PHYTOREMEDIATION IN SEWAGE TREATMENT

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ABSTRACT

Water being the source of life has become a scarce resource in this millennium. Since the limited resource availability, reuse of the available supply is more suggestible. For the said goal, many technologies prevail addressing the task, among which is the technique Phytoremediation. Lots of waste waters get generated from industrial, commercial and domestic origins and are discarded. Phytoremediation converts this wastewater into usable water with the help of plants. This is a very eco-friendly technique which decontaminates the wastewater in a very economical way. This study emphasis on treatment of wastewater using different plants such as Duckweed, water hyacinth etc. It has found that this plant reduces COD, BOD, TDS & Chloride content of waste water with efficiency of 50% with HRT of 2 day. As density of plants increases, the efficiency of treatment also increases. Hence at the end of 2nd day more than half of concentration of the waste is reduced.

Keywords- Wastewater Treatment, Phytoremediation, Eco-friendly

1. INTRODUCTION

The combination of two words Phyton-plant(in Greek) and Remediar-remedy(In latin) gave rise to the term phytoremediation. Phytoremediation is a cheaper and feasible sustainable method for removal of pollutants. At the same time, it is eco-friendly and further, it does not affect people living and working in the surrounding as it uses plants for cleaning nature. The plant, plant origin microbes or associated microbiota are used to take up the contamination from soil or water. The remediation is achieved either by retaining, elimination or degradation, by the natural process as it happens in an ecosystem by the involvement of organic or inorganic constituent cycles, thus lead to the development of a low-cost remediation technology. Various plant species possess the endogenous quality to treat soil, water, and air `pollution. The basic principle behind phytoextraction is the plants ability to accumulate various metals (essential or nonessential).

The remedial technologies for the removal of heavy metals are quite expansive and injuries to health. Contrary to this, phytoremediation can guarantee an effective, economical, & sustainable means to achieve this end for developing countries because they are cheaper to make and a little skill is required to operate them. [2] Phytoremediation nowadays is done using wetland constructions. The water purification capability of wetlands is being recognized as an

attractive option in wastewater treatment due to its multi-pollutant treatment capability, low cost, and easy to operate. Constructed wetlands (CWs) are designed to take advantage of many of the same processes that occur in natural wetlands but do so within a more controlled environment.

Phytoremediation is one of the biological methods that can be used in remediation of polluted sites in situ. There are various techniques of phytoremediation which are an application in wastewater treatment, in surface water and groundwater purification, in the removal of excessive nutritive substances from water reservoirs, and in the reclamation of soil polluted as a result of environmental disasters.

2. MECHANISM

1. Rhizofiltration method is used for the treatment of surface wastewater produced by industry and agriculture. The wastewater is sprinkled on the surface of roots or the plants are submerged in the treated water. For this reason, the plants used in this method should be highly tolerant to toxic compounds, resistant to low oxygen concentration, and should have an extensive root system, which grows rapidly and produces large amounts of biomass**.**

2. In Phytostabilisation process, the roots of plants are used in the soil remediation process. Phytostabilization prevents the movement of contaminants to groundwater and their migration to the surface soil and further with the rainwater runoff.

3. Phytoextraction technique allows removal of contaminants from the soil, groundwater or surface water by plants that have a high capacity for accumulation of toxic substances.

4. Plants used in Phytovolatization technique absorb contaminants from the soil or enwater, metabolize them and then release them to the atmosphere as a volatile and less toxic form. This mechanism is mainly used for the purification of water and soil contaminated with selenium (Se), mercury (Hg) or arsenic (As) and organic compounds such as trichloroethylene, benzene, nitrobenzene, phenol, antrazine.

5. Phytodegradation method uses plants which produce enzymes that catalyze the degradation reactions of xenobiotics. Phytodegradation may occur either in the plant or outside it when the plant produces enzymes which are secreted into the soil of the root zone. This technique is used for the treatment of soil, river sediments, and sludges as well as ground and surface water.

