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ARTIFICIAL FLOATING ISLAND SOLUTION TO RIVER WATER POLLUTION IN ERODE DISTRICT

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ABSTRACT

Water is one of the primary sources for the existence of life on the earth. But we are neglecting the importance of quality in water and thereby polluting it for ages. To preserve the quality of water and to enable the aquatic life we must treat the waste water before letting them into the resources. Out of natural and artificial resources for the treatment of polluted river water, we can use the natural resources these by preserving the economic resources of the country. Cauvery is one of the major rivers in South India and is being polluted abnormally due to dyeing industries, paper industries, discharge of drainages etc., Thus, Artificial Floating Island Technique can be effectively used to reduce the organic and inorganic pollutants in river water and also to enhance the growth of aquatic ecosystem.

KEYWORDS: Water, Primary Source, Artificial Floating Island, Organic and Inorganic Pollutant

INTRODUCTION

Water is essential for life. No living being on the planet can survive without it [1]. But world is facing many tribulations related to waste water treatment and India being the second most populated country in the world, it fighting with water pollutants for ages[2]. Water pollution is a serious problem in India as almost 70 percent of its groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants. In many cases, these resources have been rendered unsafe for human consumption as well for other activities, such as irrigation and industrial needs. This shows that degraded water quality can contribute to water scarcity as it limits its availability for both human use and for ecosystem[3].

Cauvery River originates at Talakavery in the Western Ghats in the state of Karnataka and it flows generally south and east through Karnataka [4]. The Cauvery River is most polluted in Erode District due to sewage disposal. The BOD level has been 38mg/lit which makes the life critical for aquatic arrangement [5]. The planet is facing a 40% shortfall in water supply by 2030, unless we dramatically improve the management of this precious resource [6].

The various chemical industries like dyeing industry, sugar and distilleries are discharging untreated effluents in the river without any treatment. They contain toxic chemicals and heavy metals like copper, zinc, iron, lead and manganese. The heavy metals contaminate the river water along with the hazardous chemicals. These chemicals have impaired the quality of water very much. The effluents are discharged continuously getting accumulated in the river making the water unsuitable for drinking as a result of which the ground water gets highly polluted [7].

Effluents discharged into river Cauvery by dyeing units in pallipalayam are polluting the water released from Mettur Dam to meet the drinking water needs in Erode city. Effluent is getting mixed up with the 1,000 cusecs meant for

drinking purpose, official sources said. Industries, on their part, say the Zero Discharge Plants that the pollution Control Board advocates is quite expensive (The Hindu, Erode, May 6, 2014).

So there is an alternative solution to waste water treatment which would be less expensive. One of such technology is Artificial Floating Islands.

Floating treatment wetlands provide a vast area within this root zone. Within this root zone pollutant- digesting microbes and bacteria bio-remediate waste water that is laiden with the nutrients, heavy metals and suspended solids. The media is open and porous in structure, which enables the plants roots to spread and create a vast activated surface area. This is where the microbes and bacteria live. These adhere to the roots and the microscopic root hairs of the plants and within the fibrous media. The microbes and bacteria secrete sticky extracellular proteins forming bio films. Several physical, chemical and biological processes are involved in the transformation and consumption of plant nutrients within the wetland. The major physical process in wetlands is the settling of suspended particulate matter, which is a major cause of reduction in BOD of the treated waste waters. The chemical processes, which include absorption, chelation, and precipitation, are responsible for the major removal of phosphorous compounds and heavy metals. Among the biological process, the most important are those mediated by micro organisms and they include either oxidation or reduction of carbon, nitrogen, and sulphur, depending on their availability of oxygen [8].

MATERIALS AND METHODS

A. Materials

The following materials are used in this research work

- Sampling Of River Water
- Glass Tank
- Plant
- Floating Bed

Sampling of River Water

The river water is obtained from Cauvery River at BhavaniKattalai barrage-II using grab sampling technique. Grab sampling is what the test material is collected at one time. As such grab sample reflects the performance only at the point in time that the sample is collected. About 85 litres of river water is collected for each glass tank using grab sampling technique.

