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Phytoremediation of Sewage Water by using *Dracaena sanderiana* and *Epipremnum aureum*

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Abstract

Industries like paper, pulp, food processing generate waste water containing different type of contaminants which are hazardous to environment. Phytoremediation is removal of contaminants in water by using various aquatic plants. In present work the plant like Dracaena sanderiana and Epipremnum aureum were used for phytoremediation process. The physico-chemical parameters of sewage water sample were analyzed before and after phytoremediation. The sewage with different concentration viz. 10%, 30%, 50%, 70%, 100% were tested for the treatment. The pH of water sample before phytoremediation process ranges from 8-9. After phytoremediation process with Dracaena sanderiana it was decreases i.e. 7-8. Similarly Chloride content and DO of water sample were also decreased after treatment. Efffect was also observed with respect to other tested parameters. Turbidity and highly offensive odour of waste water decreased with Dracaena sanderiana and Epipremnum aureum. The phytoremediation is useful and eco-friendly technology. Future prospective of this study involve study of effect of phytoremediation process on anatomical and physiological properties of plants under study.

Keywords- Phytoremediation, sewage water, *Dracaena sanderiana*, *Epipremnum aureum*

NTRODUCTION

Domestic and industrial waste is the most common cause for the water pollution. Domestic waste contains solid food particles, oil, and grease stick inside of the pipe, which clogs the pipes. Organic matter, washing soap, detergents, high organic suspended solids, oil and grease, which cause harm to the environment and human health. Pollutants, can affect the ground water. When water is contaminated with organic matter it provides food for the mosquito larvae which cause large increase in their population and they cause serious diseases in human and animals (Nayaabanjum Ansarijulaya et al.2018). Drinking contaminated water can cause serious health problems like diarrhea, cholera, typhoid, dysentery and other illnesses such as guinea worm disease. It is important to control domestic wastewater for the betterment of the society and our future.

Phytoremediation technology in the form of constructed wetlands or natural water mash is a nature's gift for control of water pollution and for sustaining livelihood wetlands, both natural and constructed are able to purify wastewater due to their ability to degrade, absorb or filter the pollutants and to take-up nutrients from the wastewater. Therefore, the use of constructed wetlands for wastewater treatment is becoming more and more popular (B.L. Chavan, V.P. Dhulap, 2012).

Phytoremediation consists of mitigating pollutants concentration in contaminated soil, water or air with plants able to degrade or eliminate metals, pesticides, solvents, explosives, crude oil and derivatives and various other contaminants from the media that contain them. Phytoremediation is cost effective is suited to remediation of contaminants in waste water. It is eco-friendly method.

In present work two plants used for phytoremediation process such as *Dracaena sanderiana* and *Epipremnum aureum*. The common name of *Dracaena sanderiana is* Lucky bamboo(Order Asparagales, Family Asparagaceae). *Dracaena sanderiana* is native to tropical west and central Africa, where it grows up to five feet tall beneath the rainforest canopy. It can grow hydroponically or in soil. This plant need moderate temperature i.e. $16\text{-}24^0$ C (60-75 F). Leaves of this plant have the potential to be used as a natural antioxidant (Mei Gee Ong et al., 2016).

Epipremnum aureum also called golden pothos. It is among the most popular tropical ornamental plant used as hanging basket crop. *Epipremnum aureum* is powerful air purifying plant. It

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continues to produce oxygen at night unlike other plants that produce carbon dioxide at night.

In the phytoremediation process, plant roots take contaminants from the wastewater in to the body of the plant. The plant root zone is referred to as the rhizosphere; this is where the action occurs. The water supports large population of diverse microorganisms. This is due to the chemicals exuded by plant roots, which provide carbon and energy for microbial growth. This combination of plants and microorganisms appears to increase the biodegradation of compounds.

Phytoremediation can be achieved through different methods like phytoextraction, rhizofiltration, phytostabilization, and phytotransformation & phytodegradation. The success of phytoremediation mainly depends on the photosynthetic activity and the growth rate of plants (Priyanka Saha et al., 2017).Phytoremediation is also useful to remove lead compounds from waste water. Different types of metals are presented in sediments then these reach the food chain through plants and aquatic animals. In small quantities, certain heavy metals are nutritionally essential for a healthy life, but large amounts of any of them may cause acute or chronic toxicity (poisoning) (Divya Singh et al., 2012). Puneetha et. al. (2017) compared the efficiency of the two plants for phytoremediation .

