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RECLAMATION OF WASTEWATER USING DRY BIOMASS OF CYANOBACTERIUM *OSCILLATORIA TENUIS* AG. EX. GOMONT.

Sukha Ram Vishnoi* and P. N Srivastava[1]
Department of Botany, Adarsh Mahavidhyalaya, Jodhpur-342001
[1]Department of Botany, Jai Narain Vyas University, Jodhpur-342005
***Corresponding Author**

ABSTRACT

The cyanobacterium *Oscilatoria tenuis* isolated from a freshwater pond of Gura-Vishnoiyan, was screened for its ability to reduce the physico-chemical parameters of textile wastewater. The physico-chemical parameters such as pH, chloride, total alkalinity and total hardness of the effluent were reduced maximum after addition of 2.0 gm of dry algal biomass/100ml of effluent. The reductions in pH value (14.1%), chloride content (65.1 %), total alkalinity (39.7%) and total hardness (63.3%) were significant.

INTRODUCTION

Blue green algae (cyanobacteria) are considered as the most primitive photosynthetic prokaryotes which are supposed to have appeared on this planet during the Precambrian period (Ash and Jenkins 2006). They are most simple photosynthetic, oxygen evolving non-vascular plants having characteristic of both microbes and higher plants (Haande et al. 2010). In terms of biomass production microalgae form the world's largest group of primary producers. Algae are ubiquitous and can thrive in almost all kinds of habitats, majority of them grow in water bodies and are sensitive to pollution. They quickly respond to environmental changes. This has led several workers to use algae as biological indicators of water quality (Sreenivasan and Doshi 1964, Mishra and Saxena 1990, Srivastava and Prakash 1991). The cationic uptake mechanism through which algae absorbed and concentrated nutrients from the surrounding medium, even when the metal ion concentration were very low was described by Venkatraman et al. (1994). There are large number of textile processing, steel re-rolling, electroplating and chemical processing units around Jodhpur situated in the semi-arid area of western Rajasthan, which discharges huge amount of untreated industrial effluent in the seasonal rivers bed. The effluent seeps in the wells situated on the banks of river and these well are utilized to irrigate the crop plants.

The algae based technology to treat industrial effluents (phycoremediation) has been implemented in a number of industrial effluent treatments in India (Arthi et al. 2008, Hanumantha et al. 2011). The chemical methods of waste water treatment are invariably cost intensive and can not be employed in all industries especially in developing countries like India. Hence in recent years, the importance of biological wastewater treatment systems has attracted the attention of the workers all over the world and has helped in developing relatively efficient, low cost waste treatment systems. The algal systems more particularly the cyanobacteria are not only useful in treating the wastewater but also in producing a variety of useful byproducts from their biomass. During the present investigation the attempts were made to treat the industrially polluted wastewater by using the biomass of cyanobacterium *Oscillatoria tenuis* which looks efficient, cheap and lasting solution of wastewater treatment and recycling.

MATERIALS AND METHODS

The dry biomass of cyanobacterial species *Oscillatoria tenuis* used in the present study was isolated from the enrichment culture of Gura - Vishnoiyan pond soil. The blue green alga growing in it have been isolated, identified and mass cultures were developed to study their efficiency to treat compound industrial effluent collected from industrial area in Basni, Jodhpur. The pure mass culture was developed in five liters glass containers. The biomass of algae was harvested and washed with distilled water, dried, powdered and powder was used for the experiments. The experiment was setup using 1.0 gm and 2.0 gm of algal powder added in to100ml compound textile effluent filled in 150 ml Erlenmeyer flask. The different combination sets were analyzed using APHA (1995) for pH, chloride, total alkalinity, and total hardness. The observations were taken after 7 days of incubation.

RESULTS AND DISCUSSION

The untreated textile effluent was reddish brown in colour. Its pH (9.20) was highly alkaline. The values of chloride content (1550 mg/l), total alkalinity (1120 mg/l) and total hardness (860.00 mg/l) were high. The effects of increasing amount of dry biomass of cyanobacterium *Oscillatoria tenuis* on textile wastewater are shown in Table 1&2.

