Performance and Efficiency of 15 MLD Sewage Treatment Plant (STP) Near Jharkhndi at Gorakhpur

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Abstract- In Gorakhpur city, there are two sewage treatment plants of aggregate limit 45MLD (30MLD+15MLD). This paper manages the execution assessment of 15 MLD Sewage Treatment Plant (STP) situated at Maherva Ki Bari, Near Lifting Canal Pumping Station Jharkhandi of Gorakhpur which takes a shot at Sequential Batch Reactor (SBR) innovation. Execution of this plant is a basic parameter to be checked as the treated emanating is released into Ramgarh Lake. The Performance Evaluation will likewise help for the better comprehension of outline and working challenges (air circulation, blowers, and so forth.) in Sewage Treatment Plant. Sewage tests were gathered from Inlet and Outlet of the Treatment Plant and broke down for the real waste-water quality parameters, for example, Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), and Total Kjehldal Nitrogen (TKN). Genuine productivity of the 15 MLD STP will be assessed by gathering tests (8 in all) for the time of one month November. The finishes of these assessments may decide required suggestions and concentrate on change necessities for the STP and will likewise figure out if the most prevalent released into the water body are under points of confinement given by CPCB. DO is an exceptionally fundamental parameter to test on the grounds that treated emanating released into Ramgarh Lake which is a gigantic control for amphibian life.

***key words**:* efficiency, performance, sequential batch reactor, total kjehldal nitrogen .

1. INTRODUCTION

The primary capacity of wastewater treatment plants is to offer support to human wellbeing and protect the earth from exorbitant over-burdening of different contaminants. Because of modern advancement in GIDA (Gorakhpur Industrial Development Authority), local gushing and urban keep running off achieve the main part of wastewater created in Gorakhpur city. Household wastewater as a rule contains dim water (sullage), which is produced by washrooms, lavatories, laundries, kitchens and so forth. It additionally contains dark water made up of pee, excreta and flush water produced from toilets. Mechanical and organic procedures are connected to expel screenings, flotsam and jetsam, inorganic particles and natural contaminants. The main goal of this wastewater treatment plant is to deliver a waste stream (or treated emanating) and an organic strong waste or slime likewise reasonable for release or reuse once again into the earth. In Gorakhpur, the normal treatment advancements embraced for local sewage treatment are successive clump reactors. The proficiency of sewage treatment plants can be given by measuring the poison levels of the influent and the emanating at the treatment plant releasing into the environment. The treatment plant at Gorakhpur is intended to treat 15MLD sewage. There has not been any examination led on the plant to learn the effect of the last gushing being released into Ramgarh lake.

A. Present Scenario

India is the nation which confronts the poor sanitation and support framework. Treatment limit is much lower than the sewage era limit. Wastewater era over the wastewater treatment proportions are 15644(MLD): 8040 (MLD), 35558(MLD): 11553(MLD), 2696(MLD): 233.7 (MLD) in Metropolitan Cities, Class I Cities and Class II Towns individually. This is because of the absence of sewage treatment plants at many places in the nation the undesirable water is devoured by the people and in addition by a creature which causes wellbeing risks and at some point demise. The water system framework may likewise utilize that undesirable water, which can antagonistically influence the farming exercises. Because of urbanization, biggest wellsprings of contamination are Municipal wastewater and henceforth it requires extraordinary treatment before being discharged into the earth. "The higher the level of treatment gave by a wastewater treatment plant, the cleaner the gushing and the littler the effect on the earth". Disregarding treatment, a few contaminations stay in gushing released into the water body. Treated wastewater some of the time may pathogens, making aggravations human/creature and furthermore water control. At the present time, all procedure, item or administrations should likewise be investigated. In this way it is important to break down the framework to decide the general contamination related to these exercises. Decadal populace development and movement of provincial individuals to the city has offered ascend to multitudinous issues. More noteworthy issue

related is the weakening of Ramgarh Lake water quality list because of pretty much unlimited transfer of gigantic measure of wastewater.