3. METHODOLGY

Sewage From Common Effluent treatment Plant (CETP), Thane-Belapur Association has been selected to treat. Depending on the characteristics of wastewater, two plants have been selected, namely Duckweed and Water Hyacinth.

1. Duckweed
   Duckweeds are flowering aquatic plants which float on water. This plants have a simple structure, lacking an obvious stem or leaves.

2. Water Hyacinth
   Water Hyacinth is a free-floating perennial aquatic plant having broad, thick, ovate leaves. Water Hyacinth may rise above the surface of the water as much as 1 meter in height.

Initially these plants are kept in normal water. After that acclimatization of plants was done. An acclimatization period was kept for 2 days. Results of acclimatization are shown in Table1.

Table 1 – Acclimatization Result

Waste-water	Plants Species	Period of Acclimatization	Remark
CETP, Koparkharine	Duckweed Wastewater Without dilution	2 days	Not survived
	Hyacinth Wastewater Without dilution	4 days	Not survived
	Water Hyacinth Wastewater with 100% dilution	4 days	Survived.

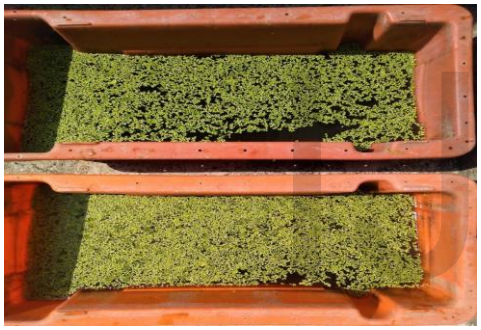


Fig.1 Duckweed (First Day)

Fig.2 Duckweed (Second Day)

Fig. 3 Water Hyncinth (First day)

Fig. 4 Water Hyacinth (Fourth day)

Fig.5 Water Hyacinth (Acclimatization after dilution)

