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CETP: A Boon or Bane for Small & Medium Scale Enterprise

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Abstract

After Independence government started with the slogan “Industrialise or perish” but with the unplanned and haphazard development the slogan has changed to “Industrialise and perish” government of India took tremendous efforts for setting up various industries near the water bodies, but with the exponential rate of industrialization the pollution load also increased astronomically due to lack of setting up of proper treatment facilities for the effluent generated from these industries. The disposal of effluent without treatment from industries presents complex problems. The central government enacted several laws to overcome these problems. The Water (P&CP) Act 1974 requires every industry to provide adequate treatment facility for its effluent generated before its disposal in stream, land or in sea. The Large scale & medium scale units have infrastructure and resources in terms of finance space & technology and can afford to treat their industrial effluent. On the other hand small scale industries do not have such infrastructure or finance to set up such facilities and this is where the concept of CETP comes into picture. The CETP concept was originally promoted by the Ministry of Environment and Forests (MoEF) in 1984 to treat wastewaters from a large number of small- and medium-scale industries. CETP scheme was implemented mainly to tackle the problem of liquid effluents generated especially from small scale industrial units who have techno economic constraints. World Bank promoted CETPs under "Pollution Prevention Programme" as a viable solution to control industrial pollution. Also in most of the water pollution cases the courts have given the ruling to abate the problem using this concept.

In India today there are about 100 CETPS all over the nation, CPCB had conducted a survey of 78 CETPs and found their working unsatisfactory largely because of poor operation & maintenance it then directed the SPCBs to monitor the CETPs regularly and evaluate them as per the discharge norms. Maharashtra has 26 CETPS of which 18 are in operation, 4 are under construction, 2 under commissioning & 2 have not yet been commissioned. MPCB had taken initiative to improve the efficiency of CETPs by preparing guidelines for operation & maintenance; it also constituted Local Area Environmental Monitoring Committee, for vigilance of CETPs and also undertook the work of performance evaluation of some of the CETPs.

Performance evaluation of one such CETP at TTC Khirane, Navi Mumbai was carried out and recommendations to the problems associated were suggested. The plant operates on the extended aeration activated sludge process. The performance evaluation exercise revealed that the average overall efficiency with respect to BOD was found to be 91.69%, that of COD is 85.29% and of TSS is 88.07% other than this pH and oil & grease of the treated water is also found to be well within the MPCB prescribed limits and pollutants like heavy metals are below detectable levels. The plant had problem of shock loading to which a sensor based tracking system solution was suggested, to deal with the monsoon problems it was recommended to switch to HDPE pipe lines which could take care of the percolation and leakage trouble. CETP, Khirane has good operation & maintenance structure in place to take care of the effluent it receives from its member units and has the capacity to recycle the treated water to its member units in near future as it is essential to preserve this very precious natural resource.

Keywords: CETP, Extended aeration, Activated sludge process

1.0 Introduction

The government of India took tremendous efforts for setting up various industries near the water bodies, but with the exponential rate of industrialization the pollution load also increased astronomically due to lack of setting up of proper treatment facilities for the effluent generated from these industries. The disposal of effluent without treatment from industries presents complex problems. The SME's today play a vital role in our country's economy and are responsible for providing raw materials required for the large & medium scale units and also cater to various other day to day requirements. The bulk of industrial pollution in India is caused by the small and medium scale industrial (SMIs) sector [3]. These units generally produce output in batches rather than continuous production which leads to higher concentration of effluents. SME's use less efficient, non automated and cheap manufacturing equipments, which results in loss of raw materials, energy and output of products and raises the pollution levels. The Lack of financial resources also leads to non availability of modern and sophisticated technology for pollution abatement. It has become very difficult for small scale industries to have their own wastewater treatment facility. The two main causes are nonavailability of land and skilled manpower to maintain the ETP [7].

The central government enacted several laws to overcome these problems. The Water (P&CP) Act 1974 requires every industry to provide adequate treatment facility for its effluent generated before its disposal in stream, land or in to sea. The Large & medium scale units have infrastructure and resources in terms of finance space & technology and can afford to treat their effluents. On the other hand small scale industries do not have such infrastructure or finance to set up such facilities and this is where the concept of Common Effluent Treatment plant (CETP) comes into picture. The cost function estimates provide evidence of significant scale economies and high marginal abatement cost in wastewater treatment by small-scale factories [1]

CETP scheme was implemented mainly to tackle the problem of liquid effluents generated especially from small scale industrial units which have techno economic constraints. The facility was also made available to all medium & large scale industrial units with the aim to strengthen the financial feasibility and also to get advantage of mixing of treated effluents of these units and to utilize the common single disposal system. Ministry of Environment & Forest (MoEF), Central Pollution

Control Board (CPCB) & State Pollution Control Board (SPCB), State Industrial Development Corporation (SIDC) & World Bank (WB) are actively involved in setting up of CETP facility and are extending their cooperation for successful operations of CETP.