II. Sewage Treatment Plant At Gorakhpur

The sewage treatment plant at Maherva Ki Bari is intended to treat 15 MLD approaching stream by and large premise yet top stream variable is 2.25 so it can deal with up to 33.75 MLD of waste water which is recently twofold for which it is outlined. At present, the plant gets the waste water mostly from Kuda Ghat (Nalla No.1) and Gordhaiya (Nalla No.2). The result of these two Nallas at last meets at SPS 1(sewage pumping station arranged at RKBK Mohaddipur), from where it pumped to STP by method for gravity channels and conductors. The STP incorporates for the most part 4 individual working units that are Screens, Grit Chamber, SBR and Chlorine Contact Tank. Natural matters, for example, plastic, clothes, vast items and so forth are evacuated by screens. Coarseness chambers are intended to store overwhelming inorganic solids by adequately decreasing the speed so these directs are long in development yet natural material stay in suspension. For the expulsion of dissolvable natural matter and perhaps at the same time nitrogen from the wastewater, organic treatment, the second step is utilized and taken after by sterilization unit (Chlorine contact tank).

Fig.1.sewage treatment plant 15 MLD

Wastewater treatment plants are built to offer support to nature from unnecessary over-burdening from different sorts of unsafe contaminants. These treatment plants must meet the fitting gushing releasing models. The present review depends on the successive cluster reactor framework since they are among the most generally utilized frameworks.

A. Sequencing Batch Reactors For Wastewater Treatment

Water regulation that gets the release of household waste water can be dangerous from a natural perspective. Thusly, it is important to treat squander water by some sort of use and innovation to deliver profluent with great quality norms. In such manner, choosing a viable treatment framework is essential. A treatment procedure that experiences through redundant cycles of sequenced air circulation, settling, tap stage to treat spaces of waste water. Sequencing bunch reactors (SBRs) in view of a fill-and-draw actuated ooze treatment prepare. SBRs are a variety of the activated sludge procedure. Not at all like, initiated ooze plants SBRs consolidate the majority of the treatment steps and procedures into a solitary bowl, or tank, though ordinary procedures depend on numerous bowls. In spite of the fact that the procedures suggested in SBR are like the traditional initiated slop prepare. SBR is time situated and smaller framework, and every one of the means are completed consecutively in a similar bowl. SBR's available a practical approach to deliver bring down emanating limits. Headways in air circulation gadgets and controls endorsed the SBRs to effectively equal over routine enacted ooze frameworks. A U.S. EPA report outlined this by expressing that, "The SBR is close to an enacted slop framework which works in time instead of in space."

B. SBR Operating principles

There are number of tanks/bowls suggested by ordinary enacted slime frameworks for the unit procedures of organic responses (air circulation of blended alcohol) and solids-fluid partition (illumination) and furthermore require handle blended alcohol solids (return initiated slop) to be coming back from the last elucidation stage to the air circulation tanks. Interestingly, treatment capacities, for example, evening out, air circulation and sedimentation happen successively inside the indistinguishable tank in a period rather in a space grouping. Henceforth, SBR framework requires less affable development, between associated doors to direct stream, and process gear and the ensuing reserve funds in capital and working expenses. The working capacity of SBR framework in light of stretched out air circulation enacted slime standard to diminish carbonaceous BOD, nitrification, denitrification, forestall nitrogen gas disturbance in the settle stage and in addition adds up to phosphorus expulsion utilizing energy efficient, fine air pocket diffused air circulation framework with programmed control of air supply in view of oxygen take-up rate. The Aerobic gliding decanter takes after the fluid level and expands the crevice between the gushing withdrawal and ooze cover. This encourages withdrawal of supernatant under laminar stream conditions to guarantee the settle solids or skimming flotsam and jetsam does not meddle with treated sewage.

C. Phases of Operation

The sequencing group reactor framework makes utilization of the variable treatment in mix with a biological selector and operated in a batch- fed reactor mode. Equalization and clarification take place within a reactor itself. The complete biological operation is divided into various cyclic modes. Each basic cycle comprises of.