Plants can degrade, extract or stabilize contaminants in wastewater, thus making it unavailable for other organisms and reducing environmental hazards. If the contaminants in its present concentration are not phytotoxic, cultivation of plants can be a valuable tool in wastewater remediation. Mechanism and efficiency of this technology called phytoremediation, depending on type of contaminant, bioavailability and wastewater properties. It is an economic method to reduce contaminant load in a wastewater. It involves the use of green aquatic plants like *Eicchornia crassipes* (water hyacinth), *Nymphaea sp (*water lily), *Lemnoideae*(duckweed), *Canna indica* (water canna), *Dracaena sanderiana* (Lucky bamboo), *Epipremnum aureum* (Money plant) and many more.

MATERIAL AND METHODS

1. Plant collection

Plant like *Dracaena sanderiana* (Lucky Bamboo) was collected from Nursery, Karad. And *Epipremnum aureum* (Money Plant) was collected from Vagheri Village, near Karad.

2. Sample Collection

The sewage water sample was collected from Sadguru Gadage Maharaj College, Karad. Before treatment various parameters of water sample were analyzed and remaining water sample used for phytoremediation. Two sets were prepared for Phytoremediation. One set for *Dracaena sanderiana*, and another set for *Epipremnum aureum.* These plants were taken in glass beaker containing sewage with different concentration viz. 10%, 30%, 50%, 70%, and 100%. Distilled water used as control in phytoremediation process. These glass beakers were put taken at Room Temperature for 10 days.

The physico-chemical parameters include pH, TDS, TSS, Absorbance, Hardness (Total and Permanent), Chloride, DO, MPN etc. These parameters of water sample were analyzed by using standard method are as follows:

pH

The pH of the water samples was determined by using a Digital Pen pH meter. (MCP Digital LCD pocket pen type pH meter).

TDS AND TSS

Before and after phytoremediation process the TDS and TSS of water sample were analyzed using the procedure as described by the standard APHA methods of examination of water sample.

HARDNESS (Total and Permanent)

The Total and permanent hardness of water sample were analyzed by using Standard procedure as described by APHA, Standard methods for the examination of water and wastewater.

Chloride Test

Chloride Content in the untreated and treated samples was analyzed by using Mohr's method of titration (4500 B-CI; Argentometric method).

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Dissolved oxygen (DO)

Dissolved oxygen in water sample was estimated by Winkler Method as described by standard APHA methods of examination of water sample.

MPN (Most Probable Number)

Total Coliform organism in water sample is carried out using MacConey's broth. Double and Single strength tubes containing MacConkey's broth with Durham's tubes were used. After incubation for 24 hr at 37^0C, the coliform count was analyzed.

RESULTS AND DISCUSSION

The sewage water collected from the Campus was analyzed for different parameters such as pH, Total Suspended Solids, Total Dissolved Solids, Total Solids, Hardness, Chlorides and Dissolved Oxygen. These parameters were measured as per the standard methods of APHA before and after the treatment. The results are mentioned in the following tables.

Table 1.Values of the water sample before treatment

Parameters	Concentration of water sample					
	D/W	10%	30%	50%	70%	100%
pH	7.4	8.5	9.1	9.9	9.9	8.3
TDS(mg/L)	0.08	0.68	0.36	0.28	0.46	0.50
TSS(mg/L)	0.06	0.12	0.08	0.46	0.12	0.46
TS(mg/L)	0.14	0.80	0.44	0.74	0.58	0.96
Hardness(mg/L)	42	46.6	54	58.60	63.32	36.66
Total Permanent	38	45.32	51.32	56	60.66	35.32
Chloride(mg/L)	44.98	52.98	75.97	102.96	120.96	141.95
DO(mg/L)	13.73	12.53	10.93	8.40	8.26	-