2.0 Concept of CETP

The basic objective of CETP is to reduce the treatment cost for individual units while protecting the environment. CETP is a facility for treating effluent of a cluster of small scale industrial units by means of a collective effort which is similar to the concept of a municipality treating the sewage from individual houses [3]. All the member units of a CETP generally provide primary treatment (pH correction) to their industrial effluents before discharging it to the CETP collection chamber. The units can be of varying nature or can be involved in production of similar products the design of a CETP depends upon the nature of the member units connected to it. Being a central facility CETP solves the problem of lack of space and technical assistance and trained people it also reduces the problems of monitoring for SPCB's and provides greater possibilities of recycling/ reusing the treated effluent.

2.1 Elements of CETP

A properly designed CETP is capable of handling effluents from various types of industries and the effluent received at the CETP varies daily rather hourly. The basic elements for design of a CETP are Site characteristics & flow of incoming effluent, collection & transportation of the effluent, treatment, recovery & storage of the effluent and inventory of types of member units and their effluent generation capacity.

2.2 Status of CETPs

In India today we have about 100 CETPS all over the nation, CPCB had conducted a survey of 78 CETPS and found their working unsatisfactory, largely because of poor operation & maintenance, it then directed the SPCBS to monitor the CETPS regularly and evaluate them as per the discharge norms. Maharashtra has 26 CETPS of which 18 are in operation, 4 are under construction, 2 under commissioning & 2 have not yet been commissioned. MPCB had taken initiative to improve the efficiency of CETPs by preparing guidelines for operation & maintenance of the CETP; it also constituted Local Area Environmental Monitoring Committee, for vigilance of CETPs and also undertook the work of performance evaluation of some of the CETPs. Performance evaluation of one such CETP at TTC Khirane, Navi Mumbai was carried out and recommendations to the problems associated with the CETP were suggested.

2.3 CETP at TTC, Navi Mumbai

The TTC industrial area was developed in the seventies the effluent generated from various industries having a pollution load of varying pH, high COD, high BOD, high amount of suspended solids, oil & Grease and other industry specific pollutants. These pollutants adversely affect the environment and thereby the whole ecosystem so it is necessary to treat these pollutants to acceptable levels before being discharged into the stream. To suffice this Khairane CETP was established in 1997 by the Thane Belapur Industries association with a capacity of 12MLD. The final discharge point of CETP effluent is in Trans Thane creek the discharge of such effluent may deteriorate

the water quality of the creek and in turn damage the ecosystem if desired amount of treatment efficiency is not achieved. The main purpose of this CETP was to remove the suspended solids, dissolved solids, reduce COD, organic matter and oil & grease to the standards prescribed by MPCB.

The Khairane CETP receives wide variety of effluents from various industries in the TTC-MIDC, the treatment facility adopted by this CETP is extended aeration activated sludge process. The industrial units in this MIDC kept on expanding and also new units were emerging with time which resulted in addition of effluent load to the CETP and finally a stage came wherein the CETP was no longer capable of accepting any further additional effluent load. In order to tackle extra load generated by the industries in TTC industrial area, an additional CETP of 15 MLD capacity was envisaged and commissioned in 2006. TTC zone has approximately 3200 industries situated in this hub the effluent generated from these industries is conveyed through the underground pipeline to different collection sumps at different nodes viz Sanpada node which takes effluent from D- block industries, Rabale node which collects effluent from R- Block & part of W- Block and the Pawane node (P -18) which collects effluent from C- Block, A- Block & part of W- Block, the pawane node finally receives effluent collected at Sanpada node as well as the Rabale node and is the station which receives all the effluent generated from various industries as shown in Fig. 1 (Effluent collected at Sanpada & Rabale nodes are pumped to Pawane receiving station aprx. 4 to 5 hrs in a day) It is from this station the effluent is further distributed to the 12 MLD treatment plant & 15 MLD treatment plant. The acceptable inlet characteristics of CETP are shown in table 1

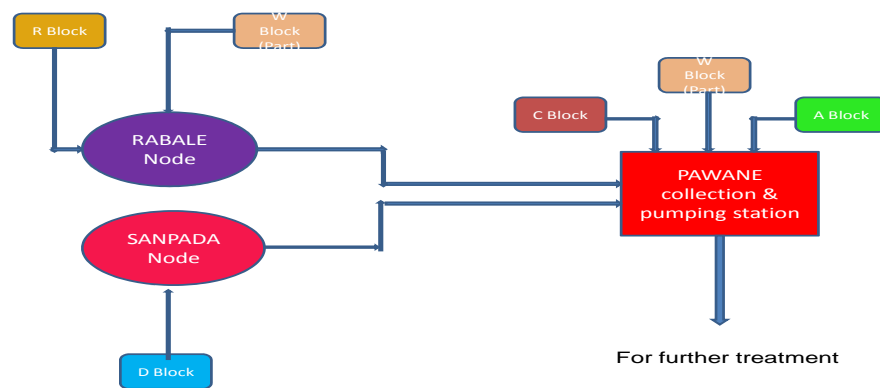


Figure 1 Schematic diagram of effluent collection system

Table 1 Design & Inlet characteristics of CETP

Parameters	Design Basis		Acceptable Inlet characteristics
	12 MLD plant	15 MLD plant	
pH	2.0 to 6.2	4.0 to 7.0	5.5 to 7.5
BOD mg/L	3200	2000	900 to 1500
COD mg/L	1000	1000	400 to 900
TSS mg/L	340	340	100 to 300
Oil & Grease mg/L	170	170	25 to 75