- Fill aeration (F/A)
- Settling(S)
- Decanting(D)

1. Fill Aeration (F/A)

During the period of fill- aeration, the liquid volume inside the reactor increases from a set operating low water level up to the high water level. Mixed liquor from the aeration zone is also recycled into the selector during the fill- aeration sequence.

2. Settling

Aeration ends at a foreordained time of the cycle to permit the biomass to flocculate and settle under quiet conditions.

3. Decanting

After a predetermined period of settling, the treated supernatant is decanted using a moving weir electromechanical decanter. After decanting, the liquid level in the reactor has returned to the bottom water level after which the cycle is repeated.

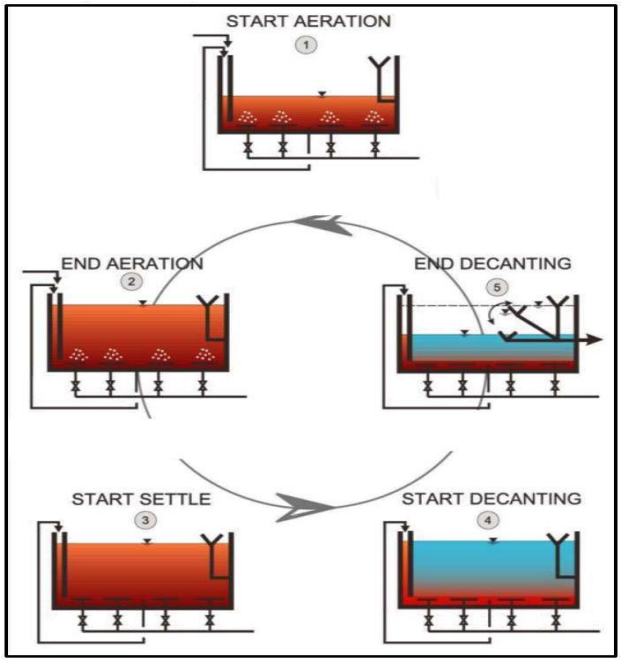

Fig.2: Cyclic Phases Of Sequential Batch Reactor

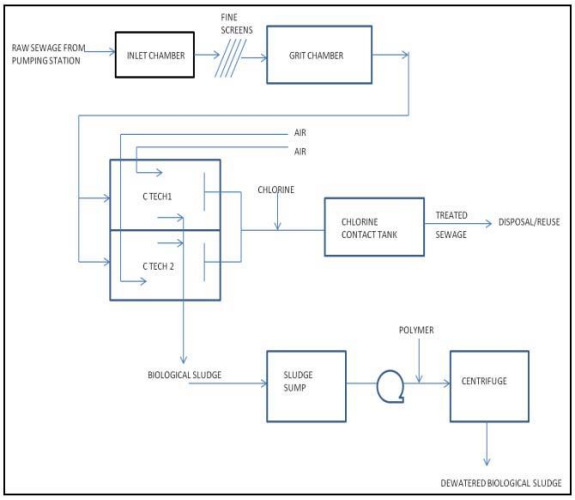

Fig.3: Process Flow Sheet Of Sewage Treatment Plant

III-METHODOLOGY

The Sewage treatment plant at Maherva Ki Bari, Near Lifting Canal Pumping Station Jharkhandi is being designed to treat 15 MLD of sewage from area of Gorakhpur city.

A. Specifications of Plant

1- Capacity of plant: 15 MLD

2- Raw Sewage Quality Parameters

- BOD_5@20°C = 200 mg/l
- COD = 450 mg/l
- TKN = 25 mg/l
- TSS = 300 mg/l
- Fecal coli form=1 × 10^7MPN/100 ml

3-screens

- Type: Mechanically and Manual fine bar screen
- Total number of screens = 3 Nos.

  Total number of mechanical screens (automatic raking mechanism) = 2 Nos. of 6m × 0.65m × 0.50 (L× B ×SWD) having angle of inclination as 45° with channel bottom and clear opening between bars is 6mm each.

- total number of manual screens (stand by arrangement) = 1 nos. of 6m × 0.65m × 0.50 (l×b×swd) having angle of inclination as 45° with channel bottom and clear opening between bars is 10mm.

