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Constructed Wetland an Efficient Treatment Method for Domestic Wastewater Treatment

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Abstract – *Due to rapid urbanisation and industrialisation there is severe environmental pollution in last few decades due to which there an adverse impact on the nature. The municipal treatment plant generally treats the wastewater of cities and disposes off safely nearby in the developing and the developed countries. The condition of the rural areas remains a problem where the treatments are not given to the wastewater in such areas the constructed wetland is option for the treatment of wastewater. Constructed wetlands are engineering systems which are designed to treat wastewater from various sources. The aim of this study is to find out the economical method of treatment of domestic wastewater and to compare the efficiency of naturally aerated and artificially aerated constructed wetland. The lab model was filled with filter media and one unit was given artificial aeration. The present study was done for the mundhwa area by constructing lab scale model. The parameter like colour, odour, pH, COD and DO was checked.*

Key Words: Constructed Wetland, domestic wastewater, artificial aeration, filter material.

1. INTRODUCTION

Tin cities we have municipal wastewater treatment plant which treats the wastewater and discharges in the nearby streams. In small cities or villages untreated wastewater is still drained directly into the nearby area as the cost of constructions of treatment plant is the main constrain. In recent years studies have been done on the design, construction and performance of constructed wetland for treating different types of wastewater such as sewage, storm water, and agricultural runoff [5] [7]. CW uses the natural treatment systems with substrate materials like sand or gravel planted with vegetation [10]. Compared to conventional treatment systems, constructed wetland is low cost, easily operated and maintained [8]. It is accepted as a reliable method for the treatment of many types of wastewater. Constructed wetland provides an effective and low cost alternative method for treatment of wastewater. The method is still in developing stage in country like India and very less work have been done for the treatment of domestic wastewater with the help of constructed wetland on a field level[9]. Vertical flow constructed wetland system have greater oxygen transport ability then horizontal subsurface flow beds in treating wastewater [2][3][4][6].

With the aim to increase the oxygen content in constructed wetland, ant check the treatment performance of the vertical flow constructed wetland, two lab scale model was designed one with artificial aeration vertical flow constructed wetland (AVFCW) and other naturally aerated vertical flow constructed wetland (NVFCW) to investigate and compare the performance in treating domestic wastewater.

2. MATERIAL AND METHOD

2.1 Site Condition

Two lab scale model designed to treat domestic wastewater situated in Wagholi, (N 18.52028 and E 73.85667) pune. The prevailing climate in wagholi area is known as a local steppe climate [48].The average annual temperature in wagholi is 25.0 °C and the rainfall is 603 mm.

2.2 Lab Scale Model Setup

The wastewater was collected from the sewer drain of mundhwa. Two lab scale model was setup in a bucket of dimension 400mm x 300 mm. one lab scale model was provided with the artificially aeration system named as artificially aerated vertical flow constructed wetland (AVFCW)and other was naturally aerated named as naturally aerated vertical flow constructed wetland (NVFCW). The outlet was provided at the bottom of the tank. The bucket was filled with supporting media of aggregate, coal and brick from top to bottom of the tank of height 120mm each. All the materials were washed three to four times and then used. For aeration system 10mm diameter pipe was provided in between aggregate and coal and between coal and brick. The pant used was Typha latifolia which was collected from local site. The wastewater parameter was checked after 12 hrs. 24 hrs. and 48 hrs.

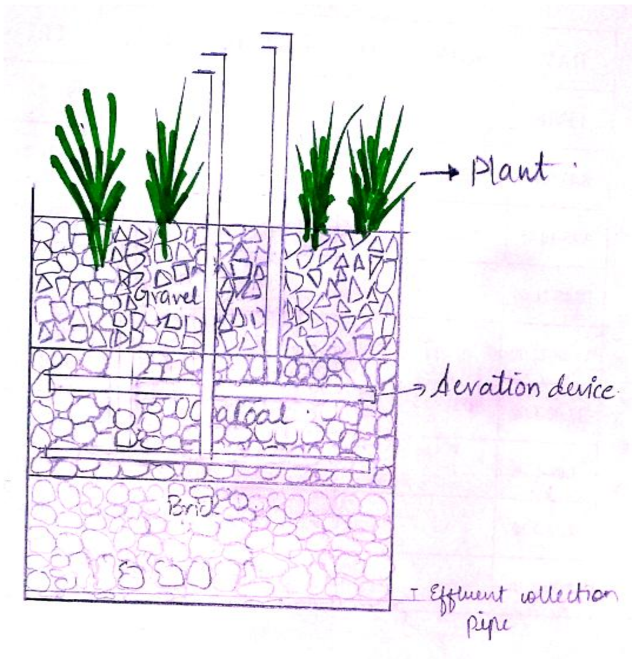

Fig.No.1: Sectional view of lab scale model.

