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# Onsite Treatment of Urban Waste Water using Eco Bio-Blocks

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***Abstract***

*Water is a limiting resource. The pressure exerted on surface and groundwater resources should be reduced or best maintained as the human population and industrial development increase; water recycling and reuse are thus of increasing importance in cities and contaminated environments. Wastewater reuse is a long-established practice used for irrigation, especially in arid countries. In Countries like India, disposal of wastewater is not correctly organized, and there is no stringent rule for eliminating or minimizing the ill effects of the disposal of wastewater into rivers. The study is to access the reuse options of the wastewater, which is stagnated in the regulator in Madurai, which is "Viraganoor regulator" and accessing feasibilities of adapting cost-effective treatment technologies like Bioremediation, widely applying Eco Bio-Blocks for the treatment of urban wastewater is explored in the study.*

**Keywords –** *Bioremediation, Eco Bio-Blocks*

## I. INTRODUCTION

Domestic wastewater is a valuable source of water and nutrients. Besides enhancing food security, water reuse for agriculture can ensure improved nutrition. Bioremediation is one of the natural processes that involve the use of biological entities to neutralize the contaminated site. Bioremediation is a "treatment that uses naturally occurring organisms to break down a hazardous substance into less toxic or non-toxic substances.

## II. RESEARCH OBJECTIVES

Urban wastewater is discharged in the river stretch is stagnated in the downstream side of river Vaigai in a suburban area. This wastewater pollutes the air, soil, and groundwater of the study area. In the meantime, treated wastewater needs an agricultural purpose, and the people doing irrigation practices are ready to accept the treated wastewater from the urban areas. Economically it is not viable to install a conventional wastewater treatment plant, hence a technology that consumes minimum energy and minimum investment, a sustainable treatment system is required. So a strategy of adapting Bioremediation is explored in this study. Viraganoor regulator is constructed across the Vaigai river at the outskirt of Madurai city nearby the Viraganoor ring road. This regulator is 8Km away from the city.

Various possibilities are there to use the reclaimed water for agricultural purposes on the downstream side of the regulator. Canals from the regulator are designed in such a way that supplying water for irrigation through small tanks.

## III. STUDY AREA

Viraganoor regulator is constructed across the Vaigai river at the outskirt of Madurai city nearby the Viraganoor ring road. This regulator is 8Km away from the city, constructed during 1971-1975.

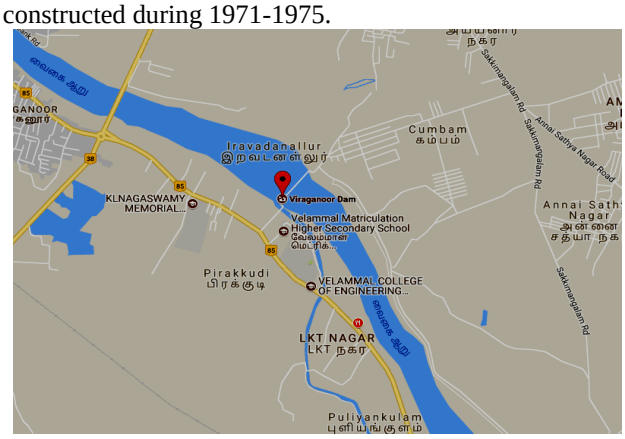



**Fig.3.1: Study area (Viraganoor regulator)**

The total length of the Vaigai river is 258Km; from its origin point, Madurai is the large city in which the river contributes more than its 50Km. Meantime river receives wastewater throughout its length in the city; residents across the bank of the river and the commercial buildings in the city discharges the wastewater into the river directly.

