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An Experimental Study on Usage of Effluent from Constructed Wetland in Concrete

D.Leela Prasad¹, J Bala Naresh², K Alekhya³, G Poojitha⁴, M Teja⁵, B Vineetha⁶, P Jagadeesh⁷,
CH Durga Sowjanya⁸

Assistant Professor, Department of Civil Engineering, Ramachandra College of Engineering, Vatluru, Andhra Pradesh,
India¹

B.Tech Student, Department of civil Engineering, Ramachandra College of engineering, vatluru, Andhra Pradesh,
India^{2,3,4,5,6,7,8}

ABSTRACT: According to WHO in 2007 there are 2.6 billion people are suffering from problem called proper sanitation. In order to overcome this problem, we have to look over the sustainable waste water treatment system. In India, about 38,255 million liters of sewage produced daily, out of which only 22% of the sewage is being treated. Wetland construction is a solution for the treatment of sewage water through the natural process of growing a plant. In this experimental setup a wetland is constructed to investigate the performance of Typhalatifolia (Elephant ear plants), when planted in sewage water and investigated for a period of 28 days. The constructed wetland (CW) setup was filled with sewage water with a hydraulic retention period of 7 days. Within the stipulated period of 4 weeks, the change in the characteristics of the effluent was tested for every 7 days. During the treatment period, the plant Elephant ear plants has considerably reduced the COD content by 28% in the sewage. Hence, it is inferred from the project that the plant species Typha latifolia has the ability to reduce the saline nature of the water. It is also noted that the efficiency of the treatment of sewage water by the plant species increases with the increase in the time period in which the CW system is maintained properly. The treated effluent is used in concrete and 28 compressive strength of specimen tested and compared with the potable water specimen.

KEYWORDS: Constructed wetland, Typha latifolia, sewage water, chemical Oxygen Demand (COD).

I. INTRODUCTION

The scarcity of water is becoming critical environmental issue worldwide. In last few decades, there has been tremendous increase in the amount of both domestic waste water and industrial waste water generated due to rapid growth of population and accelerated pace industrialization. In the coming years, India is going to face a huge problem in deal with reduced fresh water availability and increased waste water due to increased population and industrialization. There is an increasing trend of considering water reuse as an essential component of water deficient areas, but in the water abundant areas as well. As long as the treated domestic waste is under permissible limits as prescribed by the Is code, it can be utilized as a replacement for potable water in the concrete production.

The constructed wetlands, has been recently used for wastewater treatment in many sectors. Thus, an extensive research and practical application is being gained in order to operate the system effectively constructed wetlands has wide application domestic, agricultural, and also industrial wastewater treatment. The use of constructed wetland on industrial pollutants is increasingly utilized and these represent a promising alternative method to treat the various types of industrial wastewater using the new technology of constructed wetlands.

However, several investigations have shown that wetlands may act as efficient water purification systems and nutrient sinks. Constructed wetlands are artificial wastewater treatment system consisting of shallow (usually less than 0.5m deep) ponds or channels, which have been planted with aquatic plants (Elephant ear plants), and rely upon natural microbial, biological, physical and chemical processes to treat waste water.

The treatment system is vegetated with water lettuce (Elephant ear plants) plant with different experimental conditions. The test in the laboratory, the water sample would be taken from the planting area which consists of water lettuce (Elephant ear plants) that is planted in the filter bed and which is then passed waste water. These parameters that would be analyzed in the laboratory to determine the physical, chemical & Biological characteristics of the waste water which are-PH, Turbidity, Alkalinity, Acidity, Dissolved oxygen (DO), Temperature, Chloride (cl) Electrical Conductivity, Hardness, Total dissolved solids (TDS), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD). The

scope of work for this project is to investigate the removal efficiency of the aforementioned physical and chemical properties by using different number of water lettuce (Elephant ear plants) and to record the sampling of the waste water for a detention period of 28 days.