3.0 Preliminary Treatment

Screening, Grit removal Process & Equalisation – Neutralisation process

The Pawane station has preliminary treatment facilities wherein the floating material was removed with the help of screens provided. The combined wastewater received was passed through coarse bar screen, this has a pore size of about 40mm (dia.), and then it passes through the fine screen which has a pore size of about 20mm. Next it passes through the grit chamber which takes care of removal of the grit that the effluent had carried along with it. After this the equalisation tank ensures that the proper mixing of the effluent takes place this was done with the help of surface aerators neutralisation was also done after monitoring the pH. There was separate equalisation cum neutralisation tank for 12 MLD plant & 15 MLD plant the 12 MLD plants equalisation tank was an underground tank with 2375 m³ capacity (2 Nos.) and had 2 Nos. surface aerators while the 15 MLD equalisation tank was constructed above ground and had a capacity of 2500 m³ (2 Nos.) and had blower system. Separate pumps were provided for pumping this effluent further to the CETP receiving station at Plot P - 60 the standby pumps were also provided.

3.1 Primary treatment

Inlet chamber, Flash mixer & Clariflocculator

The equalized effluent was passed through the inlet chamber to reduce turbulence of the effluent and also to maintain a constant flow the inlet chamber of 12 MLD plant was of 8 m³ capacity and that of 15 MLD plant was 10 m³ and the retention time was 52 Sec. & 58 Sec. respectively. Addition of poly-aluminum chloride and poly electrolyte was dosed in the flash mixer the agitator further provided good mixing. The 12 MLD plant had capacity of 6 m³ & 15 MLD of 10 m³ and the retention time was 39 Sec. & 58 Sec. respectively. Industrial effluents contains large quantities of colloidal particles which had very less settling value and it was practically impossible to eliminate them by plain sedimentation within a short period of detention, hence the process of clariflocculation was carried the PAC & polyelectrolyte added earlier helped for coagulation and separation of suspended solids. During this primary treatment partial reduction in COD & BOD was obtained due to the separation/removal of organic matter adhered with suspended and colloidal matter. The clariflocculator capacity was 1716 m³ & 1980 m³ for 12 MLD & 15 MLD plants with retention time of 3.5 hr & 3.17 hr respectively. The treated effluent from the clariflocculator was fed to the secondary treatment facility.

3.2 Secondary Treatment

Aeration Tank, Secondary clarifier & Sludge Disposal system

Biological process involves extended aeration activated sludge process. The aeration tank with 15 fixed aerators provided the necessary oxygen. During operation MLSS level was maintained at 3000 to 4000 mg/L. The MLSS was regulated by controlling the SVI, the biological floc comes in contact with incoming effluent under highly aerobic environment, provided by the aerators. The optimum pH for this reaction was between 7.5 to 8.0. The effluent from the aeration tank flows to clarifier by gravity, the advantage of extended aeration system was that it ensured minimum sludge production which was highly stabilized along with excellent quality of treated effluent. The provision of nutrient dosing to this biological tank was also provided. The capacity of aeration tank was 15500m³ for 12 MLD plant & 16000 m³ for 15

MLD plant and the retention time was 31.5 hrs & 25.6 hrs respectively. The separation of biomass was achieved in final clarifier which was provided with scrapping mechanism to push the settled sludge into the hopper, from the hopper the sludge was pumped into the distribution box and excess sludge was pumped to the sludge sump. The capacity of secondary clarifier was 2643 m³ & 3200 m³ for 12 & 15 MLD plants and the retention time was 5.25 hrs & 5.12 hrs. The settled biomass from the final clarifier was recirculated to aeration tank to maintain the mixed liquor suspended solids concentration. The dimensions of various units are shown in table 2. The treated effluent from the final clarifier as an overflow was discharged through treated effluent disposal chamber to the Trans Thane creek, a part of the Arabian Sea. Diffusers were provided at the outlet point for proper diffusion of the treated wastewater into the sea. The sludge sump receives chemical sludge from the clariflocculator & biological sludge from the clarifier. The thickener then thickened the sludge a scrapping mechanism was provided for scrapping the sludge settled at the bottom towards the hopper. The sludge was then fed to the decanter and then to the sludge drying beds for dewatering and drying. The thickened sludge was dried on the sludge drying beds, under drain of which was connected to the filtrate sump. The dried sludge was then disposed to TTCWMA the total sludge collection was approximately 150 T per month.