Table 2.Values of the water sample after treatment with *Dracaena sanderiana*

Parameters	Concentration of water sample					
	D/W	10%	30%	50%	70%	100%
pH	7.3	8.2	8.0	7.8	7.6	7.7
TDS(mg/L)	0.04	0.04	0.08	0.12	0.12	0.16
TSS(mg/L)	0.04	0.04	0.08	0.10	0.10	0.05
TS(mg/L)	0.08	0.08	0.16	0.22	0.22	0.21
Hardness(mg/L)	27.33	24	28.66	34.66	35.53	33.32
Total Permanent	21.33	21.33	22.65	32.66	34	29.32
Chloride(mg/L)	23.99	24.99	28.99	33.98	39.98	42.98
DO(mg/L)	2.53	2.13	2.53	1.86	2	4.4

Table 3.Values of the water sample after treatment with *Epipremnum aureum*

Parameters	Concentration of water sample					
	D/W	10%	30%	50%	70%	100%
pH	7.4	8.3	8.2	7.8	7.9	7.7
TDS(mg/L)	0.10	0.10	0.12	0.14	0.16	0.24
TSS(mg/L)	0.02	0.04	0.08	0.08	0.16	0.24
TS(mg/L)	0.12	0.14	0.20	0.22	0.26	0.38
Hardness(mg/L)	19.32	19.32	22.66	32	34	34
Total Permanent	18.66	18.66	19.33	23.33	23.33	25.66
Chloride(mg/L)	22.99	23.99	22.99	36.98	40.98	51.39
DO(mg/L)	4	4.73	3.33	2.93	2.66	-

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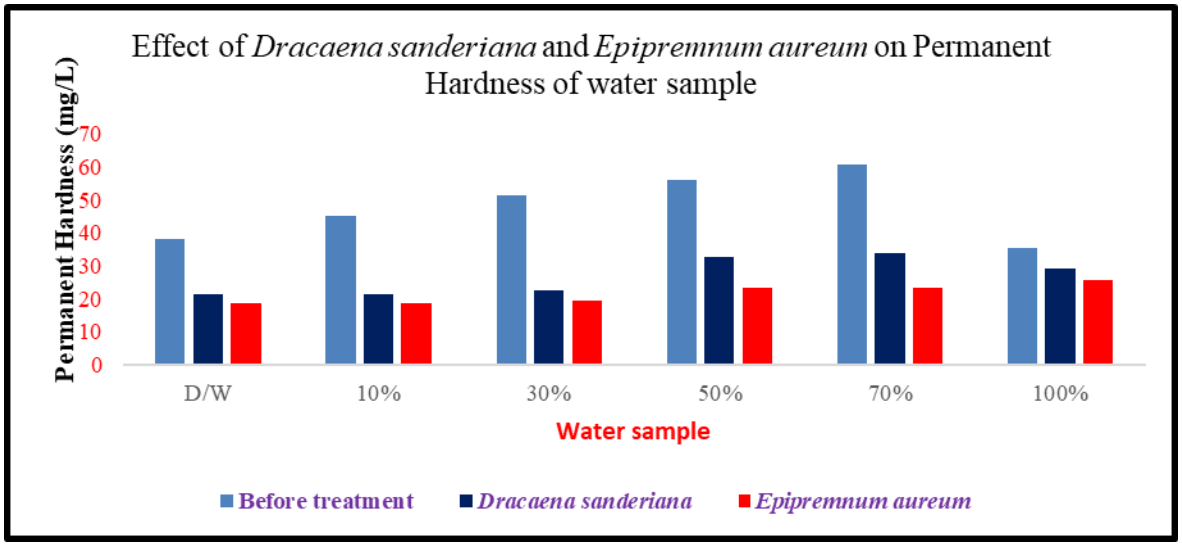