Table 1. Effect of dry algal biomass of *Oscillatoria tenuis* on physico-chemical parameters of Industrial effluent (1.0 g Algal Biomass + 100 ml Industrial effluent)

Parameters	Initial value of Ind. Effl.	Ind. Effl. +1.0g Algal Biomass	% Reduction
pH	9.20	8.30	9.7
Chloride	1550	945	39.0
Total alkalinity	1120	830	25.8
Total hardness	860	525	38.9

Except pH, all parameters are in mg/L , Ind. Effl = Industrial effluent

The study revealed improvement in wastewater characteristics with an increase in algal biomass. The maximum improvement in the physico-chemical parameters of industrial effluent was recorded after 7 days of incubations of 2.0 gm dried biomass of cyanobacteriam *Oscillatoria tenuis* (Table 2).

The micro algae *Oscillatoria tenuis* showed efficient removal ability during the present investigation. These finding are important for practical use of such species in large scale biological treatment of industrial wastewater.

Table 2. Effect of dry algal biomass of *Oscillatoria tenuis* on physico-chemical parameters of Textile wastewater (@2.0 g Algal Biomass/ 100 ml Industrial effluent)

Parameters	Initial value	Ind. Effl. +2.0g Algal Biomass	% Reduction
pH	9.20	7.90	14.1
Chloride	1550	540	65.1
Total alkalinity	1120	675	39.7
Total hardness	860	315	63.3

Except pH, all parameters are in mg/L , Ind. Effl = Industrial effluent

Present study revealed cyanobacterium *Oscillatoria tenuis* biomass to be efficient for treating textile effluent. Algal biomass can absorb salts and various ions effectively from the wastewater. This most promising species may help in the optimization of the remediation of textile wastewater before discharging into the aquatic ecosystems. Algae based remediation technology thus, can provide an excellent solution for Industrial pollution problems.

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REFERENCES

APHA. 1989. Standard method for examination of water and waste water. 17th edition, Washington, D.C., USA. pp: 10-81.

Arthi, N., P. Sumathi and V. Sivasubramanian. 2008. Algal treatment (Phycoremediation) to improve water quality. Indian Hydrobiology 11 (1):173-184.

Ash, N. and M. Jenkin. 2006. Biodiversity and poverty reduction. UNEP-WCMC Report.

Glick, B. R. and J. J. Pastemale. 1998. Principle and Applications of Recombinant DNA. 2nd ed. SM Press, Washington D.C.

Haande, S., T. Rohrlack, R. P. Semyalo, P. Brettum, B. Edvaedsen, A. Lyche-Solheim, K. Sorensen and P. Larsson. 2011. Phytoplankton dynamics and cyanobacterial dominance in Murchison Bay of lake Victoria (Uganda) in relation to environmental conditions. Limnologia 41: 20-29.

Hanumantharao, P., R. R. Kumar, B. Govindaraghavan, V. V. Subramanian and V. Sivasubramanian. 2011. Is phycovolatilization of heavy metals a probable (or possible) physiological phenomenon? – An in situ pilot-scale study at a leather-processing chemical industry. Water Environment Research 83(4): 291-297 (7).

Kaushik, B. D. 1989. Reclamative potential of cyanobacteria in salt effected soils. Phykos 28 (1&2):101-109.

Mishra, S. R. and D. N. Saxena. 1990. Population dynamics of phytoplanktonic algae of wastewater from a textile mill at Gwalior, India. Geobios New reports 9:42– 46.

Sreenivasan, A. and Y. A. Doshi. 1964. Salinity levels and the growth of algae in Sambhar lake (Abstract). Salt Res. Indust. 1A: 21.

Srivastava, P. N. and A. Prakash. 1991. Bioaccumulation of heavy metals by algae and wheat plants fed by textile effluents, Jodhpur. Indian Journal of the Water Pollution Control Federation 7: 25–30.

Venkataraman, L.V., M. K. Krishnakumari and G. Suvarnalatha. 1994. Algae as tools for pollution in aquatic system. Phykos (1 and 2): 171 – 173.