## IV. ECO BIO-BLOCKS

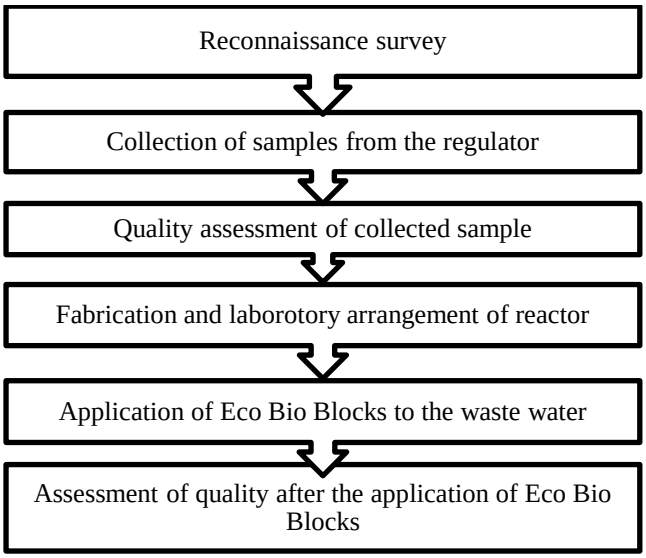
Eco-Bio blocks are made of mineral-rich, porous natural volcanic rock, in the aquarium products which more quickly and efficiently absorbs pollutants and stabilizes their structure, making it easy for the bacteria to break down organic waste), special cement, nutrients for the bacteria, and beneficial bacteria sealed in a life and prop gable state. When EBB bacteria come in contact with water, they immediately propagate, releasing millions of EBB bacteria that multiply every half hour. The beneficial bacteria then degrade organic matter. Since the microbes are necessary to degrade pollution load in sewage treatment plants, These Eco Bio-Blocks plays an essential role in generating microbes continuously when immersed in water so that adding microbes daily is not required.

## V. METHODOLOGY

### *A. Introduction*

Based on the various literature studied, the suitable least expensive technology to be adopted is the application of EBB to the wastewater. Eco Bio-Block

emulates the natural purification mechanism. The delicate natural balance must be maintained so that no species can overwhelm the ecological system. Eco Bio-block uses nature's natural purification process to renew and revitalize the environment.




***B. Reconnaissance Survey***

A reconnaissance survey for examining all or part of the study area accomplished in sufficient detail to make generalizations about the type and extent of contamination present and distributions of properties that may be present within the study area was carried out. It is a type of field survey that is often used to gather initial information regarding the presence or absence of historic properties within the study area. To assess the feasibility of reclaiming the wastewater in the regulator field visit was carried out, from which facilitating self-purification to the stagnated water was found to be a suitable process to be adopted in the study area.

***C. Sampling Procedure***

Two types of sampling procedures, as per the guidance manual (GUIDE MANUAL: WATER AND WASTEWATER ANALYSIS), were provided by the Central pollution control board of India.

- Grab sampling
- Composite sampling

The procedure followed for collecting the sample was the Grab sampling technique. A sample of wastewater was collected at the inlet of the regulator from the stream of wastewater, which is flowing into the regulator through the sluice.

***D. Fabrication And Arrangement Of Reactor In The Laboratory***

Primarily to apply Eco Bio-Blocks to the wastewater in the laboratory scale, a reactor was fabricated, it was selected on the basis that, to simulate the field conditions of the regulator.

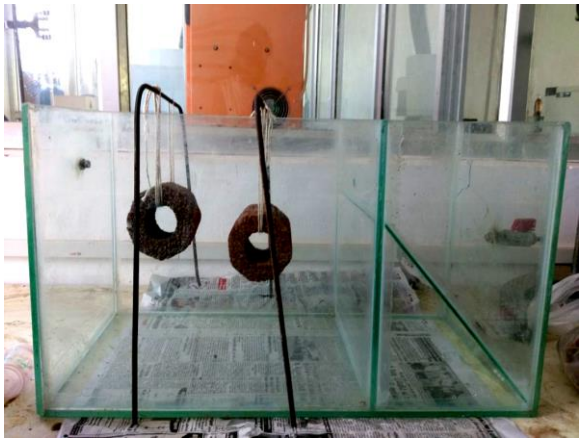


**Fig no.5.1: Arrangement of Eco Bio-blocks in the reactor**

To perform the experiment, 35 liters of wastewater were feed into the reactor for two numbers of Eco Bio-blocks, and aeration was provided continuously to the reactor. Before applying Eco Bio-block into the wastewater quality of the wastewater was identified for the significant parameters.