Fig.1 Effect on permanent hardness of test water sample with respect to control

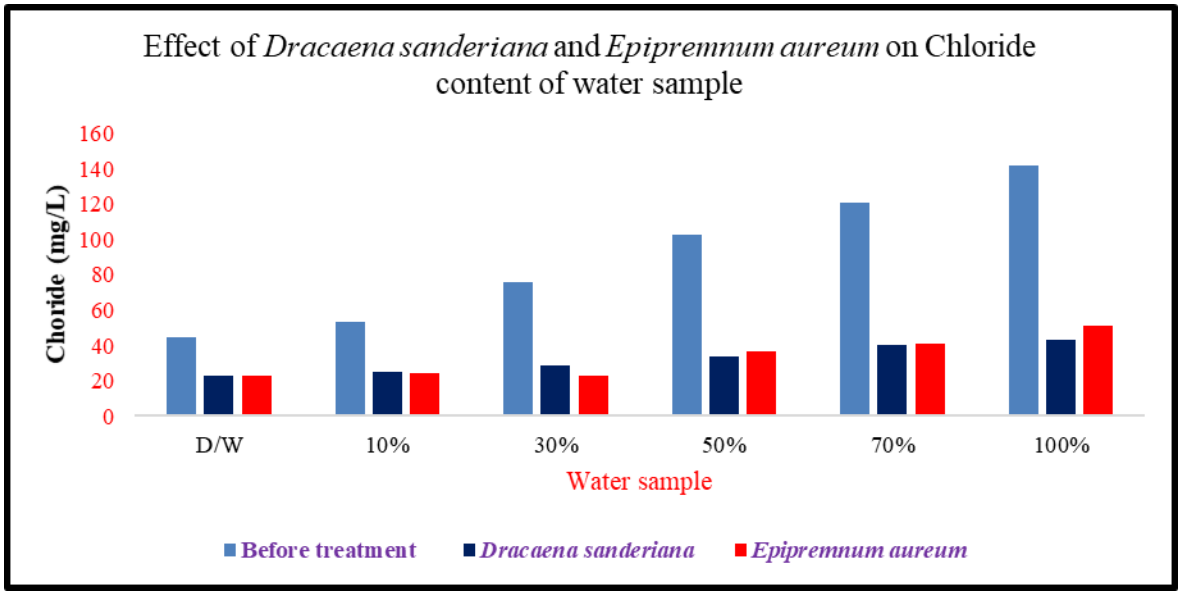

Fig.2 Effect on Chloride content of test water sample with respect to control

In the present work *Dracaena sanderiana* and *Epipremnum aureum* two plants were used for phytoremediation process. The various physico-chemical parameters such as pH, color, turbidity, TSS, TDS, TS, hardness, chlorides and dissolved oxygen were analyzed before and after phytoremediation. Within 10 days of experimental period, significant change in color, pH, turbidity, TSS, TDS, TS, hardness, chlorides and dissolved oxygen was observed. In the current finding indicates effective use of these two plants for remediation of pollutant present in wastewater.

The sewage collected was initially having turbid colour. It was full of dirt containing solids. The colour and odour were removed and hence treated samples were observed clear and odorless. For turbidity of wastewater, absorbance was measured at 540nm.

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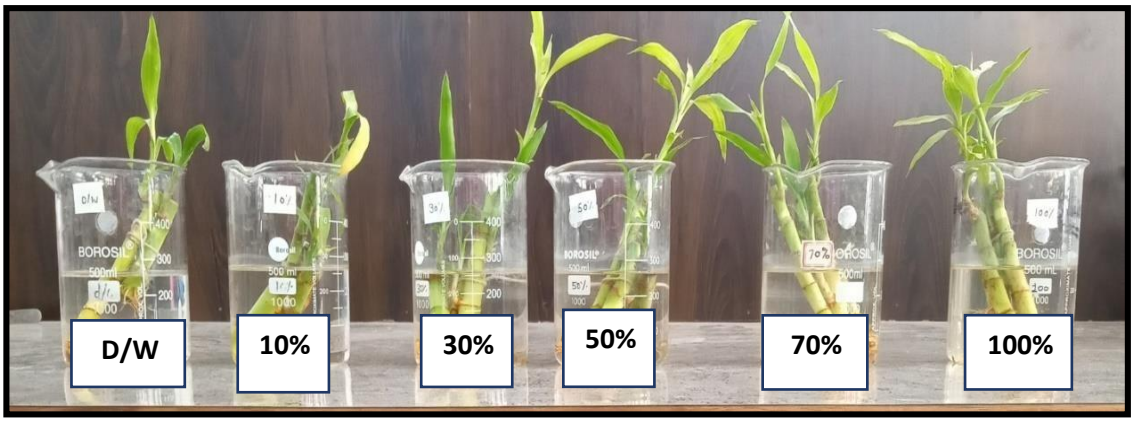

