

Performance Assessment of 100 MLD Sewage Treatment Plant Based On C-TECH Technology at Vashi, Navi Mumbai

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ABSTRACT: The aim of this study is to evaluate the performance of 100 MLD Sewage Treatment Plant (STP) located at Vashi, Navi Mumbai which is based on latest C-Tech Technology (Cyclic Activated Sludge Technology). Performance of this plant is an essential parameter to be monitored as the most of the treated effluent discharged into Vashi Creek and remaining used for Gardening purpose. Water samples were collected from raw inlet and treated outlet 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) etc. The overall performance efficiency of 100 MLD Sewage treatment plant will be evaluated by collecting samples for the period of 10 months (March to December). The results of these evaluations also determine whether the effluent discharged into the water body are under limits given by MPCB.

KEYWORDS: Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Suspended Solid, etc.

I. INTRODUCTION

The aim of wastewater treatment is to enable wastewater to be disposed safely, without being damage to public health and without polluting water bodies. Increasingly another important aim of wastewater treatment is to recover energy, nutrients, water and other valuable resources from wastewater.

There is a Township newly established by CIDCO on the either side of Thane Belapur Road which is known as Navi Mumbai and is governed by Navi Mumbai Municipal Corporation. Population of Requirement of water for the Township is 317 MLD which is fulfilled by Morbe, Barvi and Hetwane dam, and generation of sewages is 245 MLD. The NMMC have provided seven Sewage Treatment Plants (STP) at various places. STP at Vashi has total capacity of 100 MLD. The plant operation based on new technology called C-Tech Technology (Cyclic Activated Sludge Technology). There are total six basins are provided. Maximum Effluent is discharged into Creek and remaining is used for gardening.

II. LITERATURE SURVEY

Ravi Kumar et al. (2010) have put forward comparative study of performance of the Nagasandra and Mailasandra sewage treatment plants. The overall efficiency of the two treatment plants was calculated by considering the TDS, TSS, COD and BOD of the influent and the final effluent from the secondary clarifier. The performance studies on the

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Mailasandra and Nagasandra Sewage Treatment Plants located on the periphery of Vrishabhavathi valley conducted for a period of seven days indicated a positive efficiency of the system. The comparative efficiencies of the two sewage treatment plants are given below.

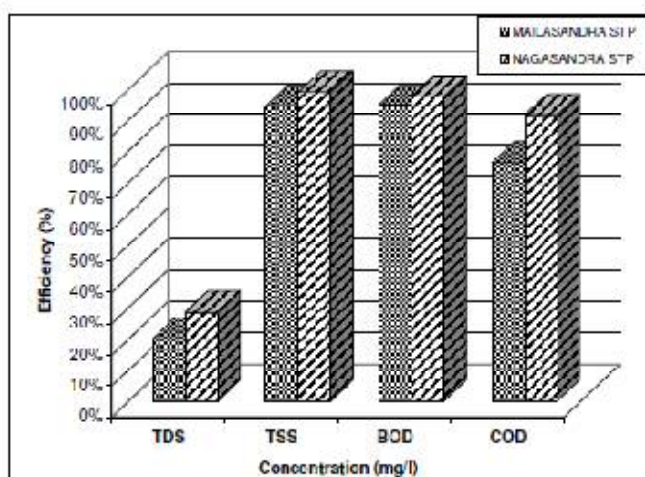


Fig. 1 Comparative Account of Efficiency of Sewage Treatment Plants at Mailasandra and Nagasandra

Prachi Wakode and Sameer Sayyad (2014) evaluated performance of 25 MLD sewage treatment plant at Kalyan which is based on Sequential Batch Reactor (SBR) process. 36 samples were collected for a period of three months and tested in the laboratory for pH, BOD, COD, TSS, Total Nitrogen, Total Phosphorous parameter. Overall BOD, COD, TSS, Total Nitrogen and Total Phosphorus Removal Efficiencies of STP are calculated.