Table 2 Details of various units of CETP

Sr.No.	Units	12 MLD Plant		15 MLD Plant	
		Capacity (m ³)	Retention Time	Capacity (m ³)	Retention Time
1	Equalisation tank	2375x 2 Nos.	4.5 hrs.	2500x2 nos.	4.0 hrs.
2	Inlet chamber	8	52 sec.	10	58 sec.
3	Flash mixer	6	39 sec.	10	58 sec.
4	Clariflocculator	1716	3.5 hrs.	1980	3.17 hrs.
5	Aeration tank	15500	31.5 hrs.	16000	25.6 hrs.
6	Clarifier	2643	5.25 hrs.	3200	5.12 hrs.
7	Sludge sump	70	--	125(2 Nos.)	--
8	Thickener	280	--	310(2 Nos.)	--
9	Filtrate sump	45	--	160	--
10	Sludge drying beds	400 Sq.m x 7 Nos.	--		--
11	Decanter	1 No.	--	1 No.	--

Source: - CETP (Thane-Belapur) Association

4.0 Details of CETP member units

There are about 3200 unit members of this CETP comprising of small, large & medium scale units. The amount of effluent and the type of effluent generated from each unit is also different and also varies daily depending upon the type & quantum of production. The CETP association has units classified as i) SSI units, ii) MSI & LSI units and iii) Associate members.

There are 583 SSI user members, the wastewater is to be subjected to primary treatment in terms of pH, degreasing & detoxification if any, and these units discharge primarily treated effluent into inlet of CETP. The MSI/LSI units amount to 92 these units have to undertake primary & secondary treatment and discharge treated effluents

to CETP after meeting inlet norms. The LSI & MSI units have to treat their effluent completely and have to discharge their treated effluents into CETP collection chamber as hydraulic load; they have to pay a fixed cost per month and additional cost as per the quantum of effluent generated. If the COD of these units is found in excess of that prescribed in the MPCB consent an additional organic cost as COD/ kg of organic load is charged. Other than this there are 2433 non user members (Associate members) these members are those who do not generate any industrial wastewater. Their domestic effluent is accepted by CETP as hydraulic load which helps in dilution. The members have to pay one time capital contribution charges.

5.0 Methodology for performance evaluation & overall efficiency of CETP

The performance evaluation of the CETP was done by collecting data for the parameters such as pH, BOD, COD, Suspended solids and Oil & Grease. The data required for carrying out performance evaluation of the CETP was collected from 15/04/2009 to 15/05/2009 and the data was collected for the wastewater characteristics at inlet chamber (Raw influent) of CETP, after primary treatment (Clariflocculator outlet) and CETP treated effluent outlet (Clarifier outlet). The data collected was of composite samples. This was then processed to calculate the overall efficiency of the plant. The summary of the study is shown in Table 3. The unit wise removal efficiency of all the units was found to be satisfactory and all the parameters are within the MPCB prescribed norms. The average overall removal efficiency of BOD was found to be 91.69%, that of COD was 85.29% and that of TSS was 88.07%. The pH and oil & grease of the treated effluent were also found to be well within the MPCB prescribed limits and pollutants like heavy metals were found to be below detectable levels. The CETP was operating properly and is meeting the statutory requirements, also the overall efficiency was found to be very good. The CETP had the capacity to further improve upon its operations to treat the wastewater to reusable /recycle levels and in turn saves the precious natural resource which is fast depleting.

Table 3 Summary of percent reduction & overall efficiency of CETP

Parameter	In mg/L	Raw Influent	Treated Effluent	% Reduction
BOD	Average	545.48	45.48	91.69
	Maximum	610	65	93.68
	Minimum	475	30	88.98
COD	Average	1420.16	208.71	85.29
	Maximum	1570	240	88.49
	Minimum	1210	165	83.33
TSS	Average	223.06	26.61	88.07
	Maximum	250	35	91.67
	Minimum	170	20	85.71
O&G	Average	7.63	2.26	70.31
	Maximum	7.8	2.5	74.03
	Minimum	7.4	2	67.95
pH	Average	7.46	6.98	All readings except pH are in mg/L
	Maximum	7.8	7.1	
	Minimum	6.9	6.2	

