Performance Evaluation of Common Effluent Treatment Plant at Jetpur Dyeing and Printing Association

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Abstract— The aim of this study is to evaluate the performance of common effluent treatment plant located at: Survey No. :782/p & 783/p, Narsang Tekri, Jetpur: 360 370. District: Rajkot, Operates a Common Effluent Treatment Plant (C. E. T. P.). These plants majorly treat effluent from Textile dyeing and printing industries. Water samples were collected at influent and effluent of treatment plant and analyzed for the major water quality parameters viz. pH, biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS) and total dissolved solids (TDS). The overall performance of treatment plant was calculated. The generated data shows that CETP has been working with the norms of Gujarat Pollution Control Board and meeting the discharge standard limits.

Key words: Effluent Treatment Plant, Waste Treatment

I. INTRODUCTION

Protection of water environment calls for waste treatment before its disposal into inland water bodies or as land irrigation. Secondly, water is a precious commodity and therefore must be conserved. In view of this it is necessary to treat wastewater for reusing or recycling it[1]. Both types of wastewater viz. municipal sewage and industrial waste water need to be treated so as to confirm the discharge conditions as stipulated in consent given by Central or State Pollution Control Board. Bulk of the industrial pollution in India results from small scale industries. The large-scale industries generally have their own treatment plants. If not, they at least do not have financial, manpower and land availability constraints for installation and maintenance of the treatment plants. A common effluent treatment plant serves many industries mostly small and medium scale industries.[5] In a common effluent treatment plant, the effluents from the different industries are treated using one universal treatment system. Common effluent treatment plants eliminate duplicity of treatment systems among the industries on the industrial estate and hence results in a reduction in the total capital required for construction of the industrial estate.[10] Common effluent treatment plants also allow better monitoring and control of effluent quality. In some cases, wastewater from some industries may require pretreatment before it is allowed to enter may enter the common effluent treatment plant. This may be necessary because of a high pollution concentration produced by a specific industry or perhaps the presence of a specific group of toxins not treated by the common effluent plant.

Jetpur is small town about 70 kms away from Rajkot on Rajkot Junagadh National Highway No. 8B with a population of 1.25 Lakh. Though a small town, Jetpur is famous all over India for its Textile Dyeing and Printing units. The textile processing units were developed as cottage industries and today there are about 1159 units existing in the town. Earlier to the construction of CETP, the effluent the printing units and the sewage from the town were discharge directly in to the Bhadar River, a perennial river on whose banks Jetpur and Navagadh is located. This unthoughtful disposal of the colored wastewater caused serious damage not only to the surface water, it also polluted the ground water. The printing industries then realized the grave problem of water pollution and formed an association under which a scheme was developed to treat effluent in a CETP after combing it with the sewage of Jetpur and then utilize for irrigation purpose. There by making the whole Jetpur as a zero discharge town.

II. MATERIALS AND METHODS

Samples were collected from the two sampling locations i.e. from the influent and effluent of the plant. Before collection of samples containers were rinsed with the samples being collected. Grab type sampling technique was used to collect the samples. Collected samples were analyzed for the parameters pH, BOD, COD, TSS, and TDS. As possible samples were analyzed on the same day whenever it was possible; otherwise these samples were preserved at 4oC. Analysis was done in the laboratory by determining various parameters according to "standards methods for examination of water and waste water

III. TREATMENT UNITS

Following treatment units are provided in CETP for the treatment of industrial effluent. **Primary Treatment**

A. Neutralization of Raw Effluent

Contents of the filled equalization tank are tested for pH. A lime slurry is prepared in lime tank is then drained by the equalization tank effluent while under mixing with aeration to neutralize. The pH is bought to approximately 7.0 (between 6.0 & 8.0). The contents of equalization tank are continued under mixing for further 30 minutes.

B. Primary Clarification

Neutral contents of equalization tank which are under aeration or mixing are pumped with one of the feed pumps to flash mixer through floculator continuously. Alum or polyelectrolyte solution is dosed from the tank continuously at a predetermined rate. Contents of the flash mixer are allowed to further flow to floculator. Suspended solids are allowed to form flocs to facilitate settling in primary settling tank. Contents of floculator, with flocs of suspended solids are further flown to primary settling tank. With the help of sludge scrapping mechanism in the primary settling tank suspended solids flocs are settle down and clear effluent is further overflown for secondary treatment. Settled solids in the primary settling tank are removed by gravity through the bottom opening, in the form of slurry and are drained from time to time to one of the sludge drying beds. Solids area

allowed to dry by solar evaporation. Dry solids are removed manually and filled in suitable containers for further disposal. Filtrate from the sludge drying beds is taken to equalization tank along with raw effluent for treatment.

C. Secondary Treatment

Effluent from Primary treatment transferred into Secondary treatment. The suspended solids and BOD are removed in this treatment. Activated Sludge process is carried out in this process. The Aeration tank is provided for removal of BOD. 95 % BOD is remove in this tank. And waste water transferred into the secondary tank and remove suspended solids. Food to Microbes ratio maintain in the aeration tank. Nitrates and phosphates are provided as nutrients. The MLSS in aeration tank is 3500 to 4500. And F/M ratio is 0.2 to 0.4 maintain in aeration tank. In solids are settled in secondary tank recycled in aeration tank.

IV. RESULTS AND DISCUSSION

The main objective of present work is to evaluate integrated performance of common effluent treatment plant by studying influent and effluent characteristics of the plant. The effluent which is coming from the various industries contains high pH, COD, BOD, TDS etc. An understanding of nature of waste water is essential in the design and operation of collection, treatment and disposal facilities. The results obtained in the present study after analyzing influent and effluent of CETP are discussed as follows.

A. pH

Measurement of pH is one of the most important and frequently used tests in water chemistry. Determination of pH is one of the important objectives in treatment of waste water. [4]. pH of water drastically changes with time due to the exposure to air, biological activity and temperature changes. Significant changes in pH occur due to disposal of industrial waste. In natural waters pH changes due to variation in photosynthetic activity which increases the pH consumption of CO2 in the process. Most chemical and biological reactions occur at a narrow range of pH.In anaerobic treatment if the pH goes below 5 due to excess accumulation of acids the process is severely affected. Shifting of pH beyond 5 to 10 upsets the aerobic treatment of waste. In these circumstances pH can be adjusted by addition of suitable acid or alkali to optimize the treatment of waste. In the present study it is found that influent pH value for CETP is in between 7.5 to 9.0 while for the effluent the pH between 6.5 to 8.5 which is slightly fluctuating towards the alkaline side. The variation in the pH occurs due to the high degree of variability in the quality as well as variations in the flow rates of industrial waste. These values are within the limit (5.5 to 9.0) set up by pollution control board.

B. Total Suspended Solids

Many industrial operations contribute turbidity and settleable solids to water with resulting bottom deposits which affects aquatic life in varying severity. Fine particulate matter which remains in suspension can limit the penetration of light, thus restricts the growth of attached bottom aquatic plants as well as floating or weekly swimming algal forms which are photosynthetic organisms depending upon light for their existence. Also solids floc, planktonic algae and animals carry them to bottom where they die. Thus in limiting growth of aquatic plant medows, food chains is interrupted, resulting in sparity of animal life.

C. Total Dissolved Solids

High TDS in treated effluent is a widespread problem in many CETPs. It is observed that salinity, primarily due to salts of sodium, is the primary contributor to the high TDS problem as high TDS is almost invariably accompanied by high chlorides and sodium concentration.[6] The TDS concentration of the wastewater is mainly due to the inorganic ions in the water supply and those added during the use of water. In industries such as tanneries, pharmaceutical units, chemicals manufacturing units and dye and dye intermediate units, the high TDS in wastewater can be primarily attributed to addition during the use of water.[10] In such cases the best approach for reduction of TDS is to try reduction at source by adopting cleaner technologies for reduction of net input of chemicals, practicing recovery and recycling of chemicals. The chemical treatment adopted in the treatment scheme at CETP generally does not specifically aim at removing these ions. Therefore, reduction in the TDS concentration of the effluent during its treatment is not expected. Here, CETP at is able to comply with the prescribed limit for TDS for the treated effluent .The TDS concentration in effluent in CETP is in the range of 710 to 1800 mg/l.

D. BOD

The amount of oxygen required by the micribial activity to oxidise and stabilise the decomposable organic matter is called the biochemical oxygen demand .The biochemical oxygen demand (BOD) determination is an empirical test in which standardized laboratory procedures are used to determine relative oxygen requirements of wastewater. The test has widest application in measuring waste loading to treatment plants and evaluation of BOD removal efficiency of such treatment systemsThe test has its limitations but still used extensively and is useful for determining approximately how much oxygen will be removed from water by an effluent or how much may be required for treatment and to estimate size of the treatment plant needed. From the result it is found that,the influent from Dombivali CETP having BOD in the range of 290 to 510 mg/l. For the effluent BOD value for CETP is in the range of 30 to 90 mg/l.If we consider inland surface water limit(30 mg/l) then both CETPs effluent BOD exceeds the limit but for other limits like discharge on land for irrigation and for discharge into marine coastal area (100 mg/l) these values are within limit

E. COD

The chemical oxygen demand (COD) is use as a measure of the oxygen equivalent of the organic matter content of a sample that is susceptible to oxidation by strong chemical oxidant. The COD test is used to measure the content of organic matter of both wastewater and natural water. The oxygen equivalent that can be oxidized is measured by using a strong chemical oxidizing agent such as potassium dichromate in an acidic medium. The COD test is also used to measure organic matter in industrial and municipal waste that contain compounds that are toxic to biological life. In

general the COD of the waste is higher than BOD because more compounds can be chemically oxidized that can biologically oxidized. In the present study, influent from CETP having COD is in the range of 1040 to 1320 mg/l.The COD of effluent of CETP is between 190 to 340 mg/l.

V. COMPARISON OF RESULTS WITH CPCB STANDARDS

Following table is showing maximum, minimum and average values of parameters at the effluent of CETP during the study, percentage reduction after treatment and their comparison with CPCB standards. All values are in mg/l except pH.

Sr No.	Parameter	Max.	Min.	average	Percent Removal	CPCB limit
1.	pH	8.5	6.5	7.44	-	5.5 to 9.0
2.	TSS	160	30	78.8	79.81%	100
3.	TDS	1800	710	1070.4	21.97%	2100
4.	BOD	90	30	51.2	86.63%	100
5.	COD	340	190	244.4	79.27%	250

Table 1:

VI. CONCLUSIONS

The study indicates that all major pollutants were reduced in the wastewater after treatment. The pH, BOD, COD, TSS and TDS at the influent were recorded to be 7.92, 381 mg/l, 1177.2 mg/l, 382.4 mg/l, 1368.4 mg/l for CETP. While the average values of the same parameters in the effluent were 7.12, 51.2mg/l, 244.4 mg/l, 78.8 mg/l, 1070.4 mg/l respectively. The BOD and COD values were reduced to much extent which shows the removal of organic content. The percentage removal of TDS was found to be comparatively low than other parameters. The study indicates that all major pollutants were reduced after the treatment and the effluent values for both CETPs were well within limit of discharge into the creek as per GPCB and CPCB standards. Hence study concludes, CETP under study is operated with the norms given by the GPCB and CPCB.

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