Sewage Treatment Plant

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Abstract - :- ***The present study has been undertaken to evaluate the performance of 30 MLD Sewage Treatment Plant (STP) located in Ramgarh Lake at Gorakhpur district which is based on Sequential Batch Reactor (SBR) process. Performance of this plant is an essential parameter to be monitored as the treated effluent is discharged into River Rapti. 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 analyzed 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), Total Nitrogen and Total Phosphates. Actual efficiency of the 30 MLD STP will be evaluated by collecting samples (36 in all) 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 ISO. 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. Administrative capability and adequacy of maintenance systems were evaluated using questionnaires and by conducting staff interviews.***

Keywords - Sewage Treatment, MLD STP, DO, BOD, TSS, Distribution.

1. INTRODUCTION

Wastewater management in India has become an extremely important area of focus due to increasing health awareness and population pressure. Despite the wastewater sector witnessing major growth in the last decade due to increasing government support and private participation, the scale of the problem remains enormous. For instance, it is estimated that less than 20% of domestic and 60% of industrial wastewater is treated. Metros and large cities (more than 100,000 inhabitants) are treating only about 29.2% of their wastewater smaller cities treat only 3.7% of their wastewater. The main function of wastewater treatment plants is to protect human health and the environment from excessive overloading of various pollutants. Due to industrial develo domestic effluent and urban run-off contribute the bulk of wastewater generated in Gorakhpur city. Domestic wastewater usually contains grey water (sullage), which is wastewater generated from washrooms, bathrooms, laundries, kitchens etc. It also contains black water made up of urine, excreta and flush water generated from toilets. Physical, chemical and biological processes are applied to remove physical, chemical and biological contaminants. Its objective is to produce a waste stream (or treated effluent) and a solid waste or sludge also suitable for discharge or reuse back into the environment, In Gorakhpur city, the common treatment technologies adopted for domestic sewage treatment are sequential batch reactors. Each node has its own sewage collection network and sewage treatment plants. The efficiency of sewage treatment plants can be illustrated by a study on the evaluation of pollutant levels of the influent and the effluent at the treatment plant of sewage treatment plants discharging into the environment. In this section author should give introduction about his/her research related contents and brief details of its integrated parts.

2. PRESENT SCENARIO

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. Nowadays, society demands that all processes, product or services must also be analyzed from an environmental point of view. Therefore it is necessary to analyses the system to determine the overall pollution associated to these activities. Rapid growth and urbanization of city over past few decades has given rise to innumerable problems. One of the major problems is the deterioration of water quality in River Rapti due to more or less unrestricted disposal of large volumes of domestic and industrial wastewater.

3. SEWAGE TREATMENT PLANT IN RAMGARH GORAKHPUR

Today, treating wastewater is generally a complex, multi-step industrial process. The first step in a sewage treatment

plant is generally some kind of mechanical treatment, where large objects and heavy materials are removed. The mechanical treatment may consist of a screening chamber (coarse and fine screening) and a degritor. To remove soluble organic matter and possibly also nitrogen from the wastewater, biological treatment is often the second step and followed by disinfection unit (Chlorine contact tank)

Wastewater treatment plants are constructed to protect the environment from excessive overloading from different kinds of pollutants. These plants must meet the appropriate effluent standards. Abnormal process conditions at sewage treatment plants result in the release of effluent that may contain toxins and unacceptably high levels of dangerous organic and inorganic materials into various water bodies and the general environment. This study is based on sequential batch reactor wastewater treatment systems because they are among the most widely-used system.

4. PROPOSED METHODOLOGY

The Sewage treatment plant at Gorakhpur is being designed to treat 30 MLD of sewage from area of Gorakhpur city.

1. Capacity of plant: 30 MLD

2. BOD considered at inlet- 135 mg/l

3. Screens

- Type: Mechanically cleaned fine screen
- fine Screens: 2 no's of 1 m x 2.3 m inclined at 60˚ to horizontal, clear opening of 20mm.