2. RESULT AND CONCLUSION

Following results was obtained after treating domestic wastewater form the lab scale model. From the results it is seen that the treatment efficiency of artificially aerated constructed wetland is more as compared to naturally aerated constructed wetland. The treated wastewater does not have any odour it is clear and the colour becomes from blackish to colourless. The efficiency of artificially aerated vertical flow constructed wetland is more as compared to naturally aerated vertical flow constructed wetland.

Result Sample-I

Sr. No.	Parameters	Before Treatment	After Treatment	
			NVFCW	AVFCW
1	Odour	Pungent Smell	No odour	No odour
2	Colour	Blackish	Colourless	Colourless
3	pH	7.35	7.10	6.83
4	Conductivity	365	515.47	584.6
5	DO	0	1.1	2.23
6	COD	717.33	435.67	363.6

Result Sample-II

Sr. No.	Parameters	Before Treatment	After Treatment	
			NVFCW	AVFCW
1	Odour	Pungent Smell	No odour	No odour
2	Colour	Blackish	Colourless	Colourless
3	pH	7.34	6.93	6.73
4	Conductivity	365.03	549.67	599.45
5	DO	0	1.43	3.2
6	COD	712.33	392.67	302

Result Sample-II

Sr. No.	Parameter	Before Treatment	After Treatment	
			NVFCW	AVFCW
1	Odour	Pungent Smell	No odour	No odour
2	Colour	Blackish	Colourless	Colourless
3	pH	7.34	6.87	6.66
4	Conductivity	366.83	575.53	608.5
5	DO	0	1.56	4.0
6	COD	703.34	357.67	231.67

a. pH Parameter

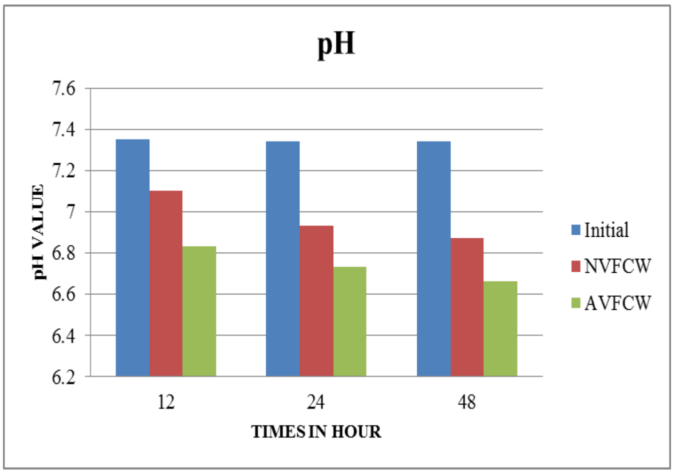

Chart -1: Showing pH variation

The pH of the influent ranges form 7.34-7.35 and that after treatment in AVFCW it ranges from 6.66-6.73. pH goes down due to acidification at the root zone.

b. Conductivity

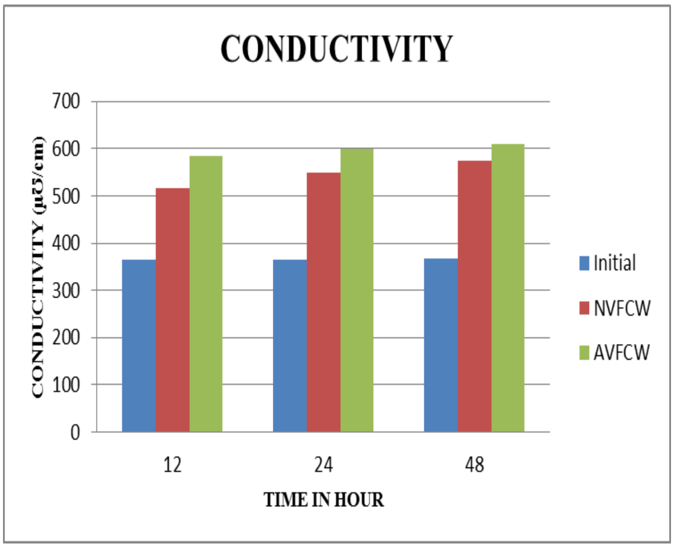

Chart -2: Showing variation in conductivity

Form the above chart it is observed that conductivity of the wastewater increases in both models.the increase in conductivity in AVFCW reported to be more than NVFCW because of the dissolved ion increases in the wastewater.

