



COMPARATIVE STUDY OF THE ROLE OF *NELUMBO NUCIFERA* (SACRED LOTUS) IN PHYTOREMEDIATION FOR SEWAGE UNTREATED WATER FROM KHAN RIVER AND ANNAPURNA LAKE WATER AT INDORE, MADHYA PRADESH.

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Abstract

One of the clean up technology which is cost effective is “Phytoremediation” for treatment of the different types of wastewater in comparison to other techniques. Various contaminants like total dissolved solids (TDS), electrical conductivity (EC), biochemical oxygen demand (BOD), chemical oxygen demand (COD) and dissolved oxygen (DO) and other contaminants have been minimized using sacred lotus. In this paper, role of this aquatic plant have been studied in remediation of waste water i.e. sewage water from river and lake and compared the role of sacred lotus performs well in remediating the sewage water from lake in comparison to river water.

Keywords - Clean up technology, Phytoremediation, Waste-Water, Sacred Lotus, Remediation

I. INTRODUCTION

The source of life “Water” is basic condition of survival for living beings. Due to industrialization and agriculture practices large amount of wastes had been released into water sources. This cause water pollution and reduced the amount of drinkable water available to the human population as well as to other to other living being. Waste water is highly polluted water contains high levels of organic material, numerous pathogenic microorganism, as well as nutrient and toxic compounds. Wastewater treatment is becoming even more critical due to diminishing water resources, increasing wastewater disposal costs and stricter discharge regulations that have lowered permissible contaminant levels in waste streams. The municipal sector consumes significant volumes of water, and consequently generates considerable amounts of wastewater discharge. Waste water is health and environment hazard and thus be treated economically through *Clean up technology* called as “Phytoremediation.”

There are many technologies available to treat the polluted water to make it usable but are not cost effective. The new “cost effective”, “low cost” and inventive technology “Phytoremediation” (phyto = plant (green plants, grasses, woody species etc and remediation = correct evil) is introduced which directly uses green plant to degrade or render harmless various environmental contaminants such as heavy metal, metalloids, trace elements , organic compound or radioactive compound present in water or soil in their tissues (1). This clean up technology is approved by academics and industrial scientist and widely applicable in both developed and developing nations since clean up polluted soil, ground water and waste water (2, 3). This technology includes all plant-based biological, chemical, and physical processes that aid in the uptake, sequestration, degradation, and metabolism of contaminants, either by plants, soil microbes, or plant and microbial interactions. Phytoremediation takes advantage of the unique and selective uptake capabilities of plant root systems that enhance below ground ecosystem for subsequent productive use. Examples of plants used for phytoremediation are *Eichornia crassipes*, *Vetiver grass*, *Typha latifolia*, *Trapa nutans* etc.

II. ROLE OF LOTUS IN PHYTOREMEDIATION

Lotus (*Nelumbo nucifera*) is a herbaceous, perennial aquatic plant grow in water. It grows in tropical Asia from Iran to Japan and from China to Queensland. It has been introduced and grown in Europe and America, mainly for ornamental purposes (4). In India, it has religious importance and considered as auspicious flower for deities.

Lotus has played important role in phytoremediation. Kanabkaew *et al.* 2004 studied the role of aquatic plants Lotus (*Nelumbo nucifera*) and Hydrilla (*Hydrilla verticillata*) for domestic wastewater treatment. These were analyzed for pH, SS, BOD₅, NH₃-N, NO₂--N, NO₃ -N etc and result showed that ponds with aquatic plants were superior to those without plants. The system with lotus showed the best removal efficiency for wastewater treatment (5). Ashraf *et al.* 2013 evaluated natural phytoremediation process occurring at ex-tin mining catchment using nine plant species including *Nelumbo nucifera* which accumulated 288 mg/kg heavy metal as well as phytoextraction rates for Arsenic in lotus found to be 56% (6). A.V. Meera *et al.* 2016 studied the role of *Nelumbo nucifera* as an Ideal aquatic macrophyte for phytoremediation of toxic metals in contaminated wetland. Lotus has ability as a hyper accumulator of Lead (Pb) thus reducing metal pollution hazards of water ecosystem and decontaminating fresh water lake (7). Luangsoonton *et al.* 2010 studied the role of wastewater treatment of sacred lotus in Suphan Buri municipal slaughterhouse wastewater. They analysed the index quality of the water such as pH, temperature, EC, DO, BOD, NH₄₊, etc. The experiment yields the result that the wastewater treatment using sacred lotus is more effective than the normal treatment not using any plants (8). The present paper deals with comparative study of sacred Lotus in phytoremediating untreated sewage water of lake and river.

