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Treatment of Sewage by Phytoremediation method using Izndian mustard Plant

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ABSTRACT

Increasing urbanization, industrialization and over population is one of the leading causes of environmental degradation and pollution. Aquatic bodies are the traditional recipients of sewage containing heavy contaminants, which are released in higher concentrations and cause deleterious effects on organisms. Phytoremediation, an ecofriendly technology which is both ecologically sound and economically viable is an attractive alternative to the current cleanup methods that are very expensive. Phytoremediation technology is a cost effective one as it utilizes plants natural ability to suck the pollutant present in the water. There are many plants having this natural ability to up take the heavy metals and organic pollutants from air, soil and water. In this project we have treated the sewage coming out after primary treatment using phytoremediation techniques. In this project, the sewage which is taken from the primary treatment unit is further treated using phytoremediation technique that is the mustard plant is used for treating the sewage and thereby reducing the contaminants in wastewater to meet the wastewater disposal standards. Among various phytoremediation techniques phytovolatilization found to be effective in removing the pollutant as BOD, COD, Turbidity, Total dissolved solids, Kjeldahl nitrogen. The phytovolatilization showed the best removal of BOD up to 59.44%, COD up to 60.02%, Turbidity up to 97.83%, Total dissolved solids up to 31.35%, Kjeldahl nitrogen 97.46%.

KEYWORDS: *Phytoremediation, eco-friendly, sewage treatment*

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INTRODUCTION

Phytoremediation (phyto), meaning 'plant', and remedium, meaning 'restoring balance' refers to the technologies that use living plants to clean up soil, air, and water contaminated with hazardous contaminants. It is defined as "the use of green plants and the associated microorganisms, along with proper soil amendments and agronomic techniques to either contain, remove or render toxic environmental contaminants harmless". 63 Phytoremediation is a cost-effective plant-based approach of remediation that takes advantage of the ability of plants to reduce elements and compounds from the environment and to metabolize various molecules in their tissues. It refers to the natural ability of certain plants called hyperaccumulators to bioaccumulate, degrade, or render harmless contaminants in soils, water, or air. Toxic heavy metals and organic pollutants are the major targets for phytoremediation. Knowledge of the physiological and molecular mechanisms of phytoremediation began to emerge in recent years together with biological and engineering strategies designed to optimize and improve phytoremediation. In addition, several field trials confirmed the feasibility of using plants for environmental clean-up. Phytoremediation is an emerging technology that uses various plants to degrade, extract, contain, or immobilize contaminants from soil and water. This technology has been receiving attention lately as an innovative, cost-effective alternative to the more established treatment methods used at hazardous waste sites. Advantage of phytoremediation are the cost of the phytoremediation is lower than that of traditional processes both in situ and ex situ, the plants can be easily monitored. The possibility of the recovery and re-use of valuable metals (by companies specializing in "phyto mining") It is potentially the least harmful method because it uses naturally occurring organisms and preserves the environment in a more natural state. It preserves the topsoil, maintaining the fertility of the soil. Increase soil health, yield, and plant phytochemicals. The use of plants also reduces erosion and metal leaching in the soil. Collection of sewage Waste water was collected for every 2 days which gives us the quantity of 4 litres. This waste water is collected from the primary treatment plant of S.A, Engineering college.

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Table1: Result of primarily treated sewage before phytoremediation process.

S.NO	PARAMETERS	PRIMARY TREATED SEWAGE	DRINKING WATER STANDARDS
1	pH value	7.3	5.5 – 8.5
2	Turbidity (NTU)	115.3	1
3	Total dissolved solids (mg/l)	1311	500
4	Total solids (mg/l)	1379	1000
5	Chlorides (mg/l)	281.7	250
6	Nitrate nitrogen (mg/l)	14.8	20
7	COD (mg/l)	152	NIL
8	BOD (mg/l)	29	NIL
9	Total alkalinity (mg/l)	289.1	200
10	Total suspended solids (mg/l)	68	30
11	Sulphates (mg/l)	204	200
12	Iron (mg/l)	3	0.3
13	Copper (mg/l)	3	0.05
14	Nitrate (mg/l)	25	45
16	Phosphate (mg/l)	20	0.05
17	Total residual chlorine (mg/l)	1	0.2
18	Total kjeldahl nitrogen (mg/l)	100	30 - 60
19	Sulphide (mg/l)	2	0.05
20	Free nitrogen (mg/l)	0.5	0.1

Selection of plant: Based on the literature study Indian mustard plant was chosen for the phytovolatilization. Two different setups were created for the pilot study.

Experimental setup 1: Multi layered setup.
Collection of material for the pilot study. A hole is made at the bottom of the tray. The pipe for inlet and outlet is fitted for source of waste water and collection of treated sewage respectively. To filter the water from soil particles filter net is tied in outlet pipe. At the bottom of tray layer of pebbles were laid for the thickness of 7cm. On the top of pebbles, carbon layer for thickness of 2 cm is provided. River sand of thickness 5cm is laid on top of the carbon layer. At the top, soil of rich nutrients were provided for the thickness of 12cm. After that seeds were sowed on the soil for the depth of half inch.