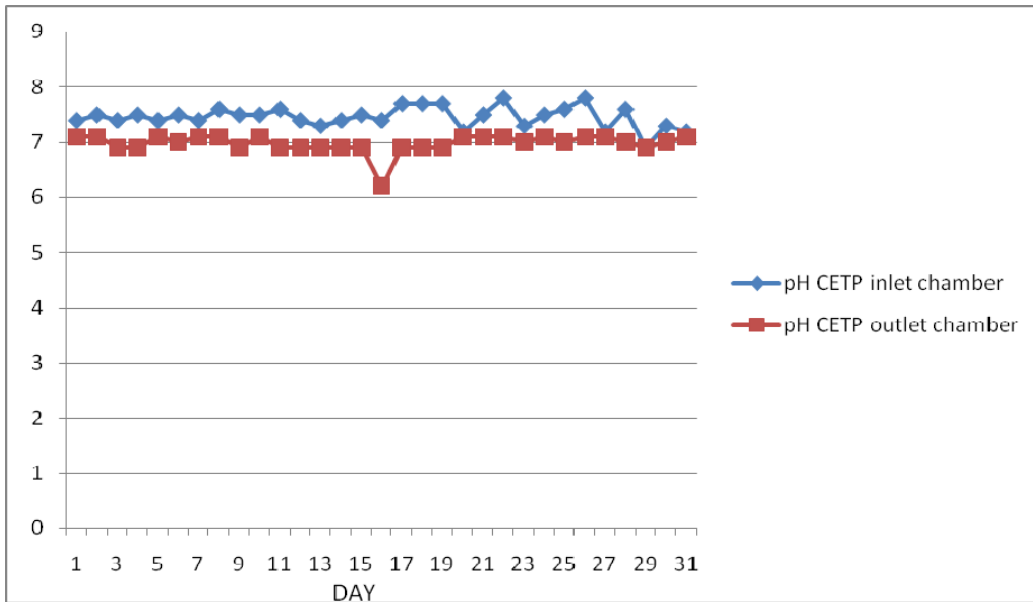


Figure 2 Plot of pH Vs Time for CETP inlet & outlet

It was observed that the MPCB norms were achieved and the pH range for inlet also signifies that the unit members also adhere to the CETP inlet (receiving) norms.

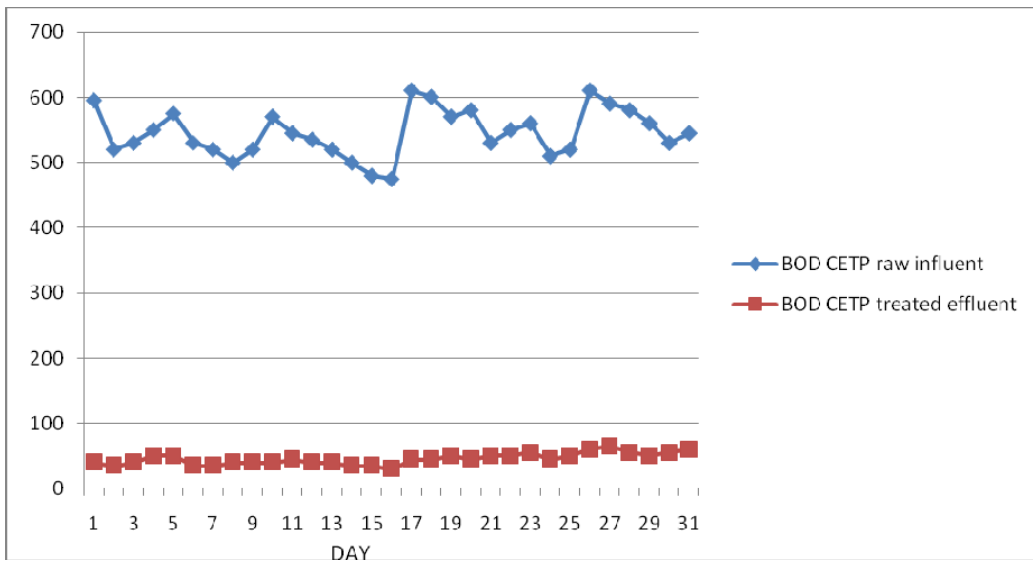


Figure 3 Plot of BOD Vs Time for CETP inlet & outlet

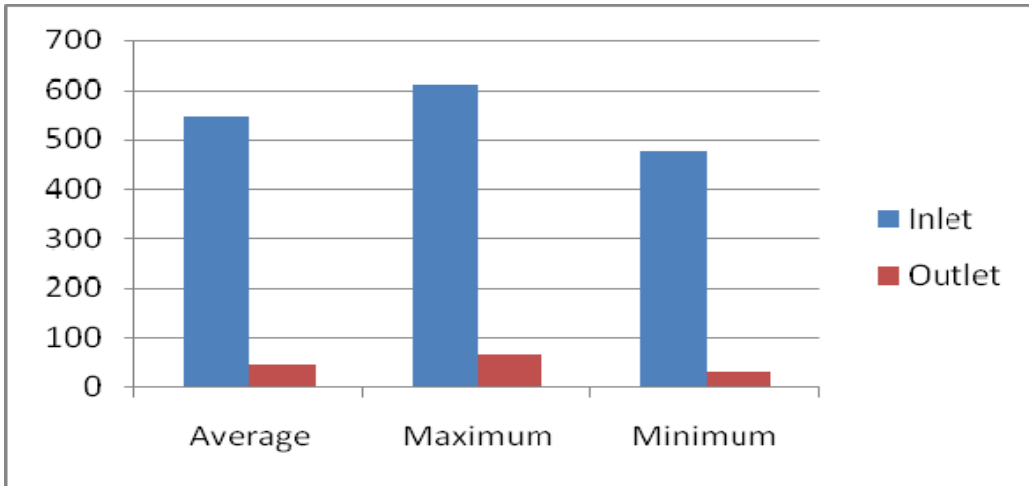


Figure 4 Plot of average, maximum and minimum BOD for CETP inlet & outlet

From the above plot it was observed that the BOD of the raw influent was in the range of 610 to 475 and the BOD of treated effluent was in the range of 65 to 30 which was well within the MPCB prescribed limits. The average overall percent reduction was found to be 91.69%

