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Decentralized Wastewater Treatment

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Abstract – This System consists of asedimentation tank, two units of anaerobic digester and two units of up-flow filters. Thefinal effluent released from the system is found to be within permissible limits, which further could be used for recreational purposes like gardening, plantation, flushing inbathrooms, W.C, etc. In this study the parameters of waste water such as pH, Turbidity, TS, TSS, TDS, BOD5, COD were observed upto the 1.5 hr of detention period and at theflow rate of 12L/hr. Initially the effluent concentration pH, Turbidity, TS, TSS, TDS,BOD5, COD were 14, 269 NTU, 6900mg/L, 5100mgL, 1800mg/L, 46mg/L, 110mg/Lthe corresponding values after passing the waste water through the system for optimizedconditions were 7, 13NTU, 400mg/L, 320mg/L, 80mg/L, 18mg/L, 43.2mg/Lrespectively.

Keywords: Sedimentation tank, BOD5, COD, flowrate.

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INTRODUCTION

1.1 Background Information

Whenever we discussed about public concern, water is always a key feature. improper management of water resources has an negative effect on economic growth of nation.It is found that only 0.007% ofoceanic water is distributed to the terrestrial area annually. About 30% of water in streams, river and lakes is consumed byman of irrigation (8%), domestic(2%) industrial(4%),thermal(4%),and electrical(12%)utilities. public authorities ignored an efficient wastewater treatment for a long time, and the result is the poor performance of existingtechnologies and the conditions of sanitations facilities. At manyplaces sewage is just drained to surface or groundwater without treating it.Water contamination could occur by several means. Most of them contaminated by water originates from the faces of human, birds and animal. We all know that 80% of thw deseases are caused by the improper sanitation of water so provision of services for the waste watertreatment is essential. To provide 80% savings in terms of providing basic health care ,10% extra investment on wastewater treatment can be expected. It is also found that approx. 6.4 % of Indian GDP is lost due to the improper sanitation of water.In India it is estimated that the loss of $448 million/year in tourism industry. It also has significant effecton wild life and fisheries. Loss of quality of life due to discharge of wastewater directly into water bodies. This experiment will provides an ways to planning and executing decentralized wastewater managementsystems.

1.2 Problem Statement

The domestic wastewater in Amravati flows down from major nalas to the sewagetreatment plant and ultimately discharged into the river nearby, without being taken intothe consideration that this treated wastewater could have been used for the recreationalpurposes. It is seen that use of water for the household activities like flushing, gardeningetc, consumes a bulk amount of water, which is constantly resulting into the stress onwater supply system of the city. In summer a problem of supply shortage of water is acollective effect of ignorance towards efficient system through which this effluent can bereused after proper treatment. Hence providing a solution in form of on-site treatment ofthis wastewater at any institution or any society so as to release stress over centraltreatment plant and reuse of end effluent.

1.3 Project Justification

The need of on-site treatment is being urged to support the existing waste watertreatment plant in Amravati i.e. to play a supportive role to release load during higherdischarge. The proposed 3 stage system is capable of working and to bring down theparameters of waste water within the permissible limits which can be used for theflushing and gardening purpose in the institution or the region for which the system isbeing designed. The foremost important thing is that cost of maintenance and operationwill be considerably low.

LITERATURE REVIEW

2.1 General

Wastewater treatment is a very important process in the industrial world alongside thismore than 97% of water is stored in Oceansand only 3% in freshwater, however less than 1% is available for consumption. As time passed by, population is going to growth for which, government would have to provide useablewater for drinking and other purpose. Use of chemical, physical, and biologicalprocesses to clean wastewater to protect the environment and public health.

The first wastewater treatment attempt was releasing the pollutants into rivers,which were the sources of most water supplies. In 1871 this problem drew the public'sattention to itself when the future King Edward VII caught typhoid fever while staying atin Yorkshire. The reason was traced to bad drainage and his illness resulted inhouse immediate efforts to improve the prevailing sanitary systems and so by the 19th century large cities realized that they must reduce the water pollution which they release into the environment. Sewage systems began to be designed and created after LouisPasteur and his colleagues proved that the bacteria which lived in sewers could causeinfectious diseases. From the early 1990s, sewer systems started to grow but as citiesstarted to develop, less spaces were available for disposal and filtration ,furthermore, theamount of wastewater increased rapidly because of the population growth. This all leadto the change in dimension of treatment facilities today and former designsproved to be insufficient for today's needs in society.

i. The Evacuation of postponed particles and floatable materials.

ii. The treatment of organic elements in the wastewater BOD removal.

iii. The removal of micro-organics which may be the cause of dangerous diseases.

These objectives have been continued into early pollutant removal and reduction

Processes only in better systematic methods. While the older treatment goals are stillvalid, the new ways of treatment have invented and developed significantly and moreobjectives have been injected into the water treatment science.

1.5 Standards by the Central Pollution Control Board

To control the increasing pollution in environment , in India under environmentprotection act ,ministry of environment protection act and forest has laid down somegeneral standard (maximum limits) for discharged of industrial pollutants under thebanner of Central Pollution Control Board and some of its main parameters as shown inTable

2.3 Wastewater Treatment Procedure

2.3.1 Stages of treatment

The processes and operations which were mentioned are being used in different stages of treatment; Preliminary, Secondary and Advanced wastewater treatment which arepursuing different objectives in the treatment process.

