International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 6, ISSN No. 2455-2143, Pages 405-408
Published Online October 2022 in IJEAST (http://www.ijeast.com)

COST EFFECTIVE MECHANISM TO TREAT WASTE WATER

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Abstract-**Cost effective mechanism is the treatment of waste water to use treated water further for irrigation purpose and also to increase ground water level. That means, to reduce the concentration of TDS, BOD, COD, DO of waste water. Waste water includes plastic, sludge, and solid waste which directly and indirectly affect human health, underground water, and agriculture. In primary treatment, Screens are used for separating the solid waste and sludge flowing with waste water. We can use this separated sludge as a fertilizer for agriculture purpose. Purification of the waste water is done by aeration and sedimentation processes by providing porous bandhara, solid bandhara, & porous gravel filter. In further process a horizontal constructed wetlands are used. Constructed wetlands are shallow extensively vegetated water bodies that use enhanced sedimentation; fine filtration and pollutant absorb process to remove pollutants from waste water.**
This technology is using a natural way to effectively treating the waste water where no external energy is required as well as having low maintenance cost. This method is beneficial in draught areas to increase ground water level.

Keywords: **Root zone technology, constructed wetlands, cost effective mechanism, natural filtration, wastewater treatment, porous bandhara, solid bandhara.**

I. INTRODUCTION

Wastewater treatment is a process used to remove all the contaminants present in the waste water or sewage and treated it to lower the concentration which can be further reused or can be discharged into the river without any harmful attack. The latter we can say is water reuse because treated water can be used for other purposes like gardening or any other purpose.
Wastewater term generally is any water that has been polluted by human use, or we can say used water from domestic, industrial, commercial or agriculture activities, and any sewer in flow or sewer infiltration.
Depending upon the source, wastewater is categorised as below: Grey water and Black water.
Grey water contains water from Showers, baths, washing machines, dishwashers and sinks other than the kitchen sink. And Black water contains water from toilets and kitchen sinks.
The waste water includes solid waste which directly impacts on flow. Other than this waste water itself contains some amount of Phosphorous and nitrogen fats. Oil and grease comes from cooking oils, and body lotions, and pathogens comes from disease causing viruses, and bacteria, and other remaining solids and chemicals comes from chemical and other industries.
'Root Zone' is a scientific term used to treat waste water naturally, with the help of roots of the reed plants. It consists planted filter-beds containing gravel, sand and soil. The Root Zone system uses nature's way of biologically processing domestic waste water& industrial effluents. Because of it is natural process, there is no need of any external energy or any additional input such as chemicals, mechanical pumps or external energy. This results the low cost of construction and almost no maintenance cost.
Wetland system is most important natural method for waste water treatment, but in case of continuous, high discharge and high concentration of waste water the treatment of the waste water alone with wetland system is quite difficult. To solve this problem the modified system is introduced to try to get maximum purification results as per mpcb limits.
With the help of natural aerators, sedimentation tanks and screens we can increase the efficiency of the wetland system to get better results.

A. Need of waste water treatment

Since the implementation of the Clean Water Act, industrial, institutional and commercial entities should improve the quality waste water treatment and then only discharge it, but still some industries are not following this rule.
Some reasons that why waste water treatment is needed are discussed below

1. High concentration of waste water-

The concentration of waste water is so high. It is measured in terms of TDS, BOD, COD, DO. High concentration of waste water should be treated so as to lower the water pollution or use this treated water for irrigation purpose or any other use.

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2. No proper treatment on waste water-
There are lots of treatments for waste water purification, but no proper treatment on waste water is present in which purification may continue without any external energy. There is no cost effective waste water treatment by which total waste water can be treated.

3. High generation rate of waste water-
One man needs 135 litres of water every day. From this 135 litres 80% is converted as a waste water. That means 100 to 110 Litres water is generated as waste water by one human.

4. Effect of waste water on River water.
The waste water of city is directly discharged into the River, so it directly pollutes the river water. So it is necessary to treat waste water.

5. Effect on the soil.
The high concentrated water directly affects the soil, especially agricultural land.

II. OBJECTIVES

- To set up working model.
- To construct natural waste water purification system.
- To construct wetland system for treatment of waste water.
- To design screens to separate solid waste and sludge flowing with water.
- To construct solid and porous bandhara

A. Mechanism

1. Screening: Screening is one of the most important parts in the process which separate the solid waste from the flow. The solid waste coming with flow is separated by screens. If the solid waste is not removed from the flow, it will effect on workability.

2. Porous Bandhara: Porous bandharas is the method of aeration. Porous bandhara is constructed in nalla for aeration purpose. The waste water is passed through porous bandhara and hence it is aerated and the dissolved oxygen is increased in waste water.