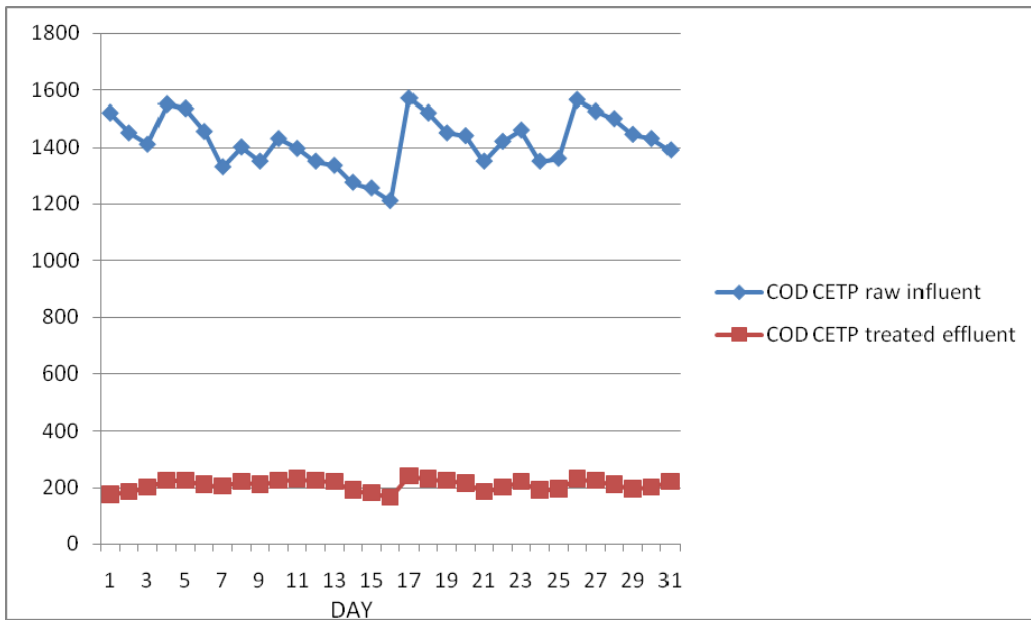


Figure 5 Plot of COD Vs Time for CETP inlet & outlet

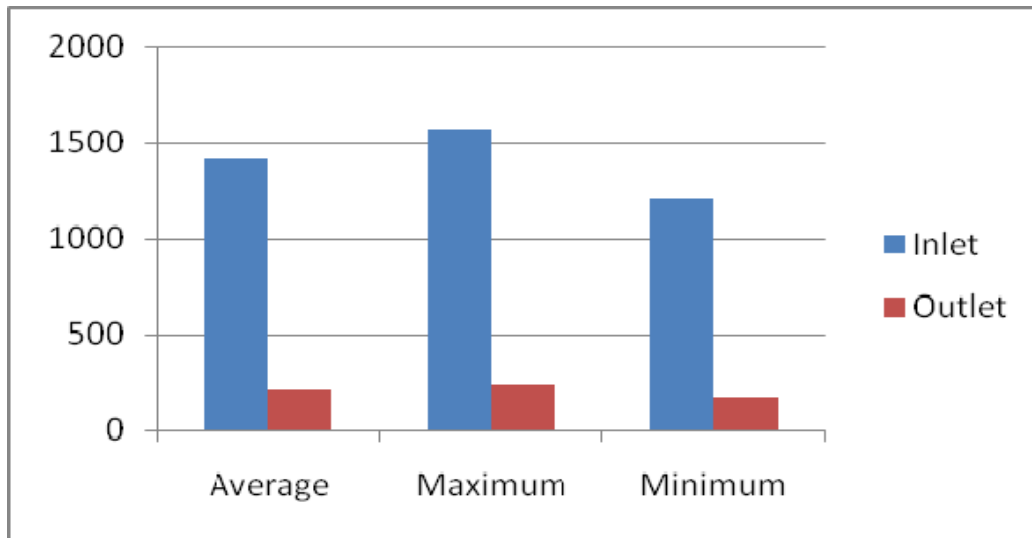


Figure 6 Plot of average, maximum and minimum COD for CETP inlet & outlet

From the above plot it was observed that the COD of the raw influent was in the range of 1570 mg/L to 1210 mg/L and the COD of treated effluent was in the range of 240 to 165 which was well within the MPCB prescribed limits. The average overall percent reduction was found to be 85.29%