Kavita Choksi et al. (2015) analyzed efficiency of the Anjana Sewage Treatment Plant, Surat. The selected parameters were pH, Turbidity, TSS, TDS, COD and BOD. The treated and non-treated samples were collected twice a week on every Monday & Thursday per month for winter sessions and summer sessions and tested. A result obtained from collected samples was compared with BIS and GPCB (Gujarat Pollution Control Board) standards to evaluate the efficiency of the plant in both seasons. The performance efficiency of each unit in treating the pollutants was calculated. Overall performance of the plant is also estimated. The variation of BOD, COD and TSS for raw sewage and treated sewage with summer and winter season is evaluated.

Mansi Tripathi and S. K. Singal (2013) was conducted study to evaluate the performance of existing sewage treatment plants (STPs) in Lucknow City of India. Two STPs are operating in Lucknow based on UASB reactor and FAB reactor technology with total operating capacity of 345MLD and 56MLD respectively. Three wastewater quality parameters BOD, COD and TSS of the 120 samples was collected, evaluated and results are observed as per CPCB norms. Table no. 1 BOD, TSS and COD removal efficiencies of two sewage treatment plants are calculated and compared.

Table no. 1 Treatment Characteristics of Treatment Plants considered under Study.

S. No.	Water Quality Parameter	Daulatganj STP			Bharwara STP		
		In flow	Out flow	% Removal	In flow	Out flow	% Removal
1	BOD ₅ (mg/l)	111	24	78	92	22	76
2	TSS (mg/l)	237	24	90	213	23	89
3	COD (mg/l)	213	52	76	200	49	76

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III. THE C-TECH PROCESS

C-Tech is a CYCLIC ACTIVATED SLUDGE TREATMENT process. The C-TECH – System is operated in a batch reactor mode. The complete process takes place in a single reactor, within which all biological treatment steps take place sequentially. The complete biological operation is divided into cycles. Each cycle is of 3 – 5 hrs duration, during which all treatment steps take place.

1. Fill-Aeration (F/A)
2. Settlement (S)
3. Decanting (D)

1. Fill-Aeration: The raw wastewater is filled in the C-Tech basin up to a set operating water level. Aeration is done simultaneously for a pre-determined time to aerate the effluent along with the biomass.
2. Settlement: After the aeration cycle, the biomass settles under perfect settling conditions.
3. Decanting: Once settled the supernatant is removed from the top by using decanter. Solids are wasted from the tank during decanting phase.

These phases in a sequence constitute a cycle, which is then repeated.

IV. METHODOLOGY

Samples were collected from the influent and effluent of the sewage treatment plant. Samples have been collected twenty times from date 27th March 2015 to 31st December 2016. Collected samples were analysed for the important parameters Ph, BOD, COD, and TSS etc. Samples were tested as quickly as possible after its collection. The results which are obtained after analysing samples from raw influent and treated effluent of STP are compared with standard parameter of MPCB.

V. OBSERVATION AND RESULTS

Samples were collected during period of ten months was tested in the laboratory for four wastewater quality parameter pH, BOD, COD, TSS.

Table no. 2 listed test observations of wastewater quality parameters taken at Inlet and Outlet. The pH values of treated outlet observed in between 7 to 7.61 which are within the permissible limits as per MPCB. (MPCB Limit: 7-8). BOD values of treated outlet are in between 2.1 to 4 which are within the permissible limits of MPCB. (MPCB Limit: ≤ 5). Minimum COD value of treated outlet is 19 and maximum value is 32. which is much lower than MPCB limit. (MPCB Limit: ≤ 50). Minimum TSS value of treated outlet is 5 and maximum value is 6.5 which is again within the permissible limits of MPCB. (MPCB Limit: ≤ 10).

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Table no.2 Results of wastewater quality parameter for the 20 samples collected at STP, Vashi.

