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Design of Sewage Treatment Plant

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Abstract: - The present case study has been undertaken to evaluate the performance of 13.43 MLD Sewage Treatment Plant (STP) located at Sangam lake, Buldana. Performance of this plant is an essential parameter to be monitored as the treated effluent is discharged into landfill. The Performance Evaluation will also help for the better understanding of design and operating difficulties (aeration, blowers, etc.) in Sewage Treatment Plant. Sewage samples were collected from different locations i.e. Inlet, Distribution Chamber and Outlet of the Treatment Plant and analysed for the major waste-water quality parameters, such as pH, Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), MLSS, Total Nitrogen and Total Phosphates. Actual efficiency of the 13.43 MLD STP will be evaluated by collecting samples for the period of 3 months (December to February). The conclusions of these evaluations may determine required recommendations and focus on modification requirements for the STP and will also determine whether the effluent discharged into the water body are under limits given by MPCB. The conclusions drawn from this study will outline the need for continuous monitoring and performance analysis by removal efficiencies of each and every unit of STP.

Keywords *- domestic waste water, BOD, COD, sewage treatment*

INTRODUCTION

Sewage treatment plays an important role for the mankind. The main function of this plant is to make the water of the sewage clean that comes from home, commercial and industrial sectors. The treatment of sewage water has become the need of the hour as it stops spreading the diseases and illness caused by the sewage water. It helps society in making the water as well as environment clean. The sewage treatment plant works composed of 3 stages that make its working more efficient. The three stages of these plants include the primary stage, the secondary stage and the tertiary stage. In the primary stage, the contaminants that are easy to eliminate are taken out from the wastewater. These substances may include oils, grease, and fats that can be easily removed from the surface area. The solids things like grits, stones, rocks, etc. are strained.

At the secondary stage, the removal of biological contaminants in wastewater takes place. A number of methods are processed there to eradicate the unwanted elements. This stage is considered as the important stage of the treatment plants. At the tertiary treatment, which is the last stage of the plant, the water is get cleaned purely to get discharged in the environment. This is composed of man-made or artificial systems that help in filtration. At this stage, the nitrogen and phosphorous content is eliminated from the water. In addition to this, the water is further disinfected by adding chlorine in the process of chlorination. Through these stages, the final water that comes out is clean and free from pollutants that can be safely released to the environment.

NEED FOR SAFE SANITATION SYSTEM

Sanitation can be perceived as the conditions and processes relating to people's health, especially the systems that supply water and deal with human waste. Such a task would logically cover other matters such as, solid wastes and other special/hazardous wastes and storm water drainage. However, the most potent of these pollutants is the sewage. When untreated sewage accumulates and is allowed to become septic, the decomposition of its organic matter leads to nuisance conditions including the production of malodorous gases. In addition, untreated sewage contains numerous pathogens that dwell in the human intestine tract.

Sewage also contains nutrients, which can stimulate the growth of aquatic plants, and may contain toxic compounds or compounds that are potentially mutagenic or carcinogenic. For these reasons, the immediate and nuisance-free removal of sewage from its sources of generation, followed by treatment, reuse, or dispersal into the environment in an eco-friendly manner is necessary to protect public health and environment.

PRESENT SCENARIO

The problem of sanitation is much worse in urban areas due to increasing congestion and density in cities. Indeed, the environmental and health implications of the very poor sanitary conditions are a major cause for concern.

Municipal wastewater is one of the largest sources of pollution, by volume. Municipal waste-water normally receives treatment before being released into the environment. "The higher the level of treatment provided by a wastewater treatment plant, the cleaner the effluent and the smaller the impact on the environment". Despite treatment, some pollutants remain in treated wastewater discharged into surface waters. Treated wastewater may contain grit, debris, disease-causing bacteria, nutrients, and hundreds of chemicals such as those in drugs and in personal care products like shampoo and cosmetics. Now a day, society demands that all processes, product or services must also be analyzed from an environmental point of view. Therefore it is necessary to analyse the system to determine the overall pollution associated to these activities.

In India, there are 234 Sewage Water Treatment plants (STPs). Most of these were developed under various river action plans (from 1978-79 onwards) and are located in (just 5% of) cities/ towns along the banks of major rivers. In class-I cities, oxidation pond or Activated sludge process is the most commonly employed technology, covering 59.5% of total installed capacity.

SEWAGE TREATMENT PROCESS

Sewage, before being disposed off either in river, stream or on land, has generally to be treated, so as to make it safe. The degree of treatment required, however, depends upon the characteristics of the source of disposal.

Sewage can be treated in different ways. Treatment processes are often classified as:

- Preliminary Treatment
- Primary Treatment
- Secondary Treatment
- Final Treatment
- **Preliminary Treatment**

Preliminary treatment consists separating the floating materials it also help in removing oils and greases etc. from the sewage. This treatment reduces the BOD of the wastewater, by about 15 to 30%.The processes used are: Screening for removing floating papers, rags, clothes, etc. Grit chamber for removing grit and sand.

- **Primary Treatment**

Primary treatment consists in removing large suspended organic solids this is usually accomplished by sedimentation in settling basin. The organic solids, which are separated out in the sedimentation tanks are often stabilized by anaerobic decomposition in digestion tank .The residue used for landfill or soil conditioners.

- **Secondary Treatment**

Secondary treatment involves further treatment of the effluent, coming from the primary sedimentation tank . This is generally accomplished through biological decomposition of organic matter, which can be carried out either the aerobic or anaerobic condition. The effluent from the secondary biological treatment will usually contain a little BOD (5-10% of the original).