6.0 Results & Discussion

Monsoon Problems

During monsoon it was a general complaint from the residents of Navi Mumbai region that the nallas in their area were flooded with effluent from CETP/industries. The member units after treating the wastewater discharge it in CETP collection chamber from where it was collected in a common chamber of that node. The pipe line network was made of stoneware (SW) and cement pipes. During monsoon season the outside water (surface runoff/water logging) entered this network system which leads to overflow of the effluent. This effluent then mixed with the storm water in the nallas of the city imparting colour to this mixture of effluent & storm water. Many a times the repair work could not be carried due to flooded chambers. **Recommendation**

In this case it was recommended that the entire underground pipe lines carrying effluent be replaced with HDPE lines to prevent leakage and percolation problems occurred during the monsoon season. This will ensure that there would not be any overflow in the chambers and the nallas of the city would not receive any polluted or coloured water. It was also suggested that while laying the HDPE lines one should also plan to lay parallel return line for recycling the treated effluent back to its members. This will prevent excavation work in future and would also result in cost saving. Laying of return/ recycle lines would also be a motivating factor to the management to treat the effluent to reusable standards.

Shock Loading Problems

This was also a major cause of concern for the CETPs as sometimes the unit members accidentally or knowingly discharges their untreated or partially treated effluent into the CETP collection. This chamber is sometimes shared by one or more units; the effluent from this section then flows to the common collection tanks of their respective nodes. As of now the CETP team collects sample at the receiving station every hour to check the incoming pH, when ever there is discrepancy backtracking is carried out.. This was done by collecting samples at different nodes and whichever node showed abnormality the team again moved further down the stream to check the pH values at the common chambers and then further down to the individual chambers to track the defaulter. The complete process was cumbersome and sometimes it was difficult to identify the defaulter because by the time the team reached the individual chamber the defaulter would have discharged the untreated effluent.

Recommendation

In this case it was recommended that the CETP installs sensor based system which automatically sends an alarm to the CETP control room of the abnormality in a particular chamber. This system had a sensor based pH meter which registered the pH of the incoming stream online and was programmed in such a fashion that as and when it registered a pH value out of the prescribed limits it will send a signal to the CETP control room. The vigilance team in this case would directly reach the exact chamber which had registered abnormality. It can then pin point the defaulter and would also had substantial evidence against the unit as the online registration of its pH values would have been recorded. This allowed the CETP vigilance team to be stationed at the control room and rush to the exact location in time rather than spending time in back tracing each and every single stream. It was also recommended that the CETP team should divert this effluent stream from that particular node to a separate collection tank where this can be separately treated. The CETP can levy additional cost required to treat this stream from the defaulter. The cost required for installing such online monitor units can be shared between the CETP and its members. This system ensures that the defaulter can be penalised and dealt with separately and it also saves time. Also by diverting the stream to a separate collection tank and treating it separately ensures safety of the complete loop and also save the cost that would have been required to rectify the system and additional irreparable damage.

7.0 Conclusion

The removal efficiency of all the units of CETP was found to be satisfactory and all the parameters were within the MPCB prescribed norms. The average overall removal efficiency of BOD was found to be 91.69%, that of COD was found to be 85.29% and TSS was found to be 88.07%. Other parameters like pH and oil & grease of the treated effluent was also found to be well within the prescribed limits. Pollutants like heavy metals were found to be below detectable levels. Table 4 shows the characteristics of treated effluent and the corresponding MPCB norms.

Table 4 Comparison of actual range & average with MPCB norms

Sr.No.	Parameter	MPCB Norms	Actual Range	Actual Average
1	pH	5.5 TO 9.0	7.1 – 6.2	6.98
2	BOD	100	65 - 30	45.48
3	COD	250	240 - 165	208.71
4	TSS	100	35 – 20	26.61
5	O&G	10	2.5 – 2.0	2.26

All the values are in mg/L, except pH

From Table 4 it can be observed that the CETP was operating properly and is meeting all the statutory requirements, also the overall efficiency was found to be good. The CETP has the capacity to further improve upon its operations to treat the wastewater to a level where it can be reused and can save the precious natural resource which is fast depleting.

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Appendix

The data collected from 15/04/09 to 15/05/09 for raw influent (CETP inlet) was as follows

Date	Flow in MLD	Inlet characteristics				
		Inlet chamber				
		pH	BOD	COD	O& G	TSS
15-04-2009	27	7.4	595	1520	7.6	240
16-04-2009	27	7.5	520	1450	7.6	240
17-04-2009	27	7.4	530	1410	7.6	230
18-04-2009	27	7.5	550	1550	7.8	250
19-04-2009	27	7.4	575	1535	7.8	240
20-04-2009	27	7.5	530	1455	7.7	230
21-04-2009	27	7.4	520	1330	7.5	220
22-04-2009	27	7.6	500	1400	7.6	240
23-04-2009	27	7.5	520	1350	7.6	220
24-04-2009	27	7.5	570	1430	7.7	240
25-04-2009	27	7.6	545	1395	7.6	230
26-04-2009	27	7.4	535	1350	7.5	220
27-04-2009	27	7.3	520	1335	7.5	220
28-04-2009	27	7.4	500	1275	7.4	190
29-04-2009	27	7.5	480	1255	7.4	180
30-04-2009	27	7.4	475	1210	7.4	170
01-05-2009	27	7.7	610	1570	7.8	240
02-05-2009	27	7.7	600	1520	7.8	230
03-05-2009	27	7.7	570	1450	7.7	210
04-05-2009	27	7.2	580	1440	7.7	210
05-05-2009	27	7.5	530	1350	7.6	200
06-05-2009	27	7.8	550	1420	7.6	220
07-05-2009	27	7.3	560	1460	7.7	230
08-05-2009	27	7.5	510	1350	7.6	210
09-05-2009	27	7.6	520	1360	7.6	220
10-05-2009	27	7.8	610	1565	7.8	245
11-05-2009	27	7.2	590	1525	7.8	245
12-05-2009	27	7.6	580	1500	7.7	240
13-05-2009	27	6.9	560	1445	7.6	220
14-05-2009	27	7.3	530	1430	7.6	225
15-05-2009	27	7.2	545	1390	7.5	210

