Application of Floating Rafter and Wetland System

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Abstract— Floating Treatment Wetlands (FTWs) are an innovative variant of the more traditional constructed wetland and pond technologies that offer great potential for treatment of urban storm waters .This case study provides are view of the FTW concept, structure and function, and discusses some of the potential advantages of this emerging technology for stormwater applications. FTWs are a hybrid between a pond and a wetland they behave hydraulically similar to a stormwater detention pond, whilst imparting similar treatment processes to that of a wetland.

Keywords: Floating, Treatment, Wetlands, Rafter, FTWS, Strom Water, Emerging Technology

I. INTRODUCTION

A. Floating Rafter

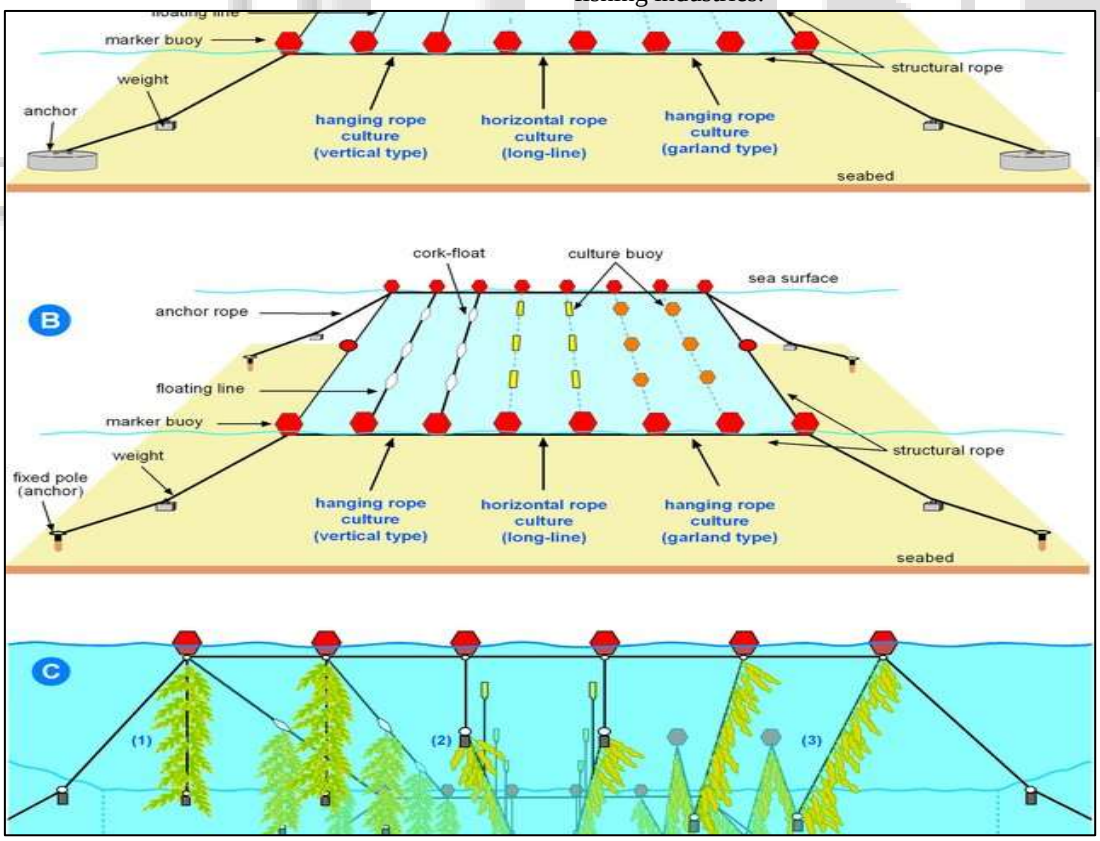
The rafters are wetland plants which float continuously on a water body. As the nutrients from the sewage get absorbed, excessive growth of plants and algae in the lake can be prevented. Both the technologies have successfully managed to purify the lake's water. a marsh of vascular vegetation having a significant mat of live and dead roots, peat and detritus, that floats over a layer of free water. The marsh mat is compact and thick enough to support the weight of a person and, because it floats, is only rarely, if ever, inundated.

B. Wetland

Wetland is a land that is saturated with water, either permanently or seasonally, such that it takes on the charateristics of a district ecosystem.

C. Why wetland are important?

Wetlands are a critical part of our natural environment. They protect our shores from wave action, reduce the impacts of floods, absorb pollutants and improve water quality. They provide habitat for animals and plants and many contain a wide diversity of life, supporting plants and animals that are found nowhere else. Wetlands provide an important range of environmental, social and economic services. Many wetlands are areas of great natural beauty and many are important to Aboriginal and Torres Strait Islander people. Wetlands also provide important benefits for industry. For example, they form nurseries for fish and other freshwater and marine life and are critical to Australia's commercial and recreational fishing industries.



