled water	Sample + Medium + Inoculum	Sample + Medium + distilled water	Sample + Medium + Inoculum	% of Reduction
Colour	Light green	Light green	Reddish brown	Green	Reddish brown	--
pH	6.8	6.8	7.2	7.0	7.2	--
Temperature(^{o}C)	32	34	36	34	36	--
DO (in mg/litre)	3.6	3.4	3.7	3.6	2.8	23
BOD (in mg/lit)	210	190	222	100	76	64
CO_2 (mg/lit)	--	--	--	--	--	--
Carbonates (mg/lit)	--	--	--	--	--	--
Bicarbonates (mg/lit)	205	196	236	174	140	32
Chlorides (mg/lit)	100	124	150	134	94	6
Organic matter (%)	0.12	0.09	0.10	0.06	0.03	75
Sulphates (mg/lit)	396	330	410	300	324	19
COD mg/lit)	3.8	4.6	5.0	5.0	2.6	32

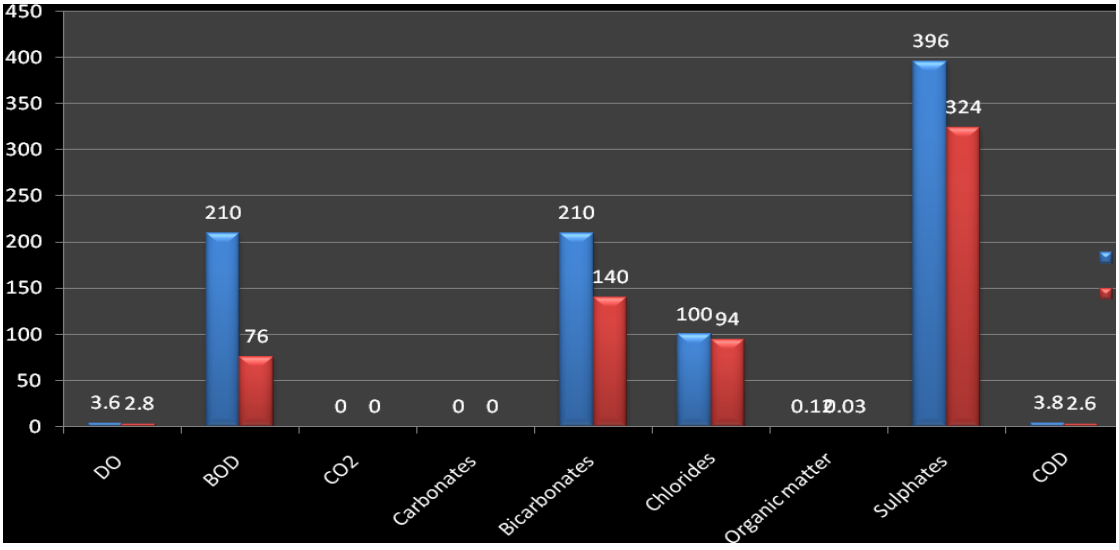

Figure 1: Remediation of Sewage water by phototrophic bacterial consortium

Chloride levles (6%), bicarbonates (32%) and sulphates (19%) were also decreased. Remediation of sewage water of Prakasam bazaar by photosynthetic bacteria showed a decrease in dissolved oxygen by 22%. COD and BOD decreases were significant and were to the extent of 60% and 38% respectively. Bicarbonates (45%), chlorides (35%), sulphates (16%) and organic matter (28%) also decreased significantly. These results are similar to our earlier work (Ramchander Merugu et al, 2012, 2014) and to that of Nepple *et al*. (2000) who have also showed the potential use of these bacteria in remediation.

Table 2: Remediation of sewage water (Prakasam Bazar) by phototrophic bacterial consortium

Parameters	Before Incubation			After Incubation of 10 days		
	Sample undiluted	Sample + Medium + distilled water	Sample + Medium + Inoculum	Sample + Medium + distilled water	Sample + Medium + Inoculum	% of Reduction
Colour	Light blue	Light blue	Reddish yellow	Light blue	Reddish Yellow	--
pH	6.3	6.4	6.8	7.0	7.2	--
Temperature (^oC)	34	36	34	36	36	--
DO (in g/litre)	4.6	4.2	4.0	4.10	3.62	22
BOD (in g/lit)	280	260	278	220	176	38
CO_2 (mg/lit)	--	--	--	--	--	--
Carbonates (mg/lit)	--	--	--	--	--	--
Bicarbonates (mg/lit)	154	136	140	100	86	45
Chlorides (mg/lit)	620	590	600	550	430	31
Organic matter (%)	0.18	0.20	0.20	0.18	0.13	28
Sulphates (mg/lit)	660	630	648	570	530	16
COD (mg/lit)	30	22	22	16	12	60

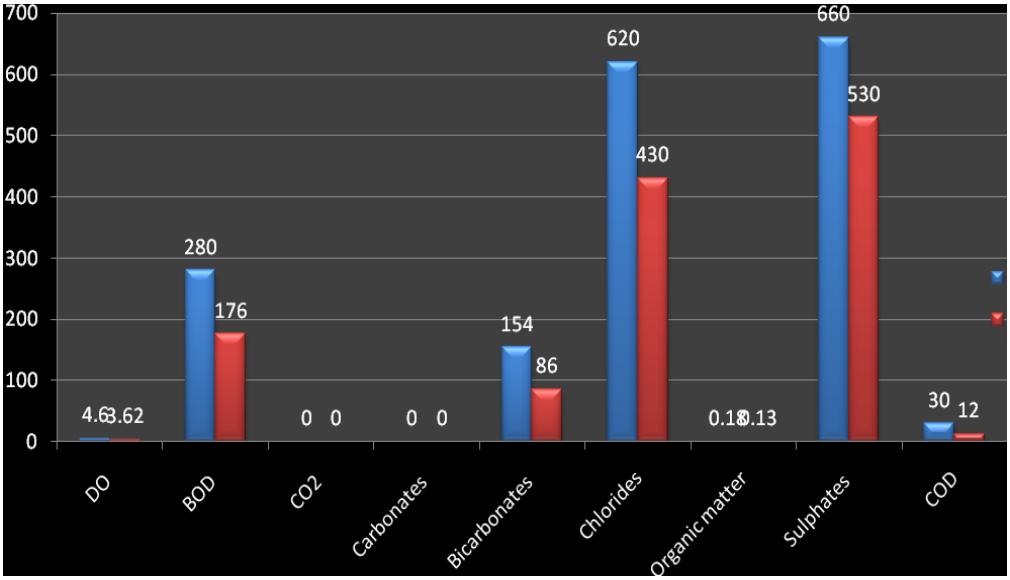

Figure 2: Remediation of sewage water by phototrophic bacterial consortium

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