II. RELATED WORK

In this related work we are casting about 4 sets of cubes for we are take 3 samples in total 12 cubes are prepared. These cubes are casted with potable water and 28 days compressive strength are determined, then obtained the value is 57.2 N/mm². then second set of cubes the compressive strength value is 68.42 N/mm², this was the optimum value. and The results are obtained. The tests were conducted on the effluent are as like the influent all the parameters are to analyzed for the effluent to check whether there is a change in the influent and effluent parameters those tests are Ph, Electrical Conductivity, Turbidity, Dissolved Oxygen, Alkalinity, Acidity, Chemical Oxygen Demand (Cod), Bio-Chemical Oxygen Demand (Bod). The test results from the constructed wetland. The influent is fed into constructed wetland at the rate of 3 lts/day and it is found that 20% of water in the wetland is lost due to losses like consumption by plants, evaporation, and absorption by filter beds. The effluent is collected and tested with an interval of 3 days and for effective and satisfactory purification 12 days detention time is required according to the results we get. At an average of 7.2 ltrs effluent is collected for 3 days interval (9.0-7.2=1.8) it shows that 20% water along with organic matter is consumed by plants.

III. METHODOLOGY

In the methodology the following steps are followed those are [1] collection of waste water, [2] analysis of waste water, [3] collection of plant suitable for wetland [4] collection of sand and gravel [5] construction of horizontal wetland [6] analysis of effluent from constructed wetland [7] comparison of quality parameters of treated effluent [8] casting specimens with potable water and treated water [9] testing of specimens [10] comparison of specimens. Then We have prepared the constructed wetland by using the following materials. [1] Coarse aggregate of 30 kg total weight is used for making bottom layer of 10 cm height. [2] Followed by medium sized sand amounting total to 25 kg will be added to form a middle layer of 10 cm height. [3] Selective healthy, small, young, locally available plants were transplanted into the bed. [4] Inlet flow and outlet flow of wastewater is adjusted to maintain Hydraulic retention Time (HRT) of 3 days.

IV. EXPERIMENTAL RESULTS

In this study results obtained for casting about 4 sets of cubes for we are taking 3 samples in total 12 cubes are prepared. Figures shows the compressive strength of potable & effluent water results are Potable water at 28 days compressive strength is 57.2 N/mm² and Effluent water compressive strength is 68.42 N/mm².

The results from the constructed wetland with a retention period of 12 days are as follows.

PARAMETER S	INITIAL	3DAY S	6DAY S	9DAY S	12DAY S	PERMISSIBLE LIMITS
PH	9.2	7.6	7.45	7.3	7.14	6.5-8.5
EC TEST	3.3	1.86	0.46	0.38	0.28	0-5 umhos/m
TURBIDITY	14	7.2	6.95	5.74	4.6	1-5 NTU
DO	1.2	2.9	3.8	4.9	5.8	4-6 mg/l
ALKALINITY	834	654	478	310	193	20-200 mg/l
ACIDITY	975	783	540	312	216	250 mg/l
COD	684	422	295	124	72	250 mg/l
BOD5	413	302	240	176	84	300 mg/l

Table 1

The following table represents cod values at 3, 6, 9 and 12 days of samples of influent and effluent values.

Sample	Initial	3days	6days	9days	12days
INFLUENT	684	684	684	684	684
EFFLUENT	-	422	295	124	72

Table 3

(b)cod chart

The maximum cod removal efficiency for the construction wet land is 10.52%.

The following table represents Bod values at 3,6,9 and12 days of Samples of influent and effluent values .

