COMPARATIVE ANALYSIS OF EFFLUENT FROM VARIOUS STP's WITH CPCB STANDARD IN GREATERNOIDA REGION

Submitted in the partial fulfillment of requirement for the award of the degree of

Master of Technology

in

Energy and Environmental Engineering

by

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GALGOTIAS UNIVERSITY

GREATER NOIDA

MAY 2020

ACKNOWLEDGEMENT

I am highly grateful to **Prof**. (**Dr) Manju Dominic**, Dean of the School of Civil Engineering for giving me her advice and facilities for the successful completion of my research work.

It give me great to express my deep sense of gratitude and indebtedness to my guide **Mr. MOHD AYUB YASIN,** Asstt. Professor, School of Civil Engineering for his val guidance, support and encouraging mentality throughout the project. I am highly obliged to him for providing me with this opportunity to carry out the ideas and work during my project period and helping me to gain the successful completion of my project.

I am also highly obliged to **Mr. Deepak Kumar Soni**, project coordinator and **Mr. Sushil Kumar,** project co-coordinator for providing me with his support and their valuable encouragement throughout my project.

My special thanks are going to all of faculties and staff of the School of Civil Engineering, Galgotias University for encouraging me constantly to work hard in this project. I pay my respect and love to my parents and all other family members and friends for their help and encouragement throughout this course of project work.

CERTIFICATE

This is to certify that the project work entitled **"Comparative analysis of effluent from various STPs with CPCB standard in Greater Noida region"** submitted by 18SOCE2020004 to the School of Civil Engineering, Galgotias University, Greaternoida for the award of the degree of **Master of Technology in Energy and Environmental Engineering** is a bonafide work carried out by him under my supervision and guidance. The present work in my opinion has reached the requisite standard, fulfilling the requirements for the said degree.

The results contained in this report have not been submitted, in part or full, to any other university or institute for the award of any degree or diploma.

(Mr. Mohd. Ayub Yain)	**(prof. (Dr) Manju Dominic)**
Asstt. Professor	**Dean,**
Guide	**School of Civil Engineering**

External Examiner

DECLARATION

I declare that this written submission represents my ideas in my own words and where other's ideas or words have been included. I have adequately cited and reference the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented any idea/fact/data/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke penal action from the source which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date:

Place:

ABSTRACT

The sewage treatment plays a vital role before disposing of the wastewater directly into a river or land. Therefore, proper sewage treatment should be given to wastewater or sewage. The need to perform this study is to examine whether the effluent from the sewage treatment plant complies with the general standard of the Central Pollution Control Board. In this study sewage samples were collected from the outlet of the treatment plant and analyzed the waste water quality parameters such as pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total suspended solids (TSS) and temperature. The conclusions draws from this study will determined the effluent discharged is under the permissible limit given by CPCB.

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CHAPTER 1

INTRODUCTION

1.1 General

Waste water is that water which has been affected by anthropogenic activities. Waste water is the water is the used of household, manufacturing, profit-making or farming actions, plane overflow water and any sewer inflow. So wastewater is a result of household, engineering, profit-making or farming actions. The distinctiveness of waste water varies depending on the resource.

Sewage management is a method to remove contaminants from municipal sewage water. The term sewage treatment plant is now a day’s often replaced with the word waste water treatment plant or wastewater management station. Physical, chemical and biological methods used to eliminate contaminants and create processed waste water (or processed effluent) that is protected adequate for discharge into the atmosphere.

1.1.1 Treatment- methods generally adopted by- STP

Manure prior to being liable stream the degree of treatment has been given depends on the source of disposal. Conservative wastewater management consists of unique processes and operations to eradicate solid items, macrobiotic material generally explain special rising action level are beginning, derived and tertiary and superior wastewater management. In few countries disinfections to remove pathogens from time to time follow the preceding action stride.

a) Preliminary Treatments:

This procedure simply consists of viewing for removing suspended supplies such as papers, rags, cloths, tree branches, etc. grit chamber or debris tanks for remove stones.

b) Primary Treatment

Occasionally, the beginning, as well as main treatments are classified together under primary treatment. This process consists of removing large suspended bio products and has a high BOD.

c) Secondary Treatment

This process involve an extra handling of the effluents from main sedimentation tanks. This is usually consummate during the natural decay of natural material that will be taken out one by aerobic or aerobic conditions. These organic bacteria shall be go moldy the fine organic matter to produce clearer effluent. The handling reactors, where the natural substance is shattered and steady by bacterial known as anaerobic biological units and many consists of anaerobic lagoons, septic tanks, Imhoff tank, etc.

d) The Final Treatment

The process is also known as tertiary treatment and it consists of remove the unrefined.

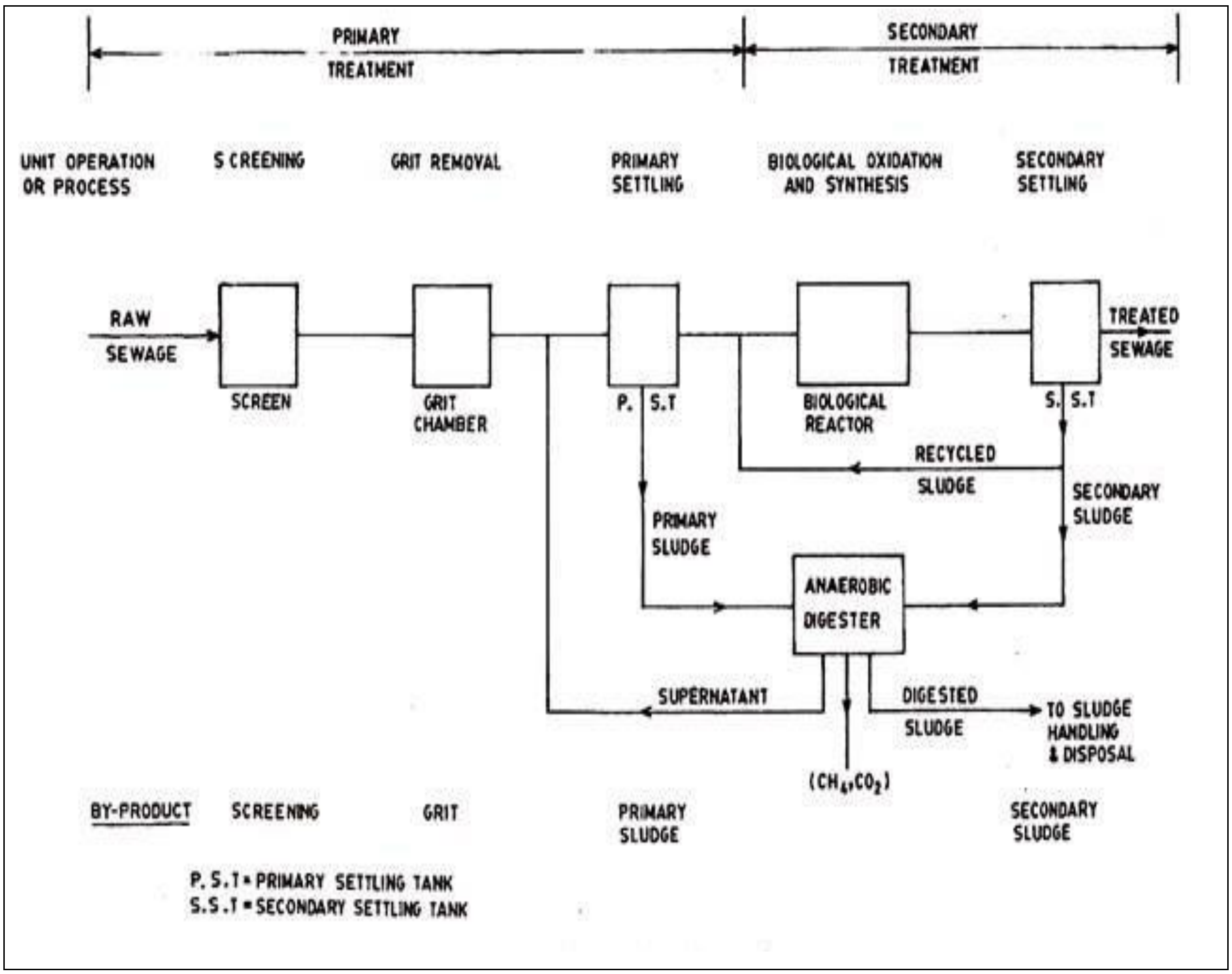

Fig.1 General flow diagram of the sewage treatment plant

1.2 Sewage Treatment Plants in Greater Noida

a) 137 MLD Sewage Treatment Plants based on SBR Technology

This sewage treatment plant is located at Kasna, Greaternoida, UttarPradesh. The present capacity of the sewage treatment plant about 137 MLD. This sewage treatment plant operates under HNB Engineering PVT.LTD. The sewage treatment plant at kasna consists of 6 sequencing batch reactor (SBR). The wastewater come through the inlet pipe after passes through fine screens bars it passes through the various treatment process it enter into SBR tank. After it, wastewater is driven for chlorination at the end of process. This treated water is used for different purpose and the remaining rest of water is drain into near nalla. The inorganic waste removed from grit chamber is used for fertilizer.

Specification of plant:-

- **Screens:** it consists 4 fine screen in which three works automatically and one is operated mechanically. The size of mechanically screen is 8mX1.6mX1.5m and it inclined 60° to horizontal with 20mm spacing between bars.
- **Reactor:** it consists 6 reactors and size of reactor is 70mX34mX5.2m+0.5FB
- BOD considered at inlet: 85 mg/l
- Total time required to complete of one cycle is 4 hrs.
- The 137 MLD treatment plant that discharge an effulient with follow parameters:
    1. Biological Oxygen Demand(BOD):≤10mg/l
    2. Chemical Oxygen Demand (COD): ≤ 50mg/L
    3. pH : 6.5- 9mg/L
    4. Total solid suspended(TSS): ≤10MG/L

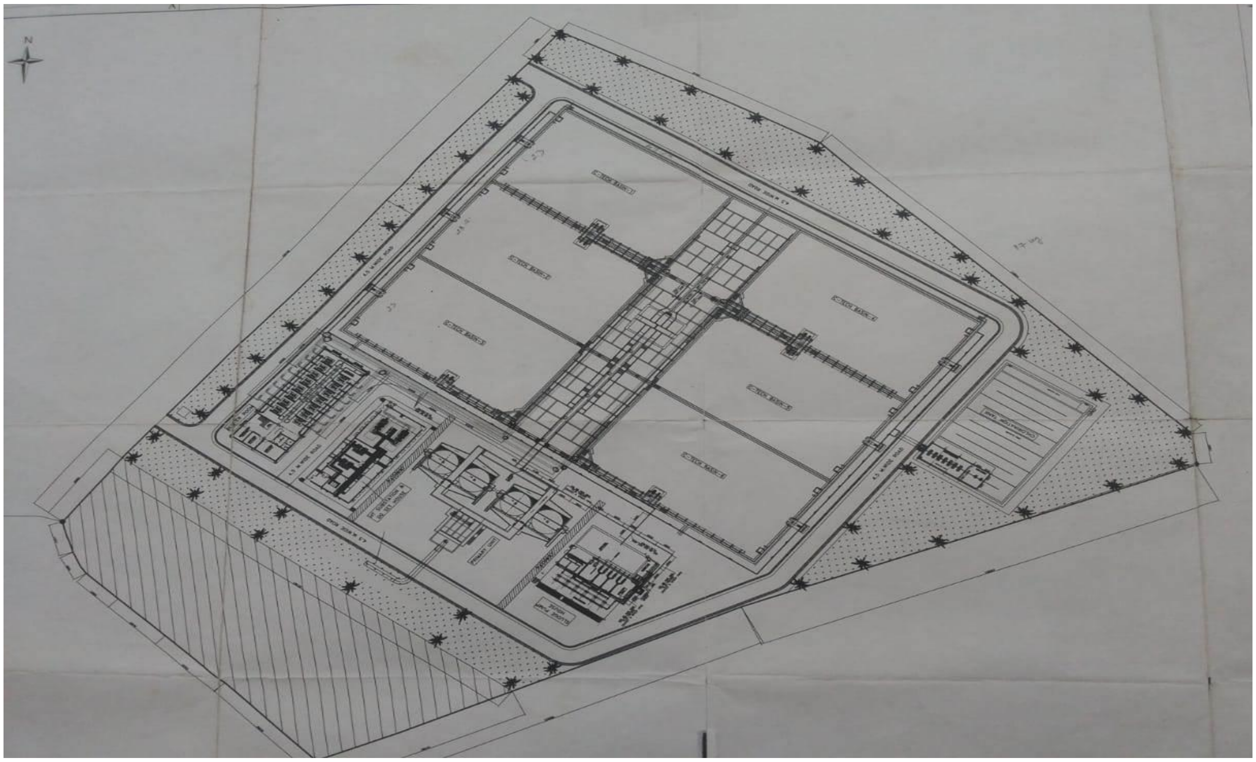

Fig 2. The layout of the sewage treatment plant at kasana

b) 15 MLD Sewage Treatment plant based on SBR Technology

This treatment plant is located at Ecotech II, Greater Noida, U.P. The present capacity of sewage treatment plant is 15 MLD and it operated under HNB Engineering Pvt. Ltd. This treatment plant also based on Sequential Batch Reactor (SBR).

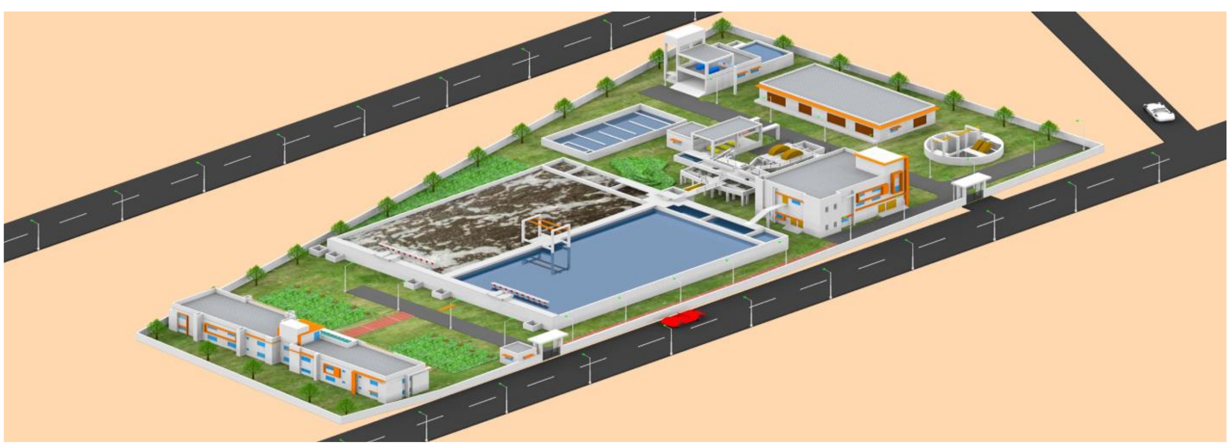

Fig 3. 15 MLD sewage treatment plant at Ecotech II

1.3 Objectives of the study

1. To get an analysis of the physicochemical parameters of the effluent of the sewage treatment plants and compare them with the CPCB standard.
2. To study the biological parameters of the effluent.

1.4 Need for study

Sewage treatment plays a vital role before disposing of the wastewater directly into a river or land. Therefore, proper sewage treatment should be given to wastewater or sewage. The need to perform this study is to examine whether the effluent from the sewage treatment plant complies with the general standard of the central Pollution control board. This study will help us to know which technique is better for the treatment of sewage and producing effluent of good quality.

CHAPTER 2

LITERATURE REVIEW

2.1 Efficiency evaluation of sewage treatment plants with different technologies in Delhi.

Priyanka Jamwal et.al (2008) carried out the study in which they examined the efficiency of sewage treatment plant that is located in Delhi. There were seventeen sewage treatment plant that treating the household wastewater which was examined over a time of year. These treatment plant basically, depend on the following treatment technologies such as ASP, Extended aeration, BIOFORE and oxidation pond. Result recommend that except Mehrauli STP which depend on the extended aeration process and oxidation pond, effluents from other STPs exceeded the FC standard of 103MPN/100 