4. No. of reactors: 4 no's

5. Size of reactor: 3.3 m x 3.3 m x 7.5 m

6. for process:

- In Fill phase, the influent is filled unto 6.5 m – 7 m.
- Decant level is up to 5 m. (i.e. 2 m sludge blanket)

7. The total cycle time for completing the process is 6 hours at 30 MLD.

- Mix fill phase: 60 minutes
- React fill phase: 120 minutes
- React phase: 60 minutes
- Settle phase: 60 minutes
- Decanting phase: 60 minutes

8. The STP consists of 4 reactors; in which daily about 3-4 MLD of sewage is treated in each reactor. About 5 cycles take place on a daily basis.

9. The Working of the Plant is totally based on PLC (Programmable Logic Control) and the process in controlled over SCADA system.

10. The 30 MLD plant having "Sequential batch reactor technology" produce an effluent of less than

- 10 mg/L BOD
- 15 mg/L TSS
- 20 mg/L COD
- 8-12 mg/L DO

5. SIMULATION/EXPERIMENTAL RESULTS

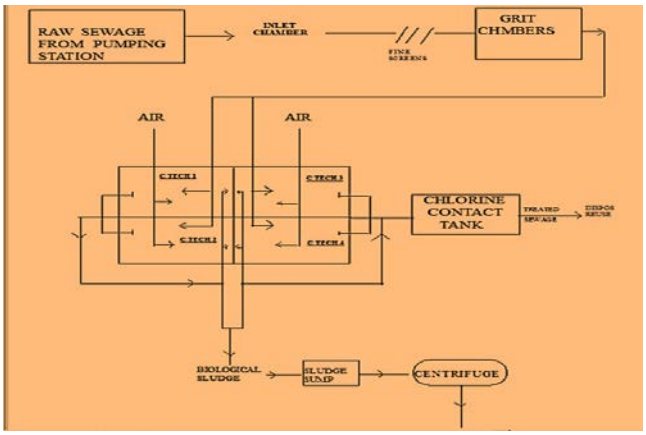

Fig.1. Name of Figure

Sequencing Batch Reactors for wastewater treatment

Discharge of domestic waste water in any water body can be harmful to the environment. Therefore, treatment of any kind of waste water to produce effluent with good quality is necessary. In this regard choosing an effective treatment system is important. Waste water discharge permits are becoming more stringent and SBR's offer a cost-effective way to achieve lower effluent limits. Sequencing batch reactor is a modification of activated sludge process which has been successfully used to treat municipal waste water. Of the process advantages are single tank configuration, easily expandable, simple operation and low capital costs. Improvements in aeration devices and controls have allowed SBRs to successfully compete with conventional activated sludge systems. A U.S.EPA report summarized this by stating that, *"The SBR is no more than an activated sludge system which operates in time rather than in space."*

Table-1: Table Heading

Parameter	units	Inlet (sewage water)	Outlet (treated water)
Flow	MLD	20	19.8
pH	-	7.75	7.5
Temperature	^{o}C	23.5	24
DO	Mg/lit	0.2	5.1
TSS	Mg/lit	207	10
COD	Mg/lit	260	20
BOD	Mg/lit	135	7
Ammonia	Mg/lit	8.96	0.5

6. CONCLUSION

- Average BOD at inlet is 135 mg/l with maximum of 145 mg/l and minimum of 120 mg/l respectively. After the advanced treatment, average BOD at outlet was observed to be 5 mg/l. Maximum BOD at effluent is 7 mg/l. Effluent BOD is within standard limits of discharging in the creek.
- The overall BOD removal efficiency is 96 %.
- The overall total suspended solids removal efficiency is 92.74 %.
- The removal efficiencies of total nitrogen and phosphates were 75.67 % and 71.79 % respectively
- The concentration of total suspended solids at inlet was observed to be 135.64 mg/l with the removal efficiency of 92.74% of which about 18.67 % of suspended solids were removed in detractor (primary treatment) itself.

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