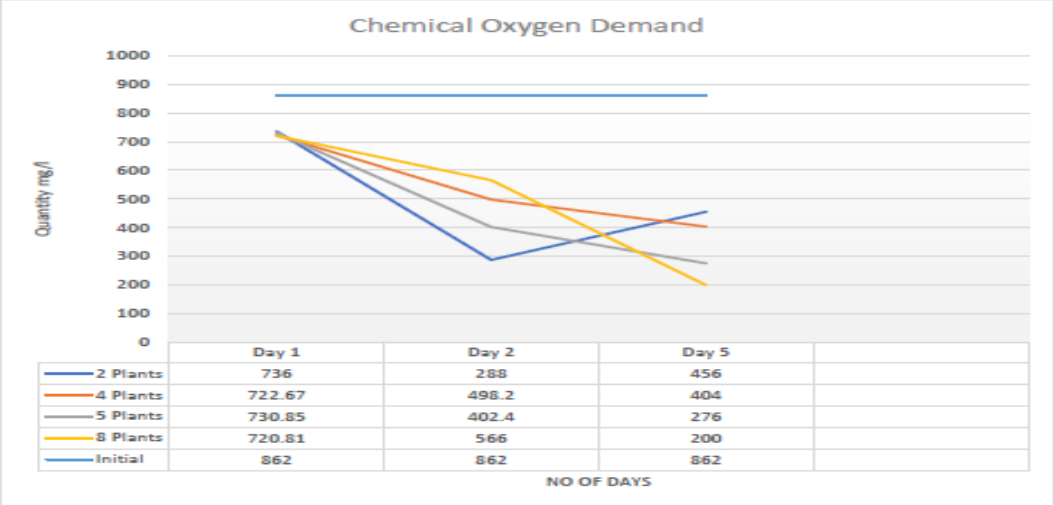
4. RESULTS & DISCUSSION

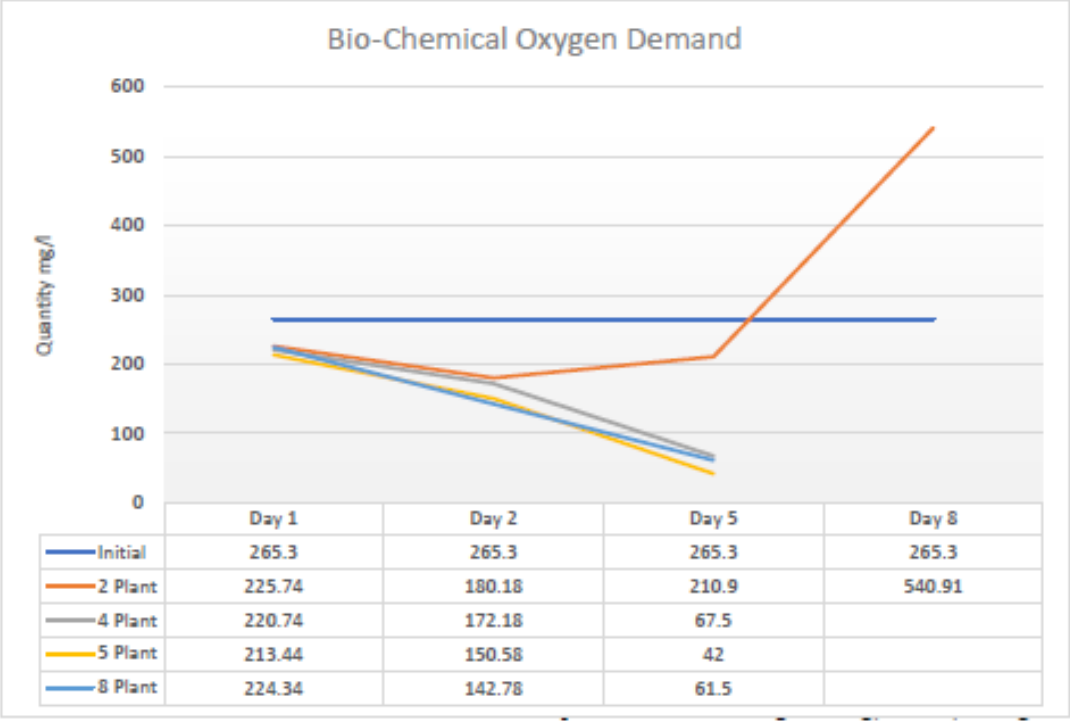
Following are the tests which are performed

- Biological Oxygen Demand
- Chemical oxygen demand
- Chloride content
- Total Dissolved Solids