Glass Tank

Two Glass tanks each of size 0.91x0.304x0.61m is used for growing plant namely Vettiveria zizanioides and water hyacinth. The thickness of the glass tank is 8mm and is filled with 0.304m of river.

Plant

The vegetation is of plant Vettiveria zizanioides. The plant Vettiveria zizanioides is commonly known as Vettiver and belongs to species of c. zizanioides. It is a perennial bunch grass of the Poaceae family, native to India. In Western

Ghats and Northern India, it is popularly known as Khus. It is suitable for light (sandy), medium (loamy) and heavy (clay) soils. It grows well in acid, neutral and basic (alkaline) soils. It prefers moist soils.

Eichhornia Crassipes, commonly known as Water Hyacinth, is an aquatic plant native to the Amazon basin. Water hyacinth is often problematic in man-made ponds of uncontrolled, but an also provide a food source for gold fish, keep water clean [9] [10] and help to provide oxygen to man-made ponds. Water Hyacinth is used for various purposes such as medicine, bio herbicidal agent, vegetable, waste water treatment and bio energy.

Figure 1: Installation of Artificial Floating Island

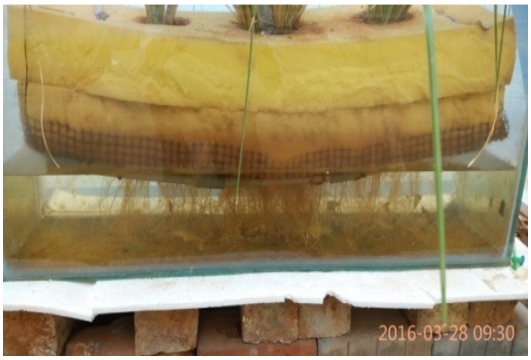

Figure 2: Development of Roots after the Installation of AFI Technique

B. Methods

The experiment was carried out to detect the characteristics of river water according to Indian standards. The initial test was carried out before the installation of AFI technique and after its installation successive test was conducted after second, fourth and sixth week respectively.

RESULTS AND DISCUSSIONS

An initial experiment was conducted to determine the characteristics of river water to compare the absorption efficiency of the two hydrophonic plants and the values are listed in the table 1.

Table 1: Characteristics of River Water Sample

Parameters	Initial Values
pH	9.8
BOD (mg/l)	8.9
Nitrate (mg/l)	29
Phosphate (mg/l)	2.9
Ammonia (mg/l)	1.3
TDS (mg/l)	1250

Effects on Stabilization of pH by Hydrophonic Plants

pH is one of the important factors which determines the presence of aquatic ecosystem. The pre-treatment analysis indicates that the river water is harmful to aquatic system. From the figure 3. It is seen that the stabilising effect of Vettiveria zizanioides increases from 4.08% to 20.41% with increase in retention period of two to six weeks while the Eichhornia Crassipes increases from 4.08% to 17.3%. This revealed that the growth of root hairs in Vettiveria zizanioides would directly influence the pH in the river water system.

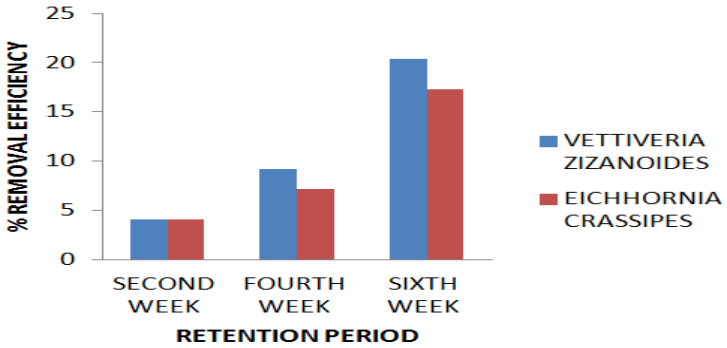

Figure 3: Effects of pH in River Water by Hydrophonic Plants for Different Retention Periods