III. MATERIAL AND METHOD

Material Collection and Pre lab Preparation

Materials for the experiment include sewage water collection from Khan River and Annapurna lake water. Plant for the experiment was chosen as "Lotus". The plastic tanks were prepared for initiating experiment and water was distributed according to the volume of the tanks. Two tanks were prepared in which one includes Lake Water and other includes Khan River water. Plant was washed with tap water and then with distilled water and before transferring the test plant into the tanks containing the water sample, the water characteristic were determined by analyzing some physiochemical parameters like TDS, BOD,DO,COD, Conductivity and pH. Then after solution were prepared according to the parameters taken in the experiment.

All the parameters were studied in untreated waste water from river and lake within interval of 0 day (absence of treatment of plant), 15 and 20 days (after treatment of water with plant in 15 and 20 days). The value before phytoremediation was noted as initial value while the value after phytoremediation is indicated by final value. All the analysis was done using the methodology of (9, 10).

IV. RESULTS AND CONCLUSION

The pH was increased by lotus more in lake water than in river water. The temperature remains almost constant but a slight increase in lake water than in river water. The electrical conductivity was reduced by 46% and 50% in 15 and 20 days interval in case of lake water than in river water which was reduced only by 10% and 28% respectively. The dissolved oxygen was increased by lotus in lake water in 15 days interval than in river water as well as in 20 days interval there was decrease in dissolved oxygen content both in lake and river water. The BOD content was reduced by 44.4% and 66.6% in lake water whereas only 42% and 71% of reduction was found in river water. The COD content was reduced by 32% and 34% in lake water whereas only 28% and 30% of reduction was found in river water in

interval 15 days and 20 days respectively. The TDS content was reduced by almost similar percentage in lake as well as in river water but slightly high in river water in interval of 15 and 20 days respectively. The overall performance of Lotus in reducing all important parameters like COD, BOD, DO, EC etc. was found to be better in lake water than in river water.

Table 1: Comparative studies of Lotus in untreated sewage water of lake and river.

S.No.	Parameters	Days	Lake water	River water	% Reduction	
					Lake water	River water
1.	pH	0	7.8	8		
		15	7.6	7.9	2	1
		20	7	7.8	10	2
2.	Temperature (°C)	0	21	22		
		15	20	20	4.7	4.5
		20	22	21	-4.7	4.5
3.	Electrical conductivity (µmho)	0	188	209		
		15	102	190	46	10
		20	95	150	50	28
4.	Dissolved oxygen (mg/litre)	0	5	4		
		15	5.5	4.2	10	-5
		20	2.5	2.75	15	31
5.	BOD (mg/litre)	0	9	7		
		15	5	4	44.4	42
		20	3	2	66.6	71
6.	COD (mg/litre)	0	130.2	134.9		
		15	88	96	32	28
		20	86	94	34	30
7.	TDS (mg/litre)	0	1760	1800		
		15	219.42	206	87	88
		20	237.51	226	86	87

V. SIGNIFICANCE OF STUDY

This study will help in treatment of sewage water with the help of aquatic plants which will make the water suitable for agriculture use and other uses except in drinking water and also use of weedy aquatic plants in phytoremediation.

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