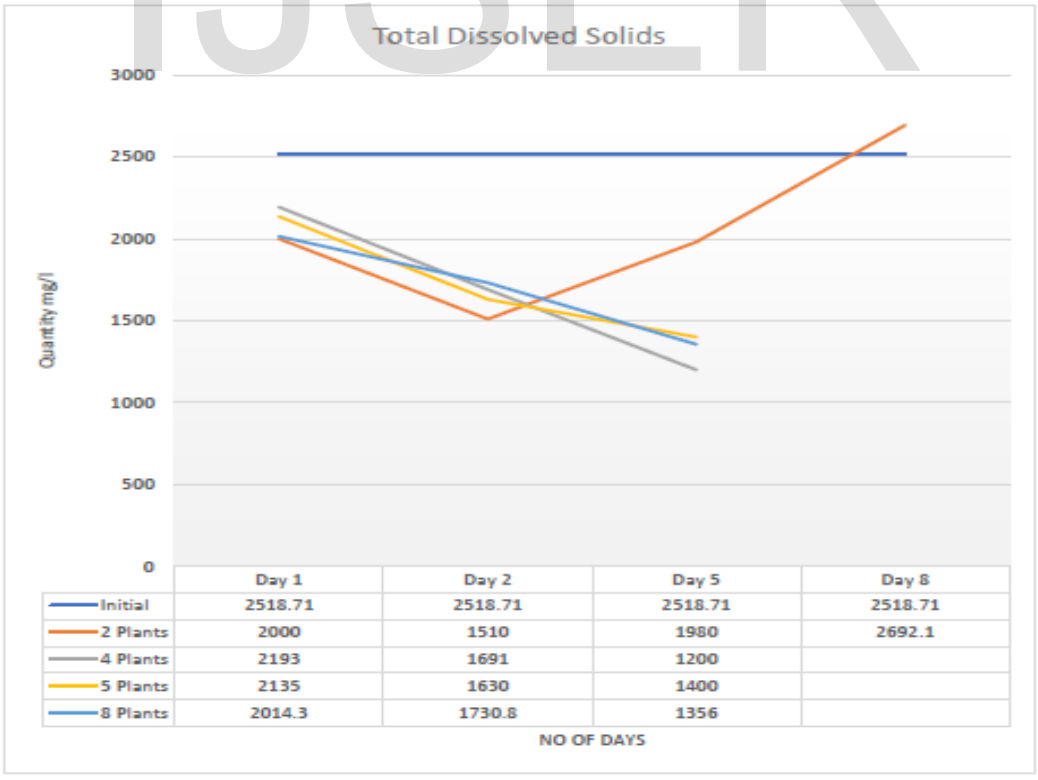
Table1 – Tabulation of Results

No. of Plants	Parameter (mg/l)	Initial	Day 1	Day 2	Day 3	Day 8
2 Plants	COD	862	735	288	456	1923
	BOD	265.3	225.74	180.1	210.9	540.91
	Chloride	1894	1754	283.6	389.8	1169.8
	TDS	2518.71	2000	1510	1980	2692.1
4 Plants	COD	862	722.67	498.2	304	-
	BOD	265.3	220.74	172.18	67.5	-
	Chloride	1894	1625	354.5	295.1	-
	TDS	2518.71	2193	1691	1200	-
5 Plants	COD	862	730	402.4	276	-
	BOD	265.3	213.44	150.48	42	-
	Chloride	1894	1878.45	424	280.13	-
	TDS	2518.71	2135	1630	1400	-
8 Plants	COD	862	726.81	566	200	-
	BOD	265.3	224.34	142.78	61.5	-
	Chloride	1894	1838.45	424	280.13	-
	TDS	2518.71	2014.3	1730.8	1356	-