S.No.	Date	pH		BOD		COD		TSS	
		Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
1	27-03-2015	6.35	7.18	110	2.2	235	25	160	6.5
2	30-03-2015	6.95	7.61	120	3	210	20	159	5.8
3	14-04-2015	6.75	7.3	116	2.5	230	25	175	6.4
4	29-04-2015	6.9	7.1	112	3.8	272	32	164	6
5	14-05-2015	6.8	7	108	3.5	292	28	150	6
6	28-05-2015	6.9	7.1	142	3.8	398	28	164	5
7	14-06-2015	6.9	7	122	3.3	246	27	143	5.5
8	29-06-2015	6.5	7.1	111	3.2	218	19	115	5
9	13-07-2015	6.9	7	110	2.1	222	23	151	5
10	30-07-2015	6.5	7.12	125	3.9	268	27	170	6.4
11	13-08-2015	6.3	7.2	125	3.2	253	25	172	6.4
12	31-08-2015	6.35	7.2	119	3.4	229	21	145	5.2
13	14-09-2015	6.75	7.48	130	3.9	245	25	165	6.5
14	28-09-2015	6.35	7	126	4	275	28	170	6.5
15	15-10-2015	6.9	7	132	3	238	21	140	5.5
16	29-10-2015	6.85	7.38	120	3.6	238	25	143	5
17	16-11-2015	6.78	7.16	110	3.6	241	23	154	5.5
18	26-11-2015	6.36	7.1	114	3.5	239	23	141	5.4
19	14-12-2015	6.67	7.24	118	3	237	24	141	5.9
20	31-12-2015	6.56	7.23	119	3.4	242	22	134	5.6

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Table no. 3 BOD Removal Efficiencies are calculated from inlet and outlet parameter. Maximum BOD Removal Efficiency is 98.1% and Minimum BOD Removal Efficiency is 96.6%.

Table no.3 BOD Removal Efficiency.

S.No.	Date	Inlet	Outlet	Efficiency
1	27-03-2015	110	2.2	98
2	30-03-2015	120	3	97.5
3	14-04-2015	116	2.5	97.84
4	29-04-2015	112	3.8	96.6
5	14-05-2015	108	3.5	96.76
6	28-05-2015	142	3.8	97.32
7	14-06-2015	122	3.3	97.29
8	29-06-2015	111	3.2	97.11
9	13-07-2015	110	2.1	98.1
10	30-07-2015	125	3.9	96.88
11	13-08-2015	125	3.2	97.44
12	31-08-2015	119	3.4	97.14
13	14-09-2015	130	3.9	97
14	28-09-2015	126	4	96.82
15	15-10-2015	132	3	97.27
16	29-10-2015	120	3.6	97
17	16-11-2015	110	3.6	96.72
18	26-11-2015	114	3.5	96.92
19	14-12-2015	118	3	97.45
20	31-12-2015	119	3.4	97.14

Table no. 4 List out COD Removal Efficiencies of STP. Maximum COD Removal Efficiency is 92.96% and Minimum COD Removal Efficiency is 88.23%.

Table no. 4 COD Removal Efficiency.

S.No.	Date	Inlet	Outlet	Efficiency
1	27-03-2015	235	22	90.64
2	30-03-2015	210	20	90.48
3	14-04-2015	230	21	90.87
4	29-04-2015	272	32	88.23
5	14-05-2015	292	28	90.41
6	28-05-2015	398	28	92.96
7	14-06-2015	246	20	91.87
8	29-06-2015	218	19	91.28
9	13-07-2015	222	19	91.44
10	30-07-2015	268	25	90.67
11	13-08-2015	253	24	90.52
12	31-08-2015	229	21	90.83
13	14-09-2015	245	22	91.02
14	28-09-2015	275	27	90.18
15	15-10-2015	238	21	91.18
16	29-10-2015	238	23	90.34
17	16-11-2015	241	23	90.45
18	26-11-2015	239	23	90.37
19	14-12-2015	237	20	91.56
20	31-12-2015	242	22	90.91

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Table no. 5 Total Suspended Solid Removal Efficiencies are listed. Maximum TSS Removal Efficiency is 96.95%. Minimum TSS Removal Efficiency is 95.65%.