4- No of reactors: 2 nos

5-size of reactor: 42m×21m×5m

6-C Tech Operating Sequence Comprises:

Table 1: Operating sequence comprises

Time, Hrs→												
	025	0.50	0.75	1.00	1.25	1.50	1.75	200	2.25	2.50	2.75	3.00
Basin1	F/A	F/A	F/A	F/A	F/A	F/A	S	S	D	D	D	D
Basin2	S	S	D	D	D	D	F/A	F/A	F/A	F/A	F/A	F/A

7- The total cycle time for completing the process is 3 to 5 hours (3.0 hrs as per design basis) at 15 MLD STP.

- Fill aeration (F/A)
- Settling(S)
- Decanting(D)

8- The STP consists of 2 reactors; in which daily about 2-3 MLD of sewage is treated in each reactor. About 8 cycles take place on a daily basis.

9- The Working of the Plant is totally based on PLC (Programmable Logic Control).

10- The 15 MLD plant having "Sequential batch reactor technology" produce an effluent as per CPCB:

- BOD_5@20°C ≤ 10 mg/l
- COD ≤ 100 mg/l
- TKN ≤ 2 mg/l
- TSS ≤ 30 mg/l
- Fecal coli Forms ≤ 1000 MPN/100 ml

B. Sampling Locations

Samples were collected at Inlet/ Stilling Chamber (inlet), and chlorine contact tank (outlet).

C. Sampling

8 Samples (4 sets of 2 samples) were collected one month November.

D. Laboratory test

Collected samples will be tested by standard methods in the laboratory for the parameters:

- Inlet sample: BOD, COD, Total suspended solids, Total Kjehldal Nitrogen and DO.
- Outlet sample: BOD, COD, Total suspended solids, Total Kjehldal Nitrogen and DO.

IV. *OBESERVATION AND RESULTS*

Table 1 :Test observations for DO and efficiency

parameter	DO mg/l		
Date	Inlet	Outlet	efficiency
1-11-2016	1.4	4.3	67.44%
8-11-2016	1.8	4.8	62.50%
15-11-2016	1.3	4.2	69.04%
22-11-2016	1.2	4.3	72.09%

Table 2: Test observations for BOD and removal efficiency

parameter	BOD mg/l		
Date	Inlet	Outlet	efficiency
1-11-2016	58	10	82.75%
8-11-2016	45	11	75.55%
15-11-2016	46	10	78.26%
22-11-2016	55	9	83.63%

Table 3: Test observations for COD removal efficiency

parameter	COD mg/l		
Date	Inlet	Outlet	efficiency
1-11-2016	56	28	50.00%
8-11-2016	54	22	59.25%
15-11-2016	67	30	55.22%
22-11-2016	73	26	64.38%

Table 4: Test observations for TKN and removal efficiency

parameter	TKN mg/l		
Date	Inlet	Outlet	efficiency
1-11-2016	27.3	1.8	93.40%
8-11-2016	23.2	1.6	93.10%
15-11-2016	25.4	1.9	92.51%
22-11-2016	24.9	1.7	93.17%

Table 5: Test observations for TSS and removal efficiency

parameter	TSS mg/l		
Date	Inlet	Outlet	efficiency

1-11-2016	64	20	68.75%
8-11-2016	53	19	64.15%
15-11-2016	60	21	65.00%
22-11-2016	59	18	69.49%

V. CONCLUSIONS

The major treatment plant removal of BOD, COD, Nitrate and TSS and it is found in the, average BOD inlet 51 mg/l and outlet 10 mg/l removal efficiency 80.39%.the more efficiency is due to the proper maintence and aeration of equipment's(Blowers and diffused aerators) .Average COD found inlet 62.5 mg/l and outlet 26.5 mg/l removal efficiency 57.60 % and ,average TKN, TSS found inlet 25.2 mg/l, 59 mg/l and outlet 1.75 mg/l, 19.5 mg/l removal efficiency 93.05% and 66.94%.

The average DO found in inlet 1.425 mg/l outlet 4.4 mg/l , which is found the permissible limit and DO required the water body for survival of the aquatic life.

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