Performance Evaluation of Decentralized Wastewater System (DEWATS) in Semradevi Prasad at Gorakhpur

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Abstract— In Gorakhpur city, there are two decentralized sewage treatment plants of aggregate limit 1500000 liters per annum (65000+85000). This paper manages the execution assessment of 65000 liters annum Decentralized Wastewater Treatment Plant (DEWATS) situated at Semradevi Prasad, About 2 km from Transport Nagar of Gorakhpur which takes a shot at Anaerobic Baffle Reactor (ABR) innovation. Execution of this plant is a basic parameter to be checked as the treated emanating is being used for the irrigation. 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), and Total Suspended Solids (TSS). The productivity of the DEWATS will be assessed by gathering tests (8 in all) for the time of one month December. The outcome of this evaluation may decide required suggestions and concentrate on modification necessities for the DEWATS and will likewise figure out if the most prevalent released into the water body or for irrigation are under points of confinement given by CPCB. BOD is an exceptionally fundamental parameter to test on the grounds that treated emanating released for Irrigation which is a gigantic control for Plants life.

Keywords: Efficiency, Anaerobic Baffle Reactor, Anaerobic Filter, Decentralized Wastewater System (DEWATS)

I. 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) the waste generated from the city finds its way to the peri-urban areas. The surrounding areas of Village Semradevi Prasad also are used for solid disposal. Added to this problem is the open defecation that was commonly practiced by households in this village –with only about one-fourth of the households having individual toilets (prior to implementation of DEWATS). This kind of polluted environment of the village was becoming detrimental to the living conditions of the people and creating acute health hazards, apart from being a general nuisance. It Generally contains dark water made up of excreta, pee and flush water produced from toilets. 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 irrigation in that area. 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 DEWATS plant at Gorakhpur is intended to treat 65000 liters per annum sewage. There has not been any examination led on the plant to learn the effect of the last gushing being released for irrigation.

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. Decentralized wastewater treatment system (DEWATS) is an effective waste-water treatment system for small and isolated communities. DEWATS is basically a small dispersed anaerobic waste water treatment system, requiring much less area (than a centralized Sewage Treatment Plant), with simple process/technology, and negligible operations and maintenance costs. The treated water can be safely used for irrigation or disposed off into the reservoirs and other bodies without polluting their water. 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". A typical DEWATS could be a five component system of first three anaerobic steps consisting of a biogas settler; an ABR and an anaerobic filter; followed by an aerobic treatment unit such as a constructed wetland (Free-Water Surface CV, Horizontal Subsurface Flow CV or Vertical Flow CV) and a maturation pond (WHO 2009). BOD may be reduced by up to 90%, which is far superior to its removal in a conventional Septic Tank.

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.

II. DEWATS AT GORAKHPUR

The sewage treatment plant at Semradevi Prasad is intended to treat 65000 liters per annum. It is Serving a total of 126

households (664 persons).The stream is received at STP by method for gravity channels and conductors. The STP incorporates for the most part 5 individual working units that are Screens, Settler, ABR, ABF and PGF. 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.

Fig. 1: DEWATS plant 178.083 L/D

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. Anaerobic Baffle Reactors and Filters for Wastewater Treatment

From the environmental point of view the water containments that receives the discharge of domestic wastewater can be Hazardous. So it becomes Necessary to treat the sewage before disposal by applying some kind of technology to produce effluent within the standards. That is why it becomes necessary for selecting an effective treatment system is Important.

A treatment procedure that should require low maintenance and energy for operating would be suitable for this plant. The ABR was developed in early 1980 it consist of a series of compartments (up to 8) in one reactor which are baffled to force the incoming wastewater up through a series of sludge blankets, thereby reducing the loss of biomass. The Sludge Reaction Time (SRT) can be separated from the Hydraulic Retention Time (HRT) leading to good Chemical Oxygen Demand (COD) and solids removal, low sludge production and a small footprint.

B. ABR (DEWATS) Operating Principles

The Anaerobic baffled reactors (ABR) are septic tanks that have been upgraded with a series of baffles along the treatment chamber. The upflow chambers provides high removal and digestion of the organic matter. As septic tanks the ABRs uses a physical treatment (settling) and a biological treatment (anaerobic digestion). The ABR consists of a tank and alternating hanging and standing baffles that compartmentalize the reactors and force liquid to flow up and down from one compartment to the next which enables a enhanced contact between the fresh wastewater entering the reactor and the residual sludge which contains the microorganisms responsible for anaerobic digestion of the organic pollutants present in the sewage. The compartmentalized design separates the solids retention time from the hydraulic retention time, making it possible to anaerobically treat wastewater at short retention times of only some hours. The treatments of solids are high, while the overall production of sludge is very low. The construction and operation is easy and cost effective as well as very robust to hydraulic and organic shock loading. Yet, both sludge and effluent still need further treatment. To increase the treatment efficiency (especially regarding pathogens), the last chamber may be an anaerobic filter. Typical inflows range from 2 to 200 m3 per day. Critical design parameters include a hydraulic retention time (HRT) between 48 to 72 hours, up flow velocity of the wastewater below 0.6 m/h and the number of up flow chambers (3 to 6). The chambers are connected by vertical pipes or baffles. All chambers should be easily accessible for the necessary maintenance.