Table 2: Treated sewage collected from experimental setup 1

Days	Water collected ml	
	Morning	Evening
5	360	384
10	372	352
15	386	340
20	369	371
25	356	362
30	373	389
35	366	376

Experimental setup 2: Single layered setup:
The same dimension of 50x30x30cm tank set up is taken. The same step by step procedures as mentioned in the experimental setup 1 is followed but here we are using only one layer that is red soil. The red soil is placed in a single layer of about 12 cm thickness.

Table 3: Treated sewage collected from experimental setup 2

Days	Water collected ml	
	Morning	Evening
5	372	359
10	389	370
15	363	386
20	366	358
25	375	395
30	392	364
35	354	381

RESULTS AND DISCUSSION:
Experimental setup 1: multi-layered treatment

Table 4: Results of treated sewage collected in multi layered setup

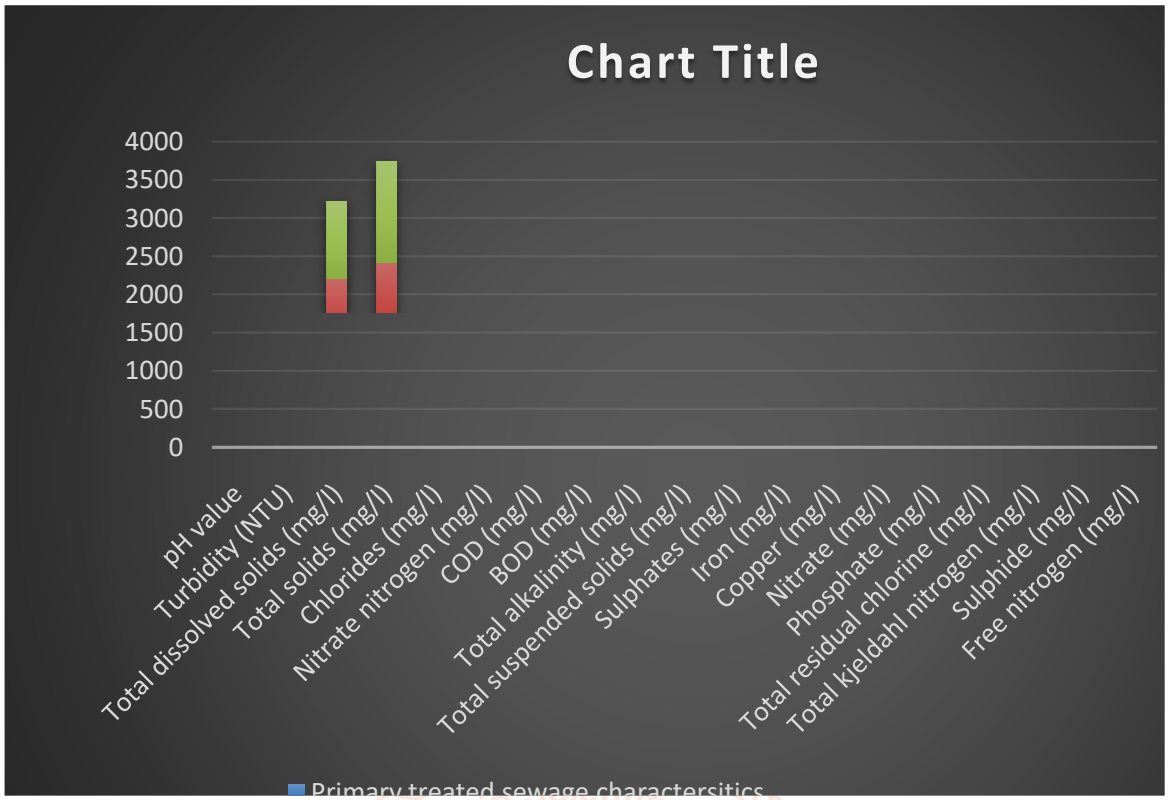
S. NO	PARAMETERS	PRIMARY TREATED SEWAGE	COLLECTED TREATED SEWAGE
1	pH value	7.3	7.8
2	Turbidity (NTU)	115.3	2.5
3	Total dissolved solids (mg/l)	1311	900
4	Total solids (mg/l)	1379	1039
5	Chlorides (mg/l)	281.7	240
6	Nitrate nitrogen (mg/l)	14.8	13
7	COD (mg/l)	152	60.76
8	BOD (mg/l)	29	11.76
9	Total alkalinity (mg/l)	289.1	336.72
10	Total suspended solids (mg/l)	68	43
11	Sulphates (mg/l)	204	173
12	Iron (mg/l)	3	0.22
13	Copper (mg/l)	3	0.010
14	Nitrate (mg/l)	25	9.0
16	Phosphate (mg/l)	20	6.62
17	Total residual chlorine (mg/l)	1	BDL
18	Total kjeldahl nitrogen (mg/l)	100	2.54
19	Sulphide (mg/l)	2	BDL
20	Free nitrogen (mg/l)	0.5	BDL

Experimental setup 2 – single layered treatment:
In experimental setup 2, the characteristic value of the primary treated sewage is high but it reduced due to single layered setup with process of phytovolatilization. At the later stage, the plant was begun to get affected by the sewage. Its growth was slowly diminished and started to decay. However, the result was not compromised, undesirable characteristics of sewage was reduced and brought down near to the permissible limits.