Effects of BOD in River Water by Hydrophonic Plants

BOD (Bio chemical Oxygen Demand) was used to access the quality of river water system. BOD value of 8.9mg/l depicts that the river contains some amount of sewage. Vettiveria zizanioides readily reduce the oxygen demand to 4.6mg/l than the Eichhornia Crassipes of 6.1mg/l. Aquatic organisms would be able survive up to 5mg/l and use of Vettiveria zizanioides in treatment would enhance the aquatic life.

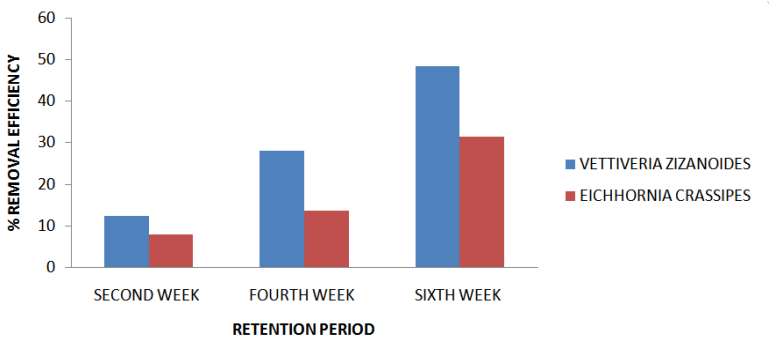

Figure 4: Effects of BOD in River Water by Hydrophonic Plants for Different Retention Periods

Effects of Nitrate in River Water by Hydrophonic Plants

Analysis carried out on pre-treatment sample shows that the total nitrate in river water was 29mg/l. This was due to use to artificial fertilizers for agricultural purposes. After the installation of Artificial Floating Islandtechnique de-nitrification process takes place. After a retention period of six weeks the removal efficiency of Vettiveria zizanioides and Eichhornia Crassipes is found to be 68.97% and 48.27%. This analysis reveals that the plant Vettiveria zizanioides has more de-nitrifying effect than the compared one.

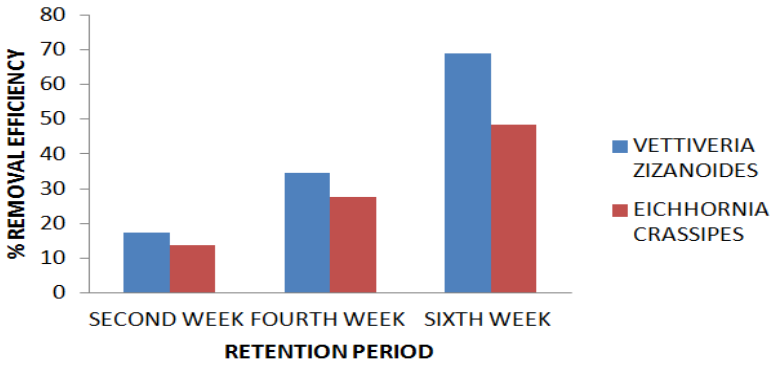

Figure 5: Effects of Nitrate in River Water by Hydrophonic Plants for Different Retention Periods

Effects of Phosphate in River Water by Hydrophonic Plants

Figure. 6 depicted that the removal efficiency of plant Vettiveria zizanioides in river water is 55.17% than the water hyacinth of 48.28%.The absorption effect of second and fourth week is found to be 10.35% and 27.58% and of Eichhornia Crassipes is 6.89% and 24.13%. These results show that the absorbing effect increases as the root system develops.