Fig. 3 Plant set up for phytoremediation with *Dracaena sanderiana*

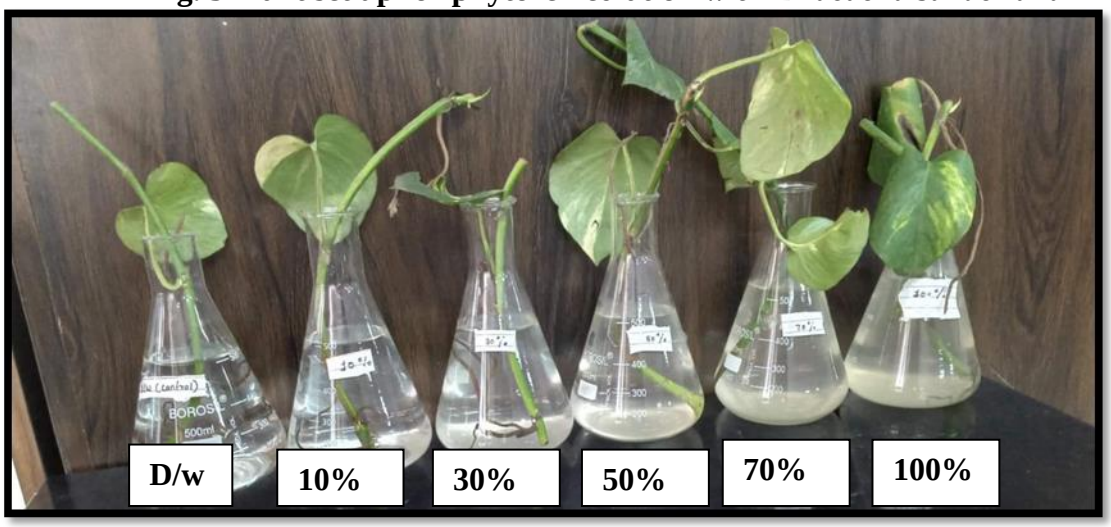

Fig. 4 Plant set up for phytoremediation with *Epipremnum aureum*

pH

pH refers to the measure of hydrogen ion concentration in a solution. The minimum and maximum values of pH before treatment are 7.4 and 9.9 respectively. After treatment the values of the pH are 7.3 to 8.3 which indicates that the pH is maintained at neutral. Drinking water with a pH between 6.5 and 8.5 is generally considered satisfactory.

pH values obtained in the test water sample after phytoremediation process with *Dracaena sanderiana* ranges between 7.3 to 8.2. After treatment of *Epipremnum aureum* the values of pH were ranges between 7.4 to 8.3.

Total suspended solids

Total suspended solids can be referred to materials which are not dissolved in water and are non filterable in nature. It is defined as residue upon evaporation of non filterable sample on a filter paper. The values before treatment are almost up to 0.46 mg/l and after the treatment with *Dracaena sanderiana* all the values are below 0.11 mg/l and in case of the *Epipremnum aureum* except 100 % concentrations all the values are below 0.20 mg/l. TSS was reduced by 89.13% in

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case of the *Dracaena sanderiana* and 47.82% in case of *Epipremnum aureum* for 100% conc. in present study.

Total dissolved solids

Total dissolved solids refer to materials that are completely dissolved in water. These solids are filterable in nature. It is defined as residue upon evaporation of filterable sample.TDS were reduced by 68% and 52% in case of the *Dracaena sanderiana* and *Epipremnum aureum* respectively for 100% concentration in present study.

Total solids

Total Solids is the term applied to the material residue left in the vessel after evaporation of a sample and its subsequent drying in an oven at a defined temperature. It is defined as residue upon evaporation of free water. Thus, Total solids are nothing but summation of total dissolved solids and total suspended solids. TS values were reduced by 78.12% in case of *Dracaena sanderiana* for 100% concentration and 82.5% in case of the *Epipremnum aureum* for 10 % concentration in present study.

