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CONSTRUCTED WETLAND

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Abstract- Constructed wetlands are artificial wastewater systems consisting of shallow ponds or which have been planted with aquatic plants, and which rely upon natural microbial, biological, physical and chemical processes to treat wastewater. Depending on the type of system, they may or may not contain an inert porous media such as rock, gravel or sand. Constructed wetlands have been used to treat a variety of wastewaters including urban runoff, municipal, industrial, agricultural and acid mine drainage. However, the scope of this manual is limited to constructed wetlands that are the major unit process in a system to treat municipal wastewater.

Index terms - Constructed wetlands,

1. INTRODUCTION

Wetlands, either constructed or natural, offer a cheaper and low-cost alternative technology for wastewater treatment. A constructed wetland system that is specifically engineered for water quality improvement as a primary purpose is termed as a 'Constructed Wetland Treatment System' (CWTS). In the past, many such systems were constructed to treat low volumes of wastewater loaded with easily degradable organic matter for isolated populations in urban areas. However, widespread demand for improved receiving water quality, and water reclamation and reuse, is currently the driving force for the implementation of CWTS all over the world.

Typically, wetlands are constructed for one or more of four primary purposes: creation of habitat to compensate for natural wetlands converted for agriculture and urban development, water quality improvement, flood control, and production of food and fiber (constructed aquaculture wetlands).

1.1 ESTABLISHMENT OF CONSTRUCTED WETLAND TREATMENT SYSTEMS

The creation of a constructed wetland treatment system can be divided into a wetland construction and vegetation establishment stage. Wetland construction includes pre-construction activities such as land clearing and site preparation, followed by construction of a wetland landform and installation of water control structures. In the stage of site clearing and grubbing, the site is cleared and existing vegetation is

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removed to allow construction of wetland cells. All tree root stumps and rubble below ground should be removed. . Wetland plants are transferred to the site and planted manually. After plants are established, water levels are gradually increased to normal water levels, and wetlands are completely created.

1.3 ROLES OF WETLANDS PLANTS IN WASTEWATER TREATMENT

In general, the most significant functions of wetland plants (emergent) in relation to water purification are the physical effects brought by the presence of the plants. The plants provide a huge surface area for attachment and growth of microbes. The physical components of the plants stabilize the surface of the beds, slow down the water flow thus assist in sediment settling and trapping process and finally increasing water transparency.

Wetland plants play a vital role in the removal and retention of nutrients and help in preventing the eutrophication of wetlands. A range of wetland plants has shown their ability to assist in the breakdown of wastewater. surface of the substrate. The sub-surface plant tissues grow horizontally and vertically, and create an extensive matrix, which binds the soil particles and

The roles of wetland plants in constructed wetland systems can be divided into 6 categories:

Physical - Macrophytes stabilize the surface of plant beds, provide good conditions for physical filtration, and provide a huge surface area for attached microbial growth. Growth of macrophytes reduces current velocity.

Organic compound release - Plants have been shown to release a wide variety of organic compounds through their root systems, at rates up to 25% of the total photo synthetically fixed carbon. This carbon release may act as a source of food for denitrifying microbes. Decomposing plant biomass also provides a durable, readily available carbon source for the microbial populations.

Microbial growth - Macrophytes have above and below ground biomass to provide a large surface area for growth of microbial bio films. These bio films are responsible for a majority of the microbial processes in a constructed wetland system, including Nitrogen reduction.

Soil hydraulic conductivity - Soil hydraulic conductivity is improved in an emergent plant bed system.

Creation of aerobic soils - Macrophysics mediate transfer of oxygen through the hollow plant tissue and leakage from root systems to the rhizosphere where aerobic degradation of organic matter and nitrification will take place. Greater oxygen transport into the substrate, creating a more aerobic environment favoring nitrification reactions. Most likely the rate limiting factor for overall Nitrogen removal from a constructed wetland system.

Aesthetic values - The macrophytes have additional site-specific values by providing habitat for wildlife and making treatment systems aesthetically pleasing.