Table no. 5 TSS Removal Efficiency.

S.No.	Date	Inlet	Outlet	Efficiency
1	27-03-2015	160	6.5	95.94
2	30-03-2015	159	5.8	96.35
3	14-04-2015	175	6.4	96.34
4	29-04-2015	164	6	96.34
5	14-05-2015	150	6	96
6	28-05-2015	164	5	96.95
7	14-06-2015	143	5.5	96.15
8	29-06-2015	115	5	95.65
9	13-07-2015	151	5	96.69
10	30-07-2015	170	6.4	96.23
11	13-08-2015	172	6.4	96.27
12	31-08-2015	145	5.2	96.41
13	14-09-2015	165	6.5	96.1
14	28-09-2015	170	6.5	96.17
15	15-10-2015	140	5.5	96.1
16	29-10-2015	143	5	96.5
17	16-11-2015	154	5.5	96.43
18	26-11-2015	141	5.4	96.17
19	14-12-2015	141	5.9	95.81
20	31-12-2015	134	5.6	95.82

The variations of wastewater quality parameters at influent and effluent are plotted for 20 samples from 27th March 2015 to 31st December 2015 and respective BOD, COD and TSS values are compared.

Fig.2 shows variation of BOD, COD and TSS at influent. The maximum value of BOD at inlet is 132 and minimum value is 108. The maximum value of COD at inlet is 398 and minimum value is 210. The maximum value of TSS at inlet is 175 and minimum value is 115.

Fig.3 shows variation of BOD, COD and TSS at effluent. The maximum value of BOD at outlet is 4 and minimum value is 2.1. The maximum value of COD at outlet is 32 and minimum value is 19. The maximum value of TSS at outlet is 6.5 and minimum value is 5.

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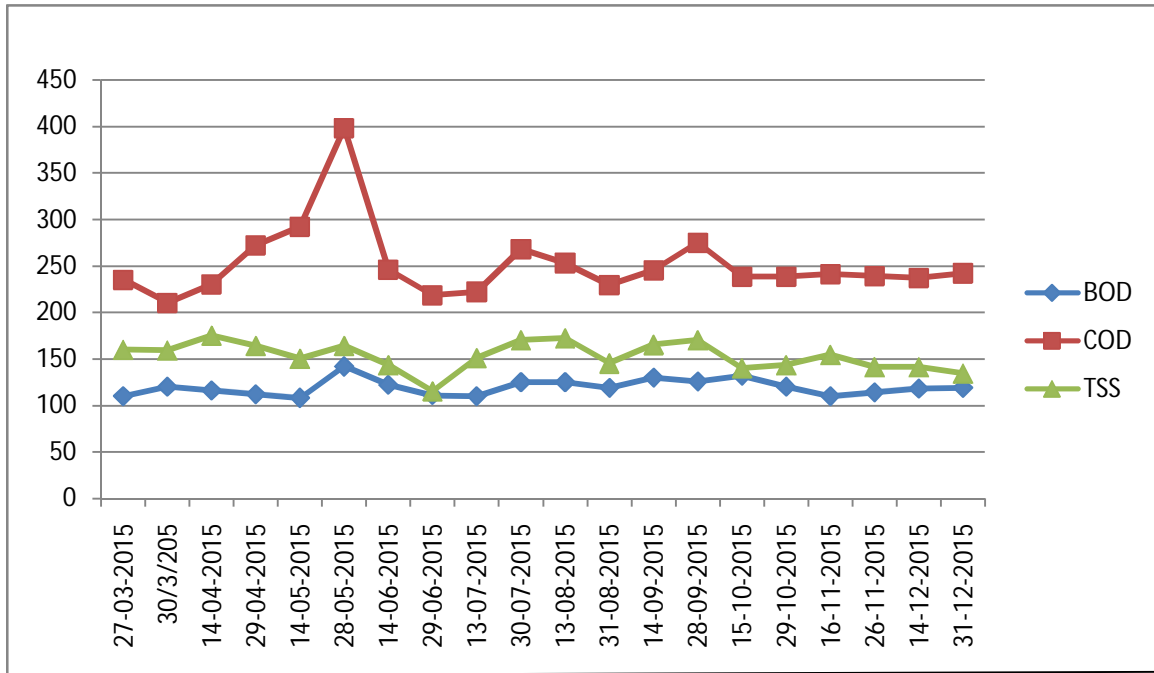