c. DO Parameter

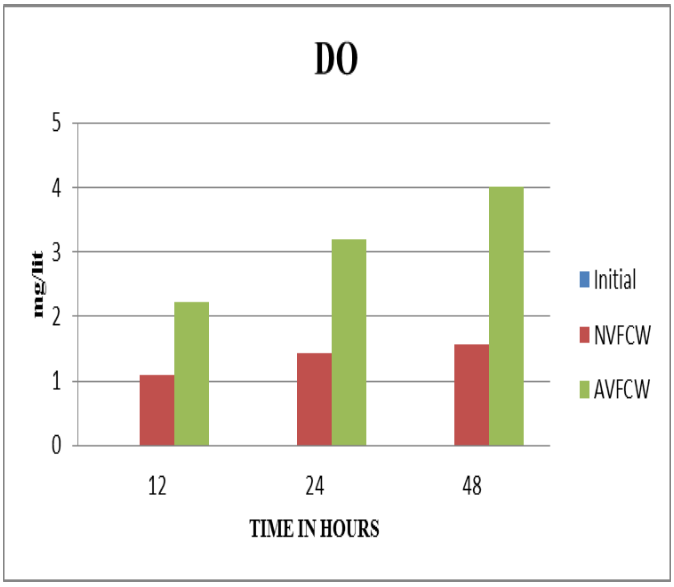

Chart -3: Showing variation in DO

From the above chart it is observed that the initial DO of the wastewater was 0 an all the sample. The increase in DO in AVFCW is more as compared to NVFCW indicating the increase in oxygen transfer through rhizospheres of plant due to provision of artificial aeration.

d. COD Parameter

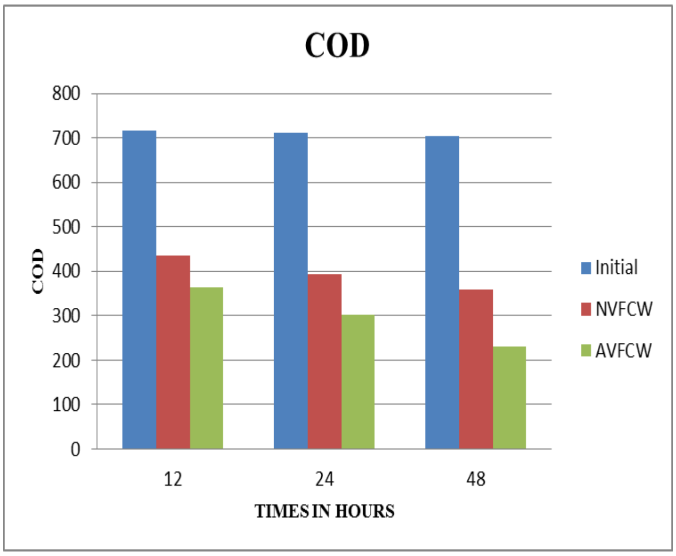

Chart -4: Showing variation in COD

The performance of constructed wetland in removing COD was significant. The influent of the wastewater was observed to be in range of 703.34 mg/l – 717.33 mg/l. The COD after treatment had better performance in artificially aerated than the naturally aerated.

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REFERENCES

[1] American Public Health Association standard method for the experimentation of water and wastewater, 1998.

[2] Cui, L. H., Ouyang, Y., Lou, Q., Yang, F. L., Chen, Y., Zhu, W. L., & Luo, S. M. (2010). Removal of nutrients from wastewater with Canna indica L. under different vertical-flow constructed wetland conditions. Ecological Engineering, 36, 1083–1088.

[3] Cui, L. H., Ouyang, Y., Chen, Y., Zhu, X. Z., & Zhu, W. L. (2009). Removal of total nitrogen by Cyperus alternifolius from wastewaters in simulated vertical flow constructed wetlands. Ecological Engineering, 35, 1271–1274.

[4] Kayser, K., & Kunst, S. (2005). Processes in vertical-flow reed beds: Nitrification, oxygen transfer and soil clogging.Water Science and Technology, 51(9), 177–184.

[5] O. Lazareva and T. Pichler, long-term performance of a constructed wetland/filter basin system treating wastewater, Central Florida, Chem. Goel. 269 (2010), PP. 137-152.

[6] Sklarz, M. Y., Gross, A., Yakirevich, A., & Soares, M. I. M. (2009). A recirculating vertical flow constructed wetland for the treatment of domestic wastewater. Desalination, 246, 617–624.

[7] Tao, W.D., & Wang, J. (2009). Effect of vegetation, limestone and aeration on nitrition, anammox and denitrification in wetlant system. Ecological Engineering, 2009, 836-842.

[8] Vymazal J. and Kröpfelová L. (2008). Wastewater treatment in constructed wetlands with horizontal sub-surface flow. Springer, Dordrecht.

[9] Vinita Vipat, U R Singh and S K Billore (2008). Efficiency of Rootzone Techonology for treatment of Domestic Wastewater: Field Scale Study of a pilot Project in Bhopal. (MP), India. Proceedingsof Taal 2007: The 12th World Lake Conference: 995-1003.

[10] Zhng, D. Q., Gersberg, M. R., & Keat, T. S. (2009). Onstructed wetland in china. Ecological Engineering, 35, 1367-1378.