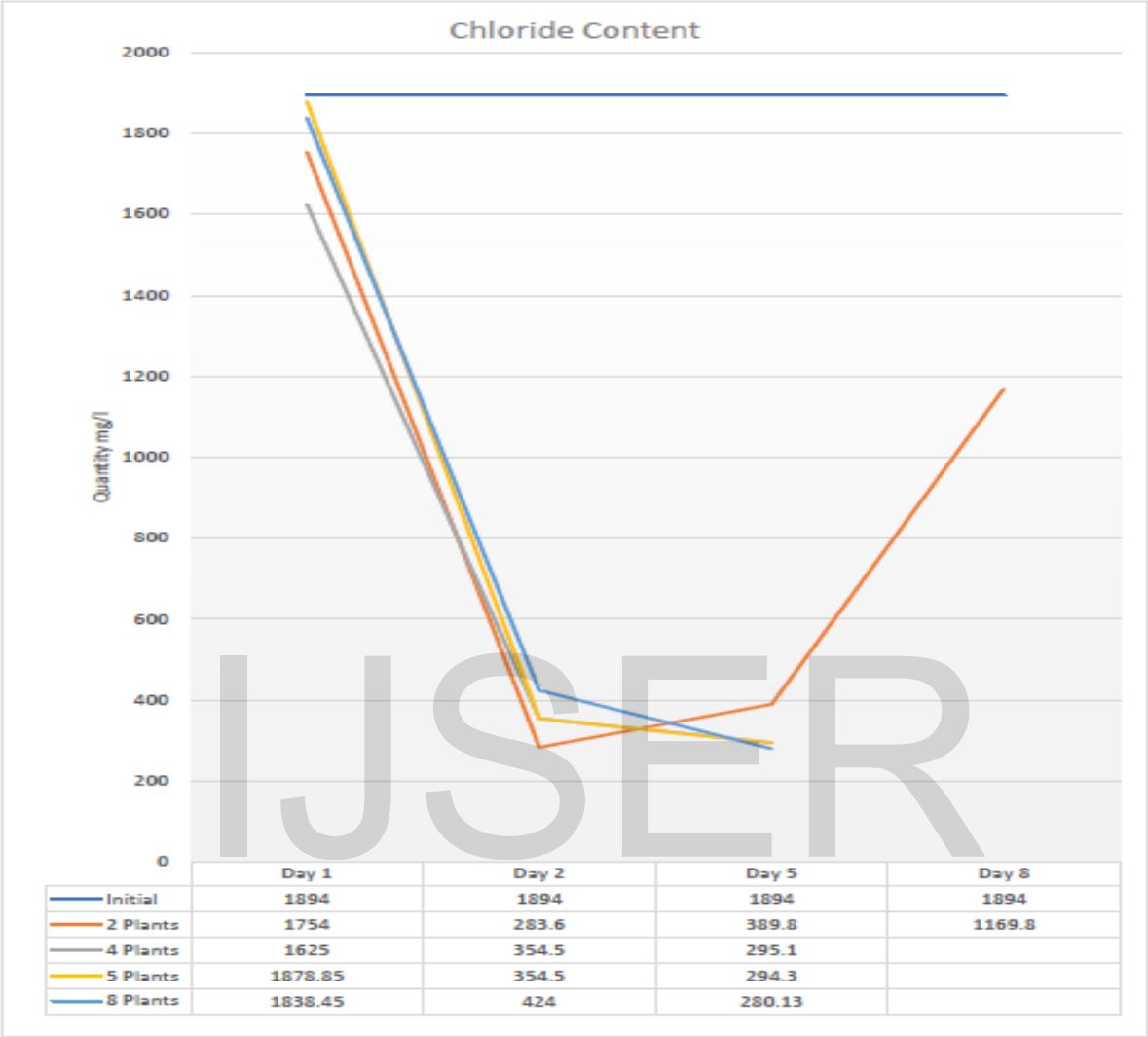


	Day 1	Day 2	Day 5	Day 8
Initial	265.3	265.3	265.3	265.3
2 Plant	225.74	180.18	210.9	540.91
4 Plant	220.74	172.18	67.5	
5 Plant	213.44	150.58	42	
8 Plant	224.34	142.78	61.5	



	Day 1	Day 2	Day 5	Day 8
Initial	2518.71	2518.71	2518.71	2518.71
2 Plants	2000	1510	1980	2692.1
4 Plants	2193	1691	1200	
5 Plants	2135	1630	1400	
8 Plants	2014.3	1730.8	1356	

NO OF DAYS



	Day 1	Day 2	Day 5	Day 8
Initial	1894	1894	1894	1894
2 Plants	1754	283.6	389.8	1169.8
4 Plants	1625	354.5	295.1	
5 Plants	1878.85	354.5	294.3	
8 Plants	1838.45	424	280.13	

From the above results, it can be seen that if 2 plants are used, then after 2 days unusual results are observed. In between plant density 4 & 5, not much variation is observed, both having almost same efficiency in treating wastewater. If 8 plants are used, there is no appreciable change in results as compared to plants 4 & 5. The toxic metal content of initial wastewater is in permissible limit of discharge; hence it is not necessary to test for toxic metal.

5. CONCLUSION

From the studies mentioned above, it could be concluded that 2 numbers of plants can be used to treat wastewater effectively with optimum HRT of 2 days. Hence 5 plants can be effectively used to treat 10 litres of waste water with 100% dilution. Hence Phytoremediation is a yet another emerging and should be encouraged, so that it can be applied practically so that water can be restored in situ. It is green technology for restoring environment. Compared to the expensive conventional techniques solar driven Phytoremediation is ecologically a better and promising choice with bright future. Efforts should be focused on exploring and utilizing this technology to get treated water meeting the standards and thus conserve the environment aiming at sustainable development and reduce stress on natural resources.

6. REFERENCES

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