Table 5: Result of Treated sewage Collected in Single Layered Setup

S.NO	PARAMETERS	PRIMARY TREATED SEWAGE	COLLECTED TREATED SEWAGE
1	pH value	7.3	8
2	Turbidity (NTU)	115.3	55
3	Total dissolved solids (mg/l)	1311	1019
4	Total solids (mg/l)	1379	1330
5	Chlorides (mg/l)	281.7	252
6	Nitrate nitrogen (mg/l)	14.8	15
7	COD (mg/l)	152	121.92
8	BOD (mg/l)	29	19.60
9	Total alkalinity (mg/l)	289.1	351.36
10	Total suspended solids (mg/l)	68	56
11	Sulphates (mg/l)	204	190
12	Iron (mg/l)	3	0.36
13	Copper (mg/l)	3	0.009
14	Nitrate (mg/l)	25	4
16	Phosphate (mg/l)	20	15.75
17	Total residual chlorine (mg/l)	1	BDL
18	Total kjeldahl nitrogen (mg/l)	100	5.6
19	Sulphide (mg/l)	2	BDL
20	Free nitrogen (mg/l)	0.5	BDL

Fig. 1 show that the sewage characteristic was reduced significantly by the phytovolatilization. The important characteristics like turbidity, COD, total solids and phosphates were diminished drastically which shows that the process of phytovolatilization was effective in both the process and cost wise.



CONCLUSION:

In our project, the sewage was treated by the phytoremediation technique, for which Indian mustard plant was chosen. The plant chosen effectively removed and brought down the number of undesirable characteristics present in the wastewater such as excess amount of nitrate, BOD and other such characteristics within allowable limits by the process of phytovolatilization. The plant was not affected in anyway at the first stage of process hence making this method of purifying wastewater eco-friendly and much efficient. At last, plant was not able to survive they showed a decline in growth at the end of the growth period. The primary treated waste water was supplied to the plant. In multilayered setup, the BOD and COD levels were reduced effectively from 29 mg/l and 152 mg/l to 12 mg/l and 60 mg/l respectively. The single layered arrangement on the other hand, was able to reduce the BOD and COD levels to about 20 mg/l and 121 mg/l among the reduced levels of other harmful chemicals present. The single layered treatment was less efficient in comparison with the multilayered arrangement. Among the two experimental setups carried out for the treatment, as aforementioned, the multilayered arrangement was able to reduce undesirable characteristics much efficiently. Thus, multilayered setup could be adopted with the choice of suitable plants such as mustard or plants with similar characters. The plants of same genus and family can be used for this phytoremediation process. Thus, through phytoremediation the amount of excess undesirable characters present in the waste water could be reduced by about 20-30% in an eco-friendly approach. For the water to be made potable, further treatment such as Reverse osmosis could be adopted to bring the levels of chemicals to drinking standards.

REFERENCES:

[1] Anji Reddy, K. Sri Lakshmi, V Hema Sailaja (2017), "Phytoremediation - A Promising Technique in Waste Water Treatment" Vol. 5, pp 5480-5489.

[2] Archana Tiwari, Divya Singh, Richa Gupta (2012), "Phytoremediation of lead from wastewater using aquatic plants" vol. 8, pp 1-11.

[3] Bashir Ahmad Ganai, Rifat Ara Wani, Manzoor Ahmad Shah (2017), "Heavy Metal Uptake Potential of Aquatic Plants through Phytoremediation Technique - A Review" vol 8, pp 1-5.

[4] S. Binu kumari, M. Mohan kumar, K. Vijaya kumar (2015), "Phytoremediation of industrial effluent and Reduction of physico-chemical parameters from pond water using aquatic weeds" vol. 9, pp 54-55.

[5] Dipu Sukumaran (2013), "Phytoremediation of Heavy Metals from Industrial Effluent Using Constructed Wetland Technology" Vol. 1, pp 92-97.

[6] Dipu Sukumaran, Anju Anilkumar, Salom Gnana Thanga (2013), "Phytoremediation of Latex Effluent by Constructed Wetland Technology" Vol. 1, pp 104-109.

[7] Harshita Nigam, Shraddha Chauhan, Manimita Das (2015), "Implementation of phytoremediation to remediate heavy metals from tannery waste: A review" vol 6, pp 119- 128.

[8] Irfana Showqi , Farooq Ahmad Lone, Javeed Iqbal Ahmad Bhat (2017), "Evaluation of the Efficiency of Duckweed (Lemna minor L.) as a Phytoremediation Agent in Wastewater Treatment in Kashmir Himalayas" VOL. 19, pp 87–96. 70

[9] Joan Savitha, T. Vel Rajan (2018), "Industrial Effluent Treatment by Phytoreme diation", Vol. 7, pp 477-482.

[10] Rohma Razzaq (2017), "Phytoremediation: An Environmental Friendly Technique - A Review" vol 4, pp 1-5.

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