This treatment process contains aerobic and anaerobic treatment units such as aeration tank, filters, oxidation ponds, aerated lagoons etc.

- **Final Treatment**

This treatment is sometimes called as tertiary treatment, and consists in removing the organic load left after the secondary treatment and particularly to kills the pathogenic bacteria this treatment, is normally carried out by chlorination.

LAND APPLICATION AS DISPOSAL OPTION

After treatment, and dependent upon the quality of sludge produced (for example with regards to heavy metal content), sewage sludge is most commonly either disposed of in landfill, dumped in the ocean or applied to land. The latter option is a form of excreta reuse as sewage sludge has fertilizing properties.

- **Land application**

Biosolids is a term widely used to denote the byproduct of domestic and commercial sewage and wastewater treatment that is to be used in agriculture. National regulations that dictate the practice of land application of treated sewage sludge differ widely and e.g. in the US there are widespread disputes about this practice. Depending on their level of treatment and resultant pollutant content, biosolids can be used in regulated applications for non-food agriculture, food agriculture or distribution for unlimited use. Treated biosolids can be produced in cake, granular, pelletor liquid form and are spread over land before being incorporated into the soil or injected directly into the soil by specialist contractors. It used to be common practice to dump sewage sludge into the ocean; however, this practice has stopped in many nations due to environmental concerns as well to domestic and international laws and treaties.

CASE STUDY OF SEWAGE IN BULDANA AND DESIGN OF SEWAGE TREATMENT PLANT AT SANGAM LAKE, BULDANA.

BACKGROUND

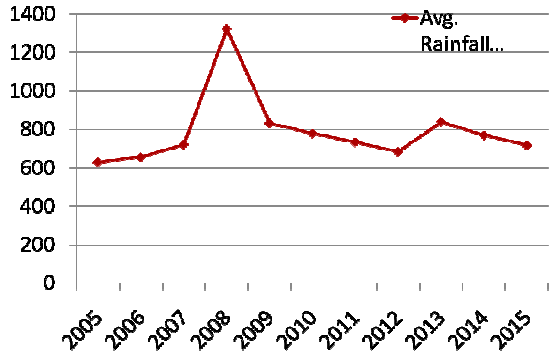
Sangam Lake is located in the south east direction of the Buldana city. Buldana is located at the intersection of latitude 20◦22'N and longitude 76◦10'30"E in Maharashtra state .It is also known as the 'Vidharbhacha Praveshdwar'. Area under town boundary is 10.89sq.m. with 14,098

households and 67,431 population as per census 2011.

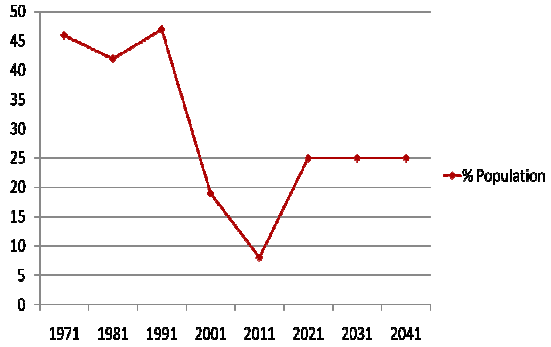
CLIMATE

The climate of the town is very pleasant. Buldana is generally dry and hot. It the coldest place in Vidarbha region considered to be healthy. Maximum temperature during summers recorded is 41.4◦C and during winter is 10◦C.

RAINFALL



POPULATION



WATER SUPPLY

Sr. No.	Year	Population	Water Supply	Sewage Formed
1	2016	73481	9 MLD	6.75 MLD
2	2041	132428	17.9 MLD	13.42 MLD

SEWAGE FLOW

Sr. No.	Sewage formed by	Quantity of Sewage
1	Water Supply	13.42 MLD
2	Rainfall (Storm Water)	0.01 MLD
Total Sewage Flow		13.43 MLD

TEST REPORT OF SEWAGE

Sr. No.	Parameters	Value(mg/l except pH) approximate average	
		Test I	Test II
1	Dissolved Oxygen	5	Nil
2	BOD (5 Days at 20°C)	-	55.78
3	COD	9.68	22.01
4	Total Suspended Solids	635.33	93.17
5	pH	7.9	7.6
6	Nitrates	9.11	0.295
7	Phosphates	0.2	0.102

DESIGN OF SEWAGE TREATMENT PLANT

Sr. No.	Name of Unit	No. of Units	Dimensions
1	Screens	1	0.725x0.8m
2	Grit Chamber	1	15x1.2x1.2m
3	Primary Settling Tank	1	Dia. 21m Depth 3.3m
4	Trickling Filter	2	Dia. 37m Depth 1.5m
5	Secondary Settling Tank	1	Dia. 25m Depth 3m
6	Digester	1	Dia. 8m Depth 6m
7	Drying Beds	4	15x20.74m

CONCLUSION

Waste minimization is of great importance in decreasing pollution load and production costs. This project has shown that various methods can be applied to treat effluents and minimize to pollution load.

The quality of life depends on the ability to manage available water in the greater interest of the people. Water depletion of good quality water and environmental pollution has given tremendous importance to the water management. Our motto is to save living species and its surrounding environment.

The case study concludes that the problem of scarcity of water in the town is encountered so we used treated water for agriculture, gardening, toilet flushing etc. Treated water may prevent contamination of water bodies such as Sangam Lake.

Prevention and treatment of wastewater pollution complementary. We can both use preventive measures as well as variety methods to control the waste and make use of treated water. This will only not reduce water consumption, but also effectively reduce the pollution of the waste water and achieve sustainable development of society

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