2.3.2 Preliminary wastewater treatment

The objective is to remove the large materials which are frequently seen in wastewater. Furthermore, it separates the floating materials which arebeing carried by water flow. Preliminary treatment procedures usually contain gritremoval, coarse screening and comminutor of large objects. In addition this treatmenthelps in removing the greases and oils. This process decreases the wastewaters BOD, byapproximately 15 to 30% and the devices which are being used during this treatment are Grit chamber and comminutor.

- Comminutor: This device consists of a screen to prevent the large materials fromaccessing further into the following treatment processes and some cutters are alsoinstalled after the screen to chop the solids which had made it through the screen.

- Grit chamber: its objective is to remove the oils and semi-liquid elements. Thereare two kinds of Grit chamber; Aerated and Vortex.

2.3.2.1 Primary wastewater treatment

The objective is to remove solid components of wastewater by sedimentation; these components can be organic elements such as, phosphorus, nitrogen, and metalsconnected to solid components. On the other hand, colloidal and dissolved elements willremain and not be affected. The waste from primary sedimentation units is known asprimary effluent and the wastes which have been produced by this process is called Primary effluent. The devices which are being used in primary treatment areSedimentation tank and clarifiers and anaerobic baffle reactor.

Sr. No.	Characteristics	Values
1	pH	5.5-9
2	BOD_5	20mg/L
3	COD	250mg/L
4	TSS	100mg/L
5	TDS	1000mg/L

a. Sedimentation tank and clarifiers**:** Upflow clarifiers and Rector clarifiers aretwo types of sedimentation tanks, perform very well if both the raw water ischaracteristics and the hydraulic loading rates are constant

b. Anaerobic Baffle Reactor: Most of the primary waste is being treatedbiologically in this system. Anaerobic baffle reactor is being used in hugeplants.

2.3.2.2 Secondary Wastewater Treatment

This treatment is used after the primary treatment which completes thecleansing process through reducing the amounts of remainingorganic elements and solid particles; in addition biodegradable removaland colloidal or organic matter used aerobic biological in secondarytreatment processes Bacteria will decompose the fine organic matter, insome biological units to produce a clear effluent while aerobic bacteriaoxidize the organic matter in some treatment units which called astreatment reactors and may consist of oxidation ponds, aerated lagoons, aeration tanks, rotating biological contactors and trickling filters.

2.3.2.3 Tertiary Wastewater Treatment

The objective is to remove the specific wastewater constitutes whichcannot be removed by secondary treatment including toxic substances, organic elements and solid particles. Tertiary removal uses the stream ofa river for recycling or industrial heat reduction and groundwaterrenewal. Shows the procedure of waste water treatment stagesschematically. The nutrient control and removal and toxic wastetreatment containment removal are the two processes which are beingdone in the advanced wastewater treatment. Nutrient control or removalis a treatment which removes nitrogen and phosphorus by chemical, biological or a combination of both.

CONCLUSION

On the basis of study decentralized waste water treatment system and itscharacteristics, following conclusions can be drawn,

- Currently there is no such decentralized wastewater treatment system inBadnera. Hence for treatment of wastewater decentralized system issuggested.
- As the topography of Amravati is higher than the Badnera it is impossibleto divert the wastewater flow of Badnera to the centralized treatment plantin Amravati, without providing a pumping station which would beuneconomical.
- Hence it is need to provide a small scale wastewater treatment plant inlocality of Badnera which would help in balancing the pollution caused bythe domestic wastewater and would provide the chance for reuse of this treated water for recreational purposes or it can be disposed of safely in the nala situated nearby Badnera.
- The suggested system is found to be successful in reducing the parameterssuch as pH, total solids, turbidity, BOD, COD of values upto 7, 600mg/L, 214 NTU, 21mg/L, 50.4 mg/L respectively, which are within thepermissible limits of CPCB 5.5-9, TSS 100mg/L, TDS 1000mg/L, BOD20mg/L, COD 250mg/L and in very low cost and nominal maintenance.

Case 1 = 14L/hr

Case 2 = 12L/hr

The flow rate at 12L/hr with detention period 1.5hr is found to be mostefficient than the 14L/hr rate with 1.5hr detention period, the values ofwastewater turbidity in CASE 1 system reduced by 95.16%, in CASE 2 itreduced by 28.9% and total solids CASE 1 in system reduced by 94.20%, inCASE 2 it reduced by 91.17% and BOD in CASE 1 system reduced by60.86% , whereas BOD in CASE 2 system reduced by 52.27% , this showsthe optimize condition of suggested system.

- It is quite clear that CASE-2 with 12L/hr flow rate at 1.5 hr detentionperiod has given nearly equal readings as that of case 1, so it will be moreeconomical and advantageous for local authorities to provide onesedimentation tank, one anaerobic baffle reactor and one biological up-flowfilter as suggested in CASE-2.
- Apart from Badnera, such units of decentralized wastewater treatment canbe installed at some points in the Amravati where the topography of land islower and where pumping is necessary for flow of

wastewater to relieve theload over the existing wastewater treatment plant.

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