Wastewater, which is collected from the regulator, was feed into the reactor, and aeration was provided. Aeration is when air is circulated through, mixed with, or dissolved in a liquid or substance. Aerators are designed to create more significant contact between air and water to enhance the transfer of gases and increase oxidation. To facilitate aeration throughout the reactor, supply pipes are arranged in such a way to ensure sufficient aeration.

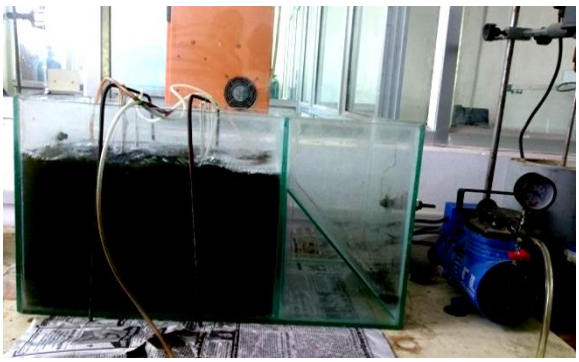


**Fig no.5.2: Wastewater treatment in the reactor**

Eco Bio-blocks are inoculated with dormant microbes which are active when gets contacted with wastewater. To provide proper treatment, aeration is required for the microbes to survive. Aeration removes odor and tastes due to volatile gases like hydrogen sulfide and algae and related organisms. Aeration also oxidizes iron and manganese, increases dissolved oxygen content in water, removes CO2, reduces corrosion, and removes methane and other flammable gases. The principle of treatment underlines that volatile gases in water escape into the atmosphere from the air-water interface, and atmospheric oxygen takes their place in water, provided the water body can expose itself over a vast surface to the atmosphere. This process continues until equilibrium is reached, depending on the partial pressure of each specific gas in the atmosphere.

### *E. Quality Assessment Of Waste Water*

To assess the quality of the wastewater from the study area, the sample was collected to test the wastewater for specific parameters. The quality of the sample collected was tested for

1. pH
2. Turbidity
3. Dissolved oxygen
4. Biochemical oxygen demand (BOD)
5. Chemical oxygen demand (COD)

The quality of the collected samples before and after the application of Eco Bio-Blocks are discussed in Chapter 6.

## VI. RESULTS

### *A. Characteristics of the sample*

As mentioned in the previous chapters, wastewater from the regulator is tested for the following parameters following results show the quality of wastewater before applying the Eco Bio-Blocks.

| | | |
|---|---|---|
| pH | - | 9.7 |
| Turbidity | - | 53.4 NTU |
| Dissolved oxygen | - | Nil |
| BOD5 | - | 153 mg/L |
| COD | - | 294 mg/L |

Obtained values are compared with the standards (Standards as provided in Tamil Nadu pollution control board manual (2013) Discharge standards for sewage pg no: 16), which does not satisfy the standards.

### *B. Characteristics of Sample*

The reactor was set to be operated continuously for fourteen days, and the quality assessment was carried out on the odd days throughout the operation. It is found that there is a significant reduction in the parameters, which are expected to be reduced after the treatment.

**Table No: 6.1 Quality of waste water after applying EBB**

| Day | pH | Turbidity (NTU) | DO (mg/L) | BOD3 (mg/L) | COD (mg/L) |
|---|---|---|---|---|---|
| **1** | **8.57** | **120.5** | **0.2** | **183** | **294** |
| **3** | **8.4** | **119** | **0.3** | **160** | **280** |
| **5** | **8.37** | **89** | **0.3** | **80** | **170** |
| **7** | **7.30** | **87** | **0.5** | **68** | **103** |
| **9** | **6.85** | **70** | **1.2** | **68** | **102** |
| **11** | **6.85** | **54** | **1.5** | **42** | **98** |
| **13** | **6.78** | **20** | **1.5** | **20** | **48** |

## VII. CONCLUSION

Results obtained are expected to meet the standards after the application of Eco Bio-Blocks in the reactor, and the parameters are all discussed below

### *A. pH*

The pH varies from 6.5 to 7.5 before treatment, and the same for after treatment; it was found as 7.3 to 7.5, which shows no significant change in pH due to EBB treatment, and it meets the effluent discharge standard.