SAMPLE	INITIAL	3DAYS	6DAYS	9DAYS	12DAYS
INFLUENT	413	413	413	413	413
EFFLUENT	-	302	240	176	84

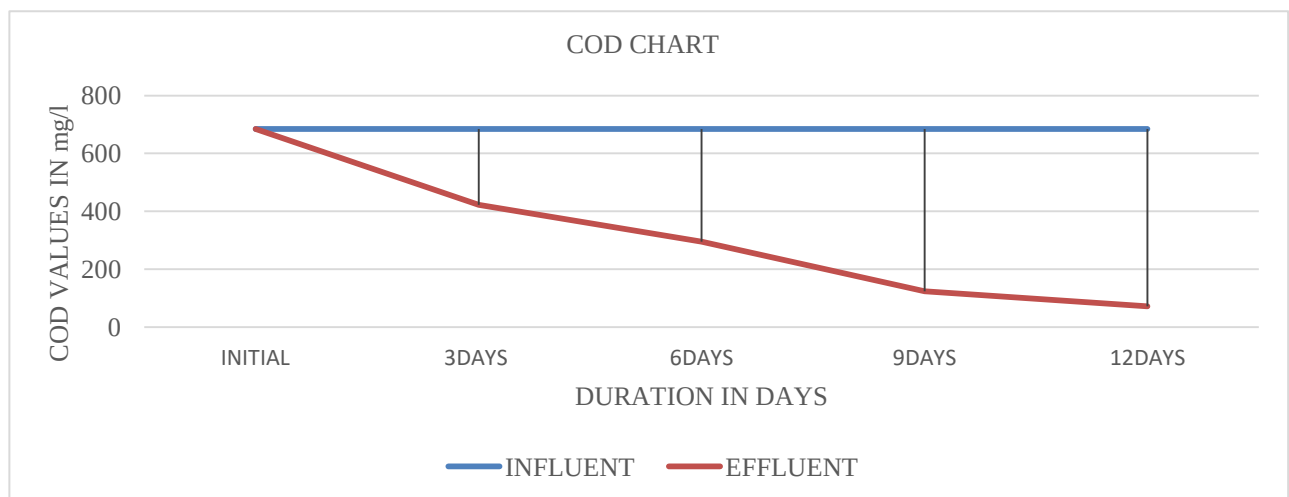
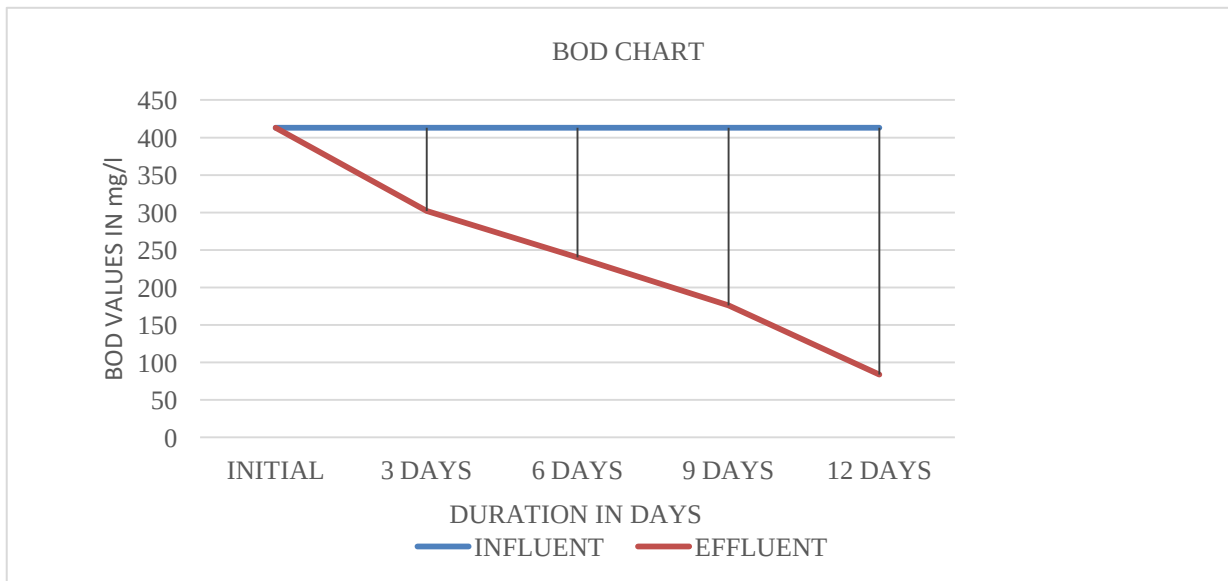