1.4 TREATEMENT OF WASTE WATER

Wastewater is simply that part of the water supply to the community or to the industry which has been used for different purposes and has been mixed with solids either suspended or dissolved. Wastewater is 99.9% water and 0.1% solids. The main task in treating the wastewater is simply to remove most or all of this 0.1% of solids.

Treatment and safe disposal of wastewater is necessary. This will facilitate protection of environment and environmental conservation, because the wastewater collected from cities and towns must ultimately be returned to receiving water or to the land. Primary treatment alone will not produce an effluent with an acceptable residual organic material concentration. Almost invariably biological methods are used in the treatment systems to effect secondary treatment for removal of organic material. In biological treatment systems, the organic material is metabolized by bacteria. Depending upon the requirement for the final effluent quality, tertiary treatment methods and/or pathogen removal may also be included. Today majority of wastewater treatment plants uses aerobic metabolism for the removal of organic matter. The popularly used aerobic processes are the activated sludge process, oxidation ditch, trickling filter, and aerated lagoons. Stabilization ponds use both the aerobic and anaerobic mechanisms. In the recent years due to increase in power cost and subsequent increase in operation cost of aerobic process, more attention is being paid for the use of anaerobic treatment systems for the treatment of wastewater including sewage. Recently at few places the high rate anaerobic process such as Up flow Anaerobic Sludge Blanket (UASB) reactor followed by oxidation pond is used for sewage treatment.

2. EXPERIMENTAL PROCEDURE

We conduct the experiments in two tanks:- one for normal filtration and other for the wet land units. The waste water is collected and different parameters were tested. The waste water is stored in a tank. Then it allowed to both units from one inlet. The treated water from the outlets are collected and again the parameters are tested after 5 days intervals. Then analyse the efficiency of treatement in normal filtration and wetland unit and compare with standard water quality.

STAGE 1 – COLLECTION OF MATERIALS AND SAMPLES

Wet lands constructions are usually done using phreatic austrials plant species, which use waste contents in water as nutrints for growth. We choose vetiver plant belongs to this category .Miscellaneous items such as treatment tank, taps etc are collected.

The Waste water is collected from fish processing unit at sakthikulangara. Soil is collected from marshy area (paravoor lake shore).

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STAGE 2 -

TESTING OF THE

PARAMETERS

Fig 1: setting up of the treatment unit.

Parameter	Obtained value
PH	7.22
Chloride	622.5 ppm
Hardness	380 ppm
DO	1.13 ppm
BOD	158 ppm
COD	718.2 ppm
Electrical condutivity	3.4 ms/cm

Table 1: concentration of parameters before treatment.

STAGE 3 - SETTING UP OF THE UNIT

Soil bed is prepared in 2 tanks, one is for the cultivation of plant and other is for normal filtration. Then the plant is cultivated in the wetland unit.

Then waste water is supplied to the sedimentation tank and constructed wetland unit through same inlet. The tap

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of the both unit are kept closed. At 5 days interval the treated waste water is collected and parameters are tested.

STAGE -4 MONITORING OF TREATEMENT UNIT

The treatment unit is daily inspected. The storage tank is stirred well in order to avoid the sedimentation. The plant in the wet land is monitored.

