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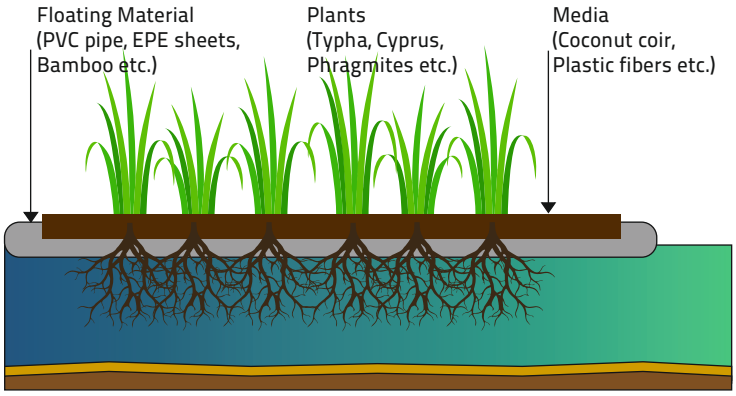
In situ Performance of Floating Treatment Wetlands for Water Quality Improvement

INTRODUCTION TO FLOATING TREATMENT WETLANDS

Floating Treatment Wetlands (FTWs) are natural water treatment systems, which are used in waterbodies for reduction of organics, nutrients and other contaminants. As urban wastewater is often discharged into waterbodies, FTWs can play an important role in reducing the impact of waterbody pollution. In India, FTWs have been installed in several waterbodies. Such as, Neknampur lake (Hyderabad), Mahadevapura lake (Bengaluru), Hebbagodi lake (Bengaluru) etc.

Treatment Mechanisms

- Nutrient uptake by plants
- Biological degradation by bacteria, which will develop on plant roots and media



Advantages of FTWs

- FTWs don't require additional land for treatment
- FTWs enhance the aesthetic value of a waterbody
- FTWs support biodiversity and enhance the ecological characteristics of a waterbody

Limitations of FTWs

- As FTWs are freely suspended in a waterbody, it is difficult to access them for maintenance
- Anchoring of FTWs can be challenging
- Frequent harvesting of plants is necessary to maintain treatment effectiveness and structural stability of the wetlands. Often, FTWs (especially pipe-based systems) are prone to damages and tend to sink.


Floating material frame


Packaging of media


Floating Island

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Survey No.205 ,Opp. Beedi Workers Colony, Kommaghatta Road, Bandemath, Kengeri Satellite Town, Bengaluru, Karnataka 560 060
P : +91 80 2848 6700/ 2194/ 2274/ 2262 | F : +91 80 2848 2144 |
E : bangalore@cddindia.org

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Testing FTW Performance in situ


Maintenance of FTWs

A FTW set-up was established at the Bharat Electronics Limited (BEL) campus in Bengaluru in order to assess FTW performance and compare treatment efficiency of different media such as rice straw, coconut coir and plastic fibres. The size and scale were designed to mimic the natural field conditions thereby ensuring control over the system and better relevance of data. A square-shaped floating island of 4 m^2 was installed in a pond of 28 m^3 water volume. Here, the water inflow was 3.8 m^3/day, which provides a Hydraulic Retention Time of 7 days. Wastewater sampling was conducted frequently and results were derived. Treatment mechanisms provided by the waterbody alone (e.g. sedimentation) were measured using a control pond (a pond without a FTW). Percentage removal is given by $(C_0 - C_i) / C_0$, where C_0 is the influent concentration and C_i is the effluent concentration.

Parameter	Percentage Removal			Comparison with Literature
	By FI	By Waterbody	Total	
COD (Chemical Oxygen Demand)	18%	44%	62%	67%
BOD (Biochemical Oxygen Demand)	14%	66%	80%	65%
Phospate (Po_4 - P)	12%	38%	50%	55%
Nitrate (No_3 - N)	22%	-	22%	35%
Ammonia (NH_4 - N)	-	77%	77%	55%

(Billore & Sharma (2009) , India Nichols et al. (2016), Switzerland

Key Findings

- FTWs provide an additional removal efficiency of ~15% for retention time of 7 days and temperature of 28^{0}C.
- Plant uptake and creation of anoxic zone by FTW, leads to nitrate removal, which was observed as 22%. This is an important finding as nitrate nitrogen removal is difficult to achieve in conventional treatment systems.
- In terms of media material, rice straw provides better efficiency compared to coconut coir and plastic fibres.


FTW research set-up at BEL Campus, Bengaluru