Fig.2 Variation of BOD, COD, TSS at Influent.

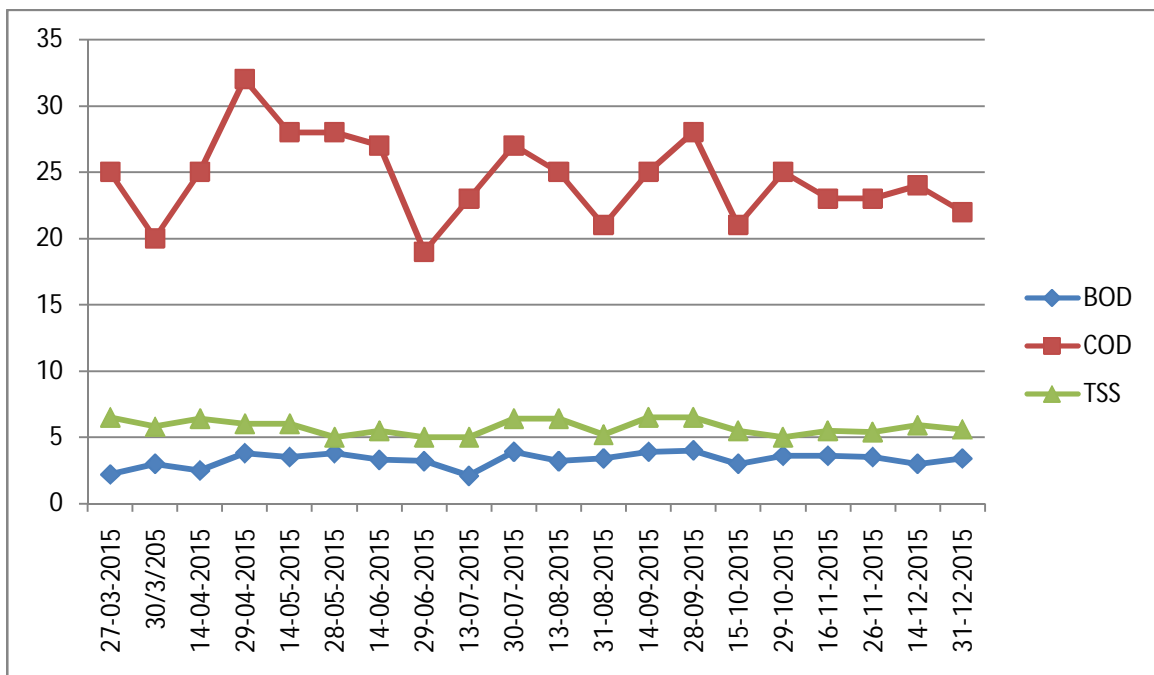


Fig.3 Variation of BOD, COD, TSS at Effluent.

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VI. CONCLUSION

The average BOD removal efficiency of the plant is 97.19 %.The average COD removal efficiency of the plant is 90.82%.The average TSS removal efficiency of the plant is 96.2 %.

The results indicates all major waste water quality parameters were reduced to much extend after the treatment and treated effluent values were well within limit of discharge into creek as per MPCB. Hence it concludes that STP based on C-TECH Technology is working with the standards given by MPCB.The results obtained indicates this latest technology is very effective in wastewater treatment.

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