Table 4



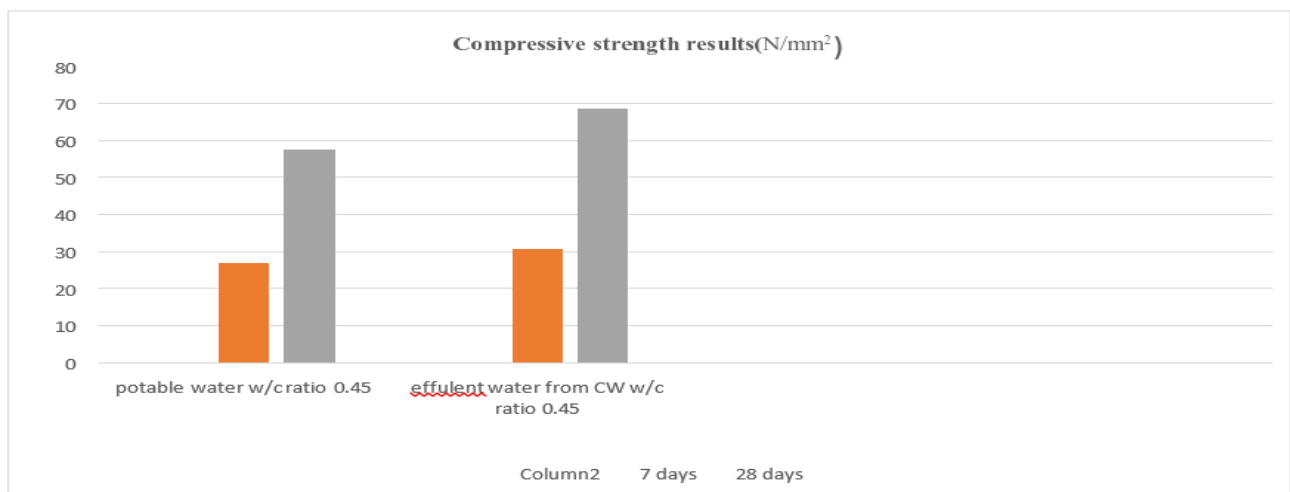
(c) bod chart

The maximum bod removal efficiency for the constructed wet land is 20.34%

The compressive strength of the cubical specimens casted with potable water and effluent from constructed wetland at 7 days and 28 days were as follows.

Days	Dimensionsof Cube (mm)	Potable water		Effluent water	
		Load (KN)	Compression strength (N/mm ²)	Load (KN)	Compression strength (N/mm ²)
7days	70.7*70.7*70.7	134	26.8	152	30.41
28days		286	57.2	346	68.42

Table 2



Potable water at 28 days compressive strength=57.2 N/mm²

Effluent water compressive strength = 68.42 N/mm².



(d) plant growth (after 3days)



(e) plant growth (after 12 days)

Initially the rate of growth of the plants is slow

Fig. shows that (d) plant growth (after 3 days) (e) plant growth (after 12 days). The nutrients which increase the strength of waste water and are responsible for the occurrence of odour, those nutrients are absorbed by the plants based on the detention time. Thereby, the growth and health of the plants is increased and the above picture shows the growth of plants at 12 days detention period and taro/elephant ear (Colocasia).

V. CONCLUSION

The wetlands perform more efficiently for treating the domestic gray-water. The removal efficiency of the constructed wetland against each parameter of waste water is as follows. The maximum PH removal efficiency for constructed wetland with elephant ear plants is 77.6%. The maximum Electrical conductivity removal efficiency for the constructed wetland with elephant ear plants is 8.48%. The maximum Turbidity removal efficiency for the constructed wetland is 32.86%. The maximum DO increasing efficiency for the wet land is 20.69%. The maximum Acidity removal efficiency for the constructed wetland is 22.1%. The maximum Alkalinity removal efficiency for constructed wetland is 22.1%. The maximum COD removal efficiency for the constructed wetland is 10.52%. The maximum BOD removal efficiency for the constructed wet land is 20.34%.

From the first set of cube first casted with potable water are having less results when compared with effluent from CW. From all the compressive strength results we observed that the effluent from CW water can be used as a best alternative for the conventional water without any compatibility issues. The 28 days results of compressive strength suggests that the effluent from CW water with 0.45 w/c ratio having more strength without any compatibility issues.

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