Generally Biogas is generally released but is the used as they are found in insignificant amount. The reactor is properly vented to control the escape the odour and potentially harmful gases. The Anaerobic Filter is a example of fixed-bed biological reactor. As wastewater flows through the filter, particles are trapped and organic matter is degraded by the biomass that is attached to the filter material. Generally the 0.5-1.5 days of HRT is found. A maximum surface-loading (i.e. flow per area) rate of 2.8m/d has proven to be suitable. Suspended solids and BOD removal can be as high as 85% to 90% but is typically between 50% and 80%.

C. Data Considered During Designing of

Details	Semradevi Prasad
Gross Area Served	0.02m²
Total no. Houses	86
Total no. of Families	126
Total population	664
No. of toilets	36
No. of cattle	23
Average Water Consumption (person/day)	40-45L
Type of soil	Sandy soil
Bearing capacity of soil	8t/m²

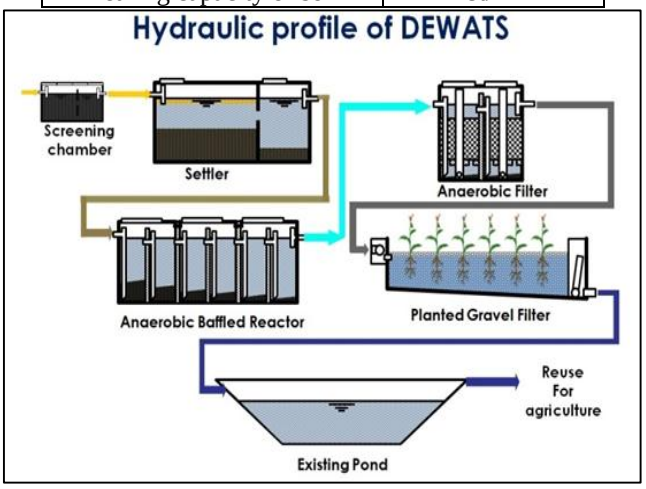

Fig. 2: Hydraulic Profile of DEWATS.

III. METHODOLOGY

The DEWATS plant at Semradevi Prasad, Near Transport Nagar is designed to treat 65000 liters per annum of sewage from that Village. In this the test were carried out to measure the sewage on the following characteristics such as BOD, COD, TSS.

A. Specifications of Plant

1) Capacity of plant: 65000 liters per annum.
2) Raw Sewage Quality Parameters
– BOD_5@20 = 300 mg/l
– COD = 600 mg/l
– TSS = 300mg/l
3) Screens
– Type: Mechanically and Manual fine bar screen
– Total number of screens = 1 Nos.
4) Anaerobic Baffle Reactor
– No Of Chambers: 6 No
– Size: 1 M 2.50 M 2.0 M
5) Anaerobic Filter
– No of Chambers: 2 No
– Size: 1M 2.50 M 2.0 M
6) Planted Gravel Filter
– No of Chambers: 2 No
– Size: 1.0 M 8.0 M 0.6 M
7) The DEWATS plant has a "Anaerobic Baffle Reactor Technology" and produces the effluent as per CPCB standard.

1) BOD_5@20 : 25 mg/l
2) COD : 70 mg/l
3) TSS: 77 mg/l

B. Sampling Locations

Samples were collected at Inlet/ Stilling Chamber (inlet), and Anaerobic Filter Chamber (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.
– Outlet sample: BOD, COD & Total suspended solids.

IV. OBSERVATION AND RESULTS

Parameter	BOD mg/l		
Date	Inlet	Outlet	efficiency
1-11-2018	290	28	90.34 %
7-11-2018	310	27	91.29 %
14-11-2018	305	30	90.16 %
23-11-2018	300	28	91.88 %

Table 1: Test observations for BOD and removal efficiency

Parameter	COD mg/l		
Date	Inlet	Outlet	efficiency
1-11-2018	619	70	88.69 %
7-11-2018	620	75	87.90 %
15-11-2016	622	73	88.26 %
23-11-2018	615	73	88.13 %

Table 2: Test observations for COD removal efficiency

Parameter	TSS mg/l		
Date	Inlet	Outlet	efficiency
1-11-2018	610	75	87.70 %
7-11-2018	600	80	86.67 %
14-11-2018	605	82	86.45 %
23-11-2018	615	77	87.48 %

Table 3: Test observations for TSS and removal efficiency

V. CONCLUSIONS

The major treatment plant removal of BOD, COD and TSS it is found in the, average BOD inlet 301 mg/l and outlet 28.25 mg/l removal efficiency 90.91 %.the more efficiency is due to the proper maintenance and use of planted gravel filter. Average COD found inlet 616.75 mg/l and outlet 72.75 mg/l removal efficiency 88.25 % and, TSS found inlet 607.5 mg/l, and outlet 78.50 mg/l removal efficiency 87.08%.

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