### *B. Turbidity*

The TSS value varies from 110-20 NTU before treatment, and the same after treatment was found to be considerably reduced to 34 found in the range of 49.2 to 88.1 %, which shows a significant reduction in turbidity due to EBB treatment. Almost all the time, turbidity values meet the standard except in initial time, which may be partial, incomplete acclimatization of EBB blocks.

### *C. Chemical Oxygen Demand (COD)*

The COD value varies from 294 to 153 mg/l before treatment, and the same after treatment was observed in the range of 115 to 48 mg/l. The percentage reduction was found in the range of 36.7 to 57.8 %. Almost all the time, COD values meet the effluent discharge standard of 250 mg/l except in the initial time, which may arise due to incomplete acclimatization of EBB blocks.

### *D. Biochemical Oxygen Demand (BOD)*

The BOD value varies from 132 to 209 mg/l before treatment, and the same after treatment was reduced in the range of 63 to 127 mg/l. The percentage reduction was found from 28.7 to a maximum of 64.6 %. The BOD values after 14 days and beyond (after installation of EBB in the drain) were found to be in the range of 63 to 74 mg/l, which although exceeds the effluent discharge of 30 mg/l BOD when discharged into a drain or other receiving water bodies, it is within the standard limit of 100 mg/l when effluent is to be used for irrigation purpose. The increasing trend of % reduction for Turbidity, COD, and BOD regarding the time after acclimatization is depicted.

## VIII. FUTURE SUGGESTIONS

The quantity of wastewater that is being discharged from the regulator through the left central canal is measured using the discharge chart calculations provided by the personnel of the Viraganoor regulator.

| | |
|---|---|
| Length of the canal | : 30.13 km |
| Width | : 10.3 m |
| Depth | : 7.32m |
| Velocity | : 0.10 to 0.24 m/s |
| Flow | : 0.5 $m^3$ /sec (say 1.22 MLD) |

If the water quality is above the value of BOD 200mg/L and there is a significant increase in specific other parameters, the Suggested quantity is,

⇒10 EBB pond use/1000 liters (264 gals)

To Estimate the quantity of EBB pond use,

**The quantity of wastewater discharged/Day is 122328 Litres/Day (Say),** and the **Number of Eco bio blocks required is 1220**

**The estimated cost for the number of Eco bio-Blocks required Rs.1,830,000/-**

There are case studies that have treated wastewater of higher quantity than our study area. By applying the type of EBB required for the canal arrangement, a considerable reduction in the required parameters can be observed. And the treated water fit for irrigation purposes. EBB does not require energy, human resources, and maintenance to perform the cleaning process. There is no operational cost practically, whereas other conventional treatments involve huge operational cost viz. energy, human resources, chemicals. Thus EBB treatment is claimed to be a very cost-effective technology compared to conventional treatment methods.

When the application of EBB into the field conditions makes some constraints expected are, there is a reduction in velocity of water flow due to placement of EBB reactors in the drain and thereby increase in hydraulic retention time, which may lead to settling of suspended solids in the drain. The accumulation of solids, in the long run, may block drain and water flow for which suitable engineering design is to be taken into consideration in such a situation.

Further, it may be noted that provision is to be made to remove floating materials, settable solids at the initial point of the treatment itself. It may be noted that EBB does not require energy, human resources, and maintenance to perform the wastewater treatment process. There is no operational cost practically, whereas other conventional treatment systems involve huge operational cost viz. energy, human resources, chemicals. Since EBB is an online treatment technology, additional large land space is not required, as in conventional methods.

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