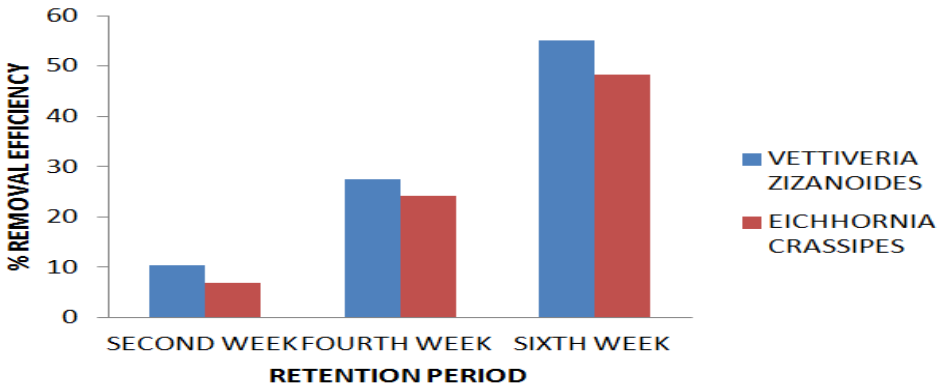

Figure 6: Effects of Phosphate in River Water by Hydrophonic Plants for Different Retention Periods

Effects of Ammonia in River Water by Hydrophonic Plants

Analysis carried out on sample river water shows that the value was found to be 1.3mg/l which was further reduced to 0.6mg/l and 0.7mg/l by the plants Vettiveria zizanioides and Eichhornia Crassipes on further treatment for the retention period of 6 weeks.

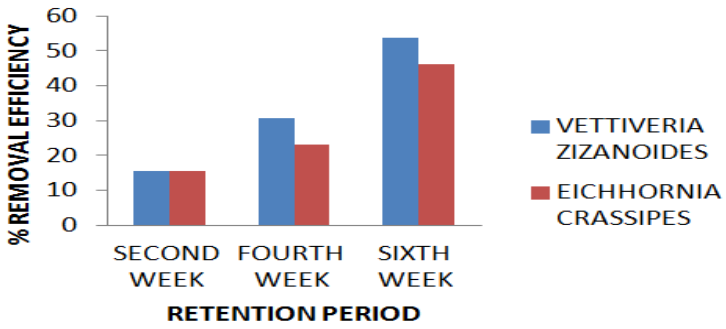

Figure 7: Effects of Ammonia in River Water by Hydrophonic Plants for Different Retention Periods

Effects of TDS in River Water by Hydrophonic Plants

TDS is total amount of dissolved solids in river water. Analysis reveals that the TDS was reduced from 1250mg/l to 743mg/l by Vettiveria zizanioides and 987mg/l by Eichhornia Crassipes.

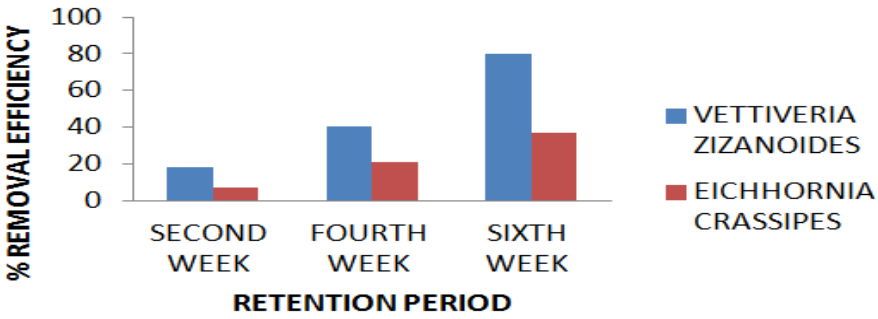

Figure 8: Effects of TDS in River Water by Hydrophonic Plants for Different Retention Periods

CONCLUSIONS

Thus the Artificial Floating Island technique can be installed to reduce the pH, BOD, phosphate, nitrate, ammonia and TDS in Cauvery river using the plant Vettiveria zizanioides. From the above details it is evident that the plant Vettiveria zizanioides is more efficient in absorbing the nutrients than the other one and the same can be used in AFI techniques. Thus the ecology of the Cauvery river can be returned to its original form by using this method.

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