All readings except pH are in mg/L

The data collected after primary treatment i.e. clariflocculator outlet was as follows

Date	Flow in MLD	After primary treatment				
		Clariflocculator outlet				
		pH	BOD	COD	O& G	TSS
15-04-2009	27	7.3	515	1410	7.5	65
16-04-2009	27	7.4	500	1350	7.4	65
17-04-2009	27	7.3	470	1300	7.4	60
18-04-2009	27	7.4	480	1400	7.5	65
19-04-2009	27	7.3	485	1410	7.5	65
20-04-2009	27	7.3	460	1300	7.4	60
21-04-2009	27	7.2	440	1210	7.3	50
22-04-2009	27	7.2	460	1320	7.5	65
23-04-2009	27	7.3	450	1250	7.4	55
24-04-2009	27	7.2	460	1340	7.5	70
25-04-2009	27	7.2	430	1280	7.4	55
26-04-2009	27	7.2	410	1260	7.4	50
27-04-2009	27	7.2	400	1230	7.4	50
28-04-2009	27	7.2	380	1180	7.3	50
29-04-2009	27	7.3	370	1150	7.3	45
30-04-2009	27	7.2	330	1120	7	45
01-05-2009	27	7.7	550	1440	7.4	70
02-05-2009	27	7.4	540	1410	7.4	65
03-05-2009	27	7.4	550	1360	7.4	80
04-05-2009	27	7.2	510	1310	7.3	55
05-05-2009	27	7.3	480	1230	7.3	50
06-05-2009	27	7.4	560	1330	7.4	60
07-05-2009	27	7.5	560	1340	7.5	60
08-05-2009	27	7.6	460	1230	7.4	55
09-05-2009	27	7.7	475	1250	7.4	55
10-05-2009	27	7.6	560	1440	7.5	60
11-05-2009	27	7.1	550	1420	7.6	60
12-05-2009	27	7.2	530	1380	7.5	55
13-05-2009	27	7.3	500	1330	7.4	55
14-05-2009	27	7.3	520	1350	7.5	55
15-05-2009	27	7.3	480	1260	7.4	50

All readings except pH are in mg/L

The data collected of treated effluent (CETP outlet) was as follows

Date	Flow in MLD	outlet characteristics				
		Sec. Clarifier outlet				
		pH	BOD	COD	O& G	TSS
15-04-2009	27	7.1	40	175	2	20
16-04-2009	27	7.1	35	185	2.3	25
17-04-2009	27	6.9	40	200	2.3	25
18-04-2009	27	6.9	50	225	2.4	30
19-04-2009	27	7.1	50	225	2.4	30
20-04-2009	27	7	35	210	2.3	25
21-04-2009	27	7.1	35	205	2.2	20
22-04-2009	27	7.1	40	220	2.4	30
23-04-2009	27	6.9	40	210	2.3	25
24-04-2009	27	7.1	40	225	2.4	30
25-04-2009	27	6.9	45	230	2.4	30
26-04-2009	27	6.9	40	225	2.4	30
27-04-2009	27	6.9	40	220	2.3	25
28-04-2009	27	6.9	35	190	2.2	20
29-04-2009	27	6.9	35	180	2	20
30-04-2009	27	6.2	30	165	2	20
01-05-2009	27	6.9	45	240	2.4	30
02-05-2009	27	6.9	45	230	2.4	30
03-05-2009	27	6.9	50	225	2.3	30
04-05-2009	27	7.1	45	215	2.2	25
05-05-2009	27	7.1	50	185	2.2	25
06-05-2009	27	7.1	50	200	2.3	30
07-05-2009	27	7	55	220	2.4	30
08-05-2009	27	7.1	45	190	2.2	25
09-05-2009	27	7	50	195	2.2	25
10-05-2009	27	7.1	60	230	2.5	35
11-05-2009	27	7.1	65	225	2.5	30
12-05-2009	27	7	55	210	2	25
13-05-2009	27	6.9	50	195	2	25
14-05-2009	27	7	55	200	2	25
15-05-2009	27	7.1	60	220	2.3	30

All readings except pH are in mg/L