Total Hardness:

Total hardness is due to the presence of bicarbonates, chlorides and sulphates of calcium and magnesium ions. Total hardness value were reduced from 63.32mg/l to 35.53mg/l & 34.00 mg/l in case of *Dracaena sanderiana* and *Epipremnum aureum* respectively for 70% concentration in present study.

Permanent Hardness:

Permanent hardness is due to the presence of chlorides and sulphates of calcium and magnesium ions. This type of hardness cannot be removed by boiling. Value of Permanent hardness were reduced from 60.66mg/l to 34.00 mg/l & 23.33 mg/l in case of *Dracaena sanderiana* & *Epipremnum aureum* respectively for 70% concentration in present study.

Dissolved oxygen

Dissolved oxygen (DO) is a measure of how much oxygen is dissolved in the water - the amount of oxygen available to living aquatic organisms. DO value of 30% sample was reduced from 10.93mg/l to 2.53 & 3.33 mg/l in case of *Dracaena sanderiana* & *Epipremnum aureum* in present study.

Chloride:

Chloride increases the electrical conductivity of water and thus increases its corrosivity. In metal pipes, chloride reacts with metal ions to form soluble salt. Value of Chloride content were reduced from 141.95mg/l to 42.98mg/l in case of *Dracaena sanderiana* for 100% concentration and 102.96 mg/l to 36.98 mg/l in case of the *Epipremnum aureum* for 50% concentration in present study.

MPN:

After phytoremediation of sewage water sample with *Epipremnum aureum* the MPN of water sample decreased i.e. 1600(According to McCardy's table).

After phytoremediation of sewage water sample with *Dracaena sanderiana*, the MPN of water sample decreased i.e. 350(According to McCardy's table).Coliform count may be decreased due to accumulation plant metabolic products in water sample.

CONCLUSION

In the present work two plants i.e. *Dracaena sanderiana* and *Epipremnum aureum* were used for phytoremediation process. The various physico-chemical parameters such as pH, color,

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turbidity, TSS, TDS, TS, hardness, chlorides and dissolved oxygen were analyzed before and after phytoremediation. Within 10 days of experimental period, significant change in color, pH, turbidity, TSS, TDS, TS, hardness, chlorides and dissolved oxygen was observed. The current findings indicate effective use of these two plants for remediation of pollutant present in wastewater. In future more attention will be paid to these plants for treatment of industrial as well as other kinds of wastewaters.

REFERENCES

1. APHA, AWWA, WEF. Standard methods for the examination of water and wastewater. 21st ed. Washington (DC): American Public Health Association, 2005.
2. B.L. Chavan & V. P. Dhulap. Optimization of pollutant concentration in sewage treatment using constructed wetland through phytoremediation", International Journal of Advanced research in Engineering and Applied Science, 2012.1(6): 1-16.
3. Divya Singh, Archana Tiwari and Richa Gupta. Phytoremediation of lead from wastewater using aquatic plants. Journal of Agricultural Technology, 2012. 8(1): 1-11
4. Mei Gee Org, Siti Nur Aishah Mat Yusuf, and Vuanghao Lim. Pharmacognostic and Antioxidant properties of *Dracaena sanderiana* leaves", Antioxidants (Basel), 2016, 5(3): 28.
5. Nayaabanjum Ansarijulaya, Bhupesh Yagnik, Neelam Amit Kungwani. Phytoremediation of Grease in wastewater using *Dracaena sanderiana.* sch. Acad. J. Biosci., 2068: 6(4): 341-347.
6. Priyanka Saha, Omkar Shinde and Supriya Sarkar. Phytoremediation of industrial mines wastewater using water hyacinth. International Journal of Phytoremediation. 2017, (19): 1, 87–96
7. Puneetha G., Sesha Srinivas V. and Giridhar M.V.S.S. Treatment of Urban Sewage Water using Phytoremediation, Proceedings of 4th National Conference on Water, Environment & Society (NCWES-2015), 333-338