This is one of the best economical method by which aeration can be carried out. By arranging the aggregate one on another without application of cement, the porous bandharas is constructed. Pours in between the aggregate completes the aeration.

Fig. 1: Porus Bandhara

3. Solid Bandhara: Solid bandharas is constructed for sedimentation purpose. The bandharas is constructed in cement mortar, so that water can get some sedimentation. The sludge is separated from flow at Solid bandharas. The discharge at wetland also decreased at solid bandharas, so that the workability of wetland system can be increased.

Fig. 2: Solid Bandhara

4. Solid gravel Filter: Porous gravel filter is type of aeration, where the aeration process is completed with the help of gravels gravels spread at bottom of the nalla. The water is passed from this filter and aeration process is completed. This is one more economical aeration system.

This method can be used for low discharge because this method requires low depth of water. In case of low availability of ground, and very small slope of nalla we can use this type of aeration.

Fig. 3: Porus gravel filter

5. Wetland system: This is the most important point in this system. This is natural waste water purification system, where maintenance cost is also less.

Constructed wetland treatment systems use rooted wetland plants, shallow, flooded or saturated soil to provide wastewater treatment.

Constructed wetlands are designed especially for chemical and biological processes of natural wetlands to remove contaminants from the wastewater.

The horizontal wetland system is used in the project. The plants used in wetland system are Canna Lily, Progmates Austriails. The one plant requires 1 to 2 Sq.m. areas in treatment plant.

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Fig. 4: Wetland system

6. Charcoal Filter: Activated Carbon Filter is used to adsorb chlorine, organics, tri-halo methane (THM), taste, odour, and colour from Water & Wastewater.
Activated carbon is the charcoal that has been treated with oxygen which opens the millions of tiny pores in between the carbon atoms. In this technology the Charcoal filter is used in removal of odour of waste water. The charcoal filter is placed at the end of the plant, so as to remove the odour.

Fig. 5: Prototype Model at Institute

B. **Tests**

➢ B.O.D.

- Biochemical Oxygen Demand (BOD) is the amount of dissolved oxygen needed to break down organic material present in water by aerobic biological organisms.
- The BOD test is of two types one is "BOD5". In this method accurate measure of dissolved oxygen at the beginning of day 1 and end of the day5 period is measured. In this process the sample is held in the dark, incubated conditions (i.e., 20°C).
- Another test is taken for three days that's why it is known as "BOD3" at 27°C

➢ D.O.

- DO test measures the concentration of dissolved oxygen in a water or wastewater sample.
- The concentration of DO in a water sample may influenced by temperature, salinity and atmospheric pressure.

➢ C.O.D.

- COD is the most popular alternative test to BOD. This test is for establishing the concentration of organic matter in water samples.
- The COD test is fast as compared to BOD and it takes only few hours to complete, giving it a major advantage.
- COD can test any waste water that may be too toxic and which cannot be tested in BOD test.
- COD carried out using sealed and heated (i.e., closed reflux)vials. The change colour from orange to green is read using a laboratory colorimeter.

➢ T.D.S.

- The term "total solids" is suspended or dissolved in water or wastewater.
- Total solids is the material left in a evaporation dish /paper after evaporation and drying of a water sample in an oven at 103 to 105° C.
- The increase in weight of the dish represents the total solids.

➢ pH

- pH is defined as the negative logarithm of hydrogen activity.
- pH measurement is used in a wide variety environmental monitoring, agriculture, industrial processes, waste water treatment, and so on.
- pH is a measure of the acidity or alkalinity of a solution.
- Acidic solutions is confirmed on greater the concentration of H+
- pH readings range from 0 to 14. Solutions with a higher [H+] than water (pH less than 7) are acidic and solutions with a lower [H+] than water (pH greater than 7) are basic or alkaline.

Table No. 1- Test results on prototype model and comparison with MPCB limits

Name of Test	Results before treatment	Results after treatment	MPCB Limits
pH	7.59	7.05	6.5 – 7.5
BOD	106	68	<100
COD	230	135	<250
TDS	980	970	<2100

III. OBESRVATIONS AND CONCLUSIONS

We have concluded that, the high concentrated waste water which gets directly mixed into the river which pollutes it to a large extent, so in order to reduce the same we have come up with a cost effective design which aids with the improvisation in purity and quality of waste water, thereby reducing the pollution.

- The design gives the effective solution of aerating the water and enriching the oxygen content in the waste water thereby eliminating the solid waste through the screening and settling of silting particles by the provision of solid bandhara.
- The present study proves that the quality of the water during the treatment process improves on high scale which is proved by the reports showing the reduction in BOD, COD, pH, TDS. Thus it shows that the process is effective in treating the waste water.
- By following this design methodology which is cost effective compared to conventional plant. The treated water can be reused by secondary purpose like irrigation, gardening, etc. and can be disposed safely in river.

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