STAGE -5 TESTING OF SAMPLE AFTER TREATEMENT

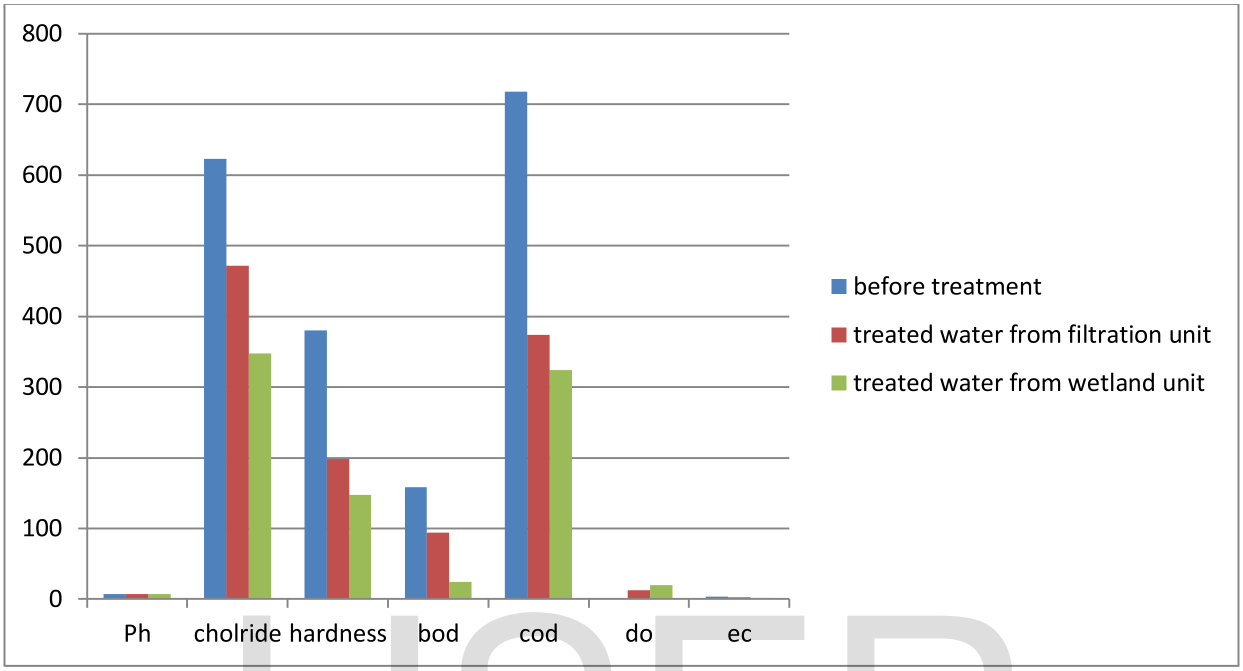
	parameter						
date	pH	CHLORIDE	HARDNESS	BOD	COD	DO	E C (ms)
3/3/016	7.2	583.71	347.56	145.32	646.03	1.44	3.36
8/3/16	7.15	531.82	285.63	139.01	588.61	1.59	3.29
13/3/16	7.14	468.03	236.19	110.11	499.42	6.1	2.98
18/3/16	7.09	392.18	194.37	73.11	384.73	12.31	2.67
23/3/16	6.93	348.02	147.46	24.38	324.23	20.17	2.2

Table 2: concentration of parameters of treated water from wetland unit

	Parameters						
Date	pH	CHLORIDE (ppm)	HARDNESS (ppm)	BOD (ppm)	COD (ppm)	DO (ppm)	E C (ms)
3/3/016	7.21	618.47	369.14	150.21	692.01	2.86	3.38
8/3/16	7.19	584.29	341.96	141.14	531.44	4.13	3.12
13/3/16	7.18	562.43	278.12	130.05	486.76	6.99	3.09
18/3/16	7.13	514.67	224.03	119.43	423.68	9.13	2.84
23/3/16	7.09	471.85	198	94.32	374.12	12.46	2.6

Table 3: concentration of parameters of treated water from filtration unit.

3. ANALYSIS OF RESULT



Graph 1: variation of concentration of parameters

The concentration of the parameters of the treated water from the wetland unit is much lower than the filtration unit.

3.1 EXPERIMENTAL RESULT

Our project work duration is only about 25 days. During these short intervals, when the obtained values are compared with standard values these are very close to each other. Hence the wetland unit advances a new technical treatment system with high efficiency.

4. CONCLUSION

The use of constructed wetlands to treat wastewater is relatively new technology. However the impressive results achieved thus far have prompted great expectations about the technology and what it can achieve. The wetlands can be used in a sustainable manner, by defining a clear design objective for the wetland system to achieve its ultimate goal and close monitoring to assess the performance of the wetlands and to ensure all objectives are fulfilled.

Wetlands can be considered a pioneer venture in constructed wetland treatment system. Most of the constructed wetland design is derived from Putrajaya Wetlands. It is a good example of a water filtration system for water resource management with environmental enhancements. The system creates an aesthetic environment for both leisure and eco-tourism purposes, and serves as habitats for native flora and fauna.

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