D. Wetlands are distributed in two types:

Fig. 1.4.1: Natural wetland

Fig. 1.4.2: Constructed wetland

Natural wetlands are ecosystems that are either permanently or seasonally saturated in water, creating habitats for aquatic plants and conditions that promote the development of hydric (wetland) soils. There are various types of wetlands, including: marshes, swamps, forested wetlands, bogs, and wet meadows, as well as coastal wetlands such as mangroves. The ability of wetlands to retain large volumes of water, which they release slowly, makes them important for combatting extreme weather conditions such as flood control and drought mitigation, that occur more frequently as a result of climate change. Additionally, wetlands contribute to water purification, water regulation, biodiversity, aesthetics and recreation.

Constructed wetland are an appropriate technology for small communities in rural and suburban areas. Many rural projects with activated sludge plants failed because it was not properly operated, often no skilled stuff is available or the energy costs is no longer affordable. Constructed wetlands are principally using the same natural degradation processes and nutrient uptake but they are acting as extensive systems.

E. Simple in construction, operation and maintenance

- Low operation and maintenance costs (low energy demand)
- High ability to tolerate fluctuations in flow
- High process stability
- Aesthetic appearance

II. PLAN OF WORK

A. Selection of site for floating raft wastewater system:

We select Nalasopara constructed wetland as a site for study. Study that we done:

According to Mumbai's municipal corporation, an average resident of Mumbai uses 135 litres of water every day. The research plant currently treats, without chemicals and electricity.At a time when the state is dealing with severe water crisis, a professor from the Indian Institute of Technology Bombay and his team of students have created a wetland at the institute's Powai campus that processes approximately 30,000 litres of sewage per day and converts it in to re-usable water.

The project, called the Constructed Wetland plan, started functioning in November 2013 and is an idea from professor Shyam Asolekar from the Centre for Environmental Science & Engineering and his research team comprising of PhD and MTech students and research engineers, Dinesh Kumar, Rahul Sutar, Dheeraj Kumar, Ketan Kamble and Anurag Singh and advised by Yogen Parikh.

"A constructed wetland bed is a natural treatment system that does not need energy or chemicals to clean wastewater. It traps the foul odour below the wetland bed and treats sewage through a continuous biotechnological process once the wastewater is released into the wetland bed."

Fig. 2.1.1: Nalasopara Constructed wetland.

B. Study on preparation of floating raft:

Bamboo/PVC pipe, coconut coir, and polyethylene mess may use to develop low cost eco-friendly floating rafts. Open textured coarse peat/soil or coconut coir materials that do not become too heavy or anaerobic once saturated are likely to be the most suitable growth media for plant establishment on floating raft. Floating rafts constructed using lengths of large diameter bamboo interwoven or other materials with mats of natural fiber (coconut coir). "The articulated nature of the bamboo means that it contains sealed chambers of air throughout the stem which is naturally buoyant". Plant roots and rhizomes can spread and grow through the matrix (coconut coir/peat), with their roots extending down into the water below. The matrix would also be incorporate with various plant growth media and potentially also reactive/absorptive media (e.g., zeolites or P-absorbing

materials) to enhance contaminants removal efficiency of the system.

C. Study of aquatic plants:

Water hyacinth (Eichhornia crassipes), duckweed (Lemna) and water fern (Azolla) store iron and copper commonly found in wastewater, these plants also reduce pathogens. Many fast-growing plants rooted in the soils of wetlands such as cattail (Typha) and reed (Phragmites) also aid in the role of heavy metal up-take.

Plants that are adapted to moist and humid conditions (such as those found in wetlands) are called hydrophytes.

- Cattails
- water lilies
- Bulltongue
- sedges
- Tamarisk

Wetland plants are adapted to the saturated conditions that persist for a majority of the year. The different vegetation types in a wetland can be divided up into emergents, floating, and submerged plants.

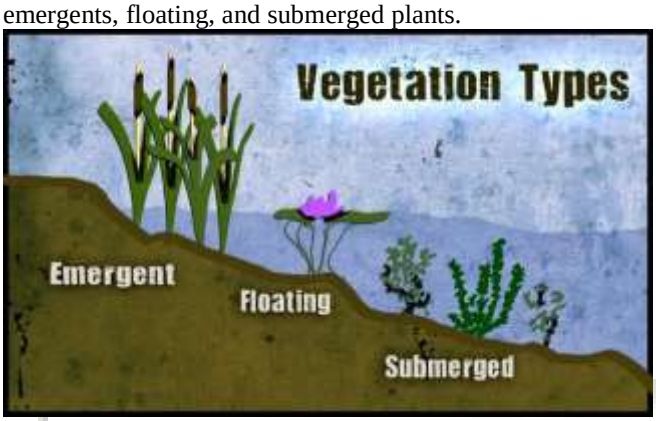


Fig. 2.3: Vegetation Types

D. Study of Phyteromediation process :

Phytoremediation is a bioremediation process that uses various types of plants to remove, transfer, stabilize, and/or destroy contaminants in the soil and groundwater. ... In this process, the plant releases natural substances through its roots, supplying nutrients to microorganisms in the soil.

There are a number of phytoremediation strategies that are applicable for the remediation of heavy metal-contaminated soils, including

1) Phytostabilization—using plants to reduce heavy metal bioavailability in soil
2) Phytoextraction—using plants to extract and remove heavy metals from soil
3) Phytovolatilization—using plants to absorb heavy metal from soil and release into the atmosphere as volatile compounds
4) Phytofiltration—using hydroponically cultured plants to absorb or adsorb heavy metal ions from groundwater and aqueous waste

E. Removal mechanism:

1) Removal of organics:

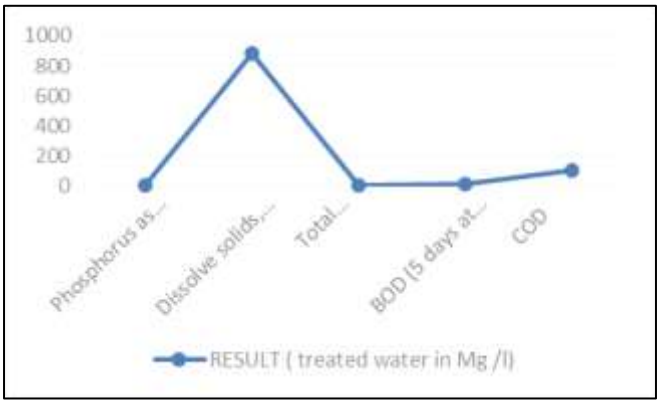
Constructed wetland have a strong ability to purify the organic matter, the soil have a huge surface area, the surface of the soil particles can form a layer of biofilm, when sewage flows through the surface of the particles, a large amount of SS is blocking interception by the filler and plant roots, the insoluble organic matter also to be retained soon through wetland matrix sedimentation, filtration, adsorption, then the tiny creatures will use the organic matter, the dissolved organic matter was removed by adsorption of plant roots biofilm, absorption and metabolism of microorganisms. In the aerobic zone, the organic matter is decomposed into carbon dioxide and water by aerobic bacteria; in the anaerobic zone, organic matter is decomposed into carbon dioxide and methane by anaerobic bacteria with fermentation.

III. RESULT AND DISCUSSION

According to case study this is result of Treated waste water.

PARAMETER	RESULT (Sewage water in mg/l)	RESULT (treated water in Mg /l)	PRPTOCOL	Standard Limits as KSPCB
Phosphorus as PO4, mg/l	0.09	0.03	IS-3025	0.1
Dissolve solids, mg/l	700	885	IS-3025 part -16	2100
Total suspended solid	20	Nil	IS-3025 part-17	30
BOD (5 days at 200)	28.5	9.85	IS-3025 part-44	10
COD	220	100	IS-3025 part-58	250

Table 1: Final Result



Graph 1: Result of Treated Water

The wastewater samples were analyzed in accordance to APHA 21st edition. The samples were studied for various parameters and the reduction percentages were noted down. The variation of the various parameters with respect to time are plotted in the Graphs. The analysis was carried out for the three types of wastewater and similar reduction percentages for the various parameters were observed. The preliminary studies revealed that water collected from outlet zone can be utilized for various purposes like irrigating fields, all domestic purposes except for drinking.

IV. Future Scope of Study

- Wetlands ensure fresh water for all of us
- Wetlands purify and filter harmful waste from water
- Wetlands feed humanity
- Wetlands are bursting with biodiversity

V. Conclusion

Floating raft technology is very easy to install in the village/urban/industrial wastewater pond or river perennially receiving wastewater for their reclamation. It is cost effective and ecofriendly in nature because does not require much maintenance and initial inputs. The output of flowers and value added products from selected plants may lead to additional income source from this wastewater treatment system. Constructed wetland have a great potential for industrial and municipal wastewater treatment with careful design and planning. They test the quality of treated waste water by using constructed wetlands for other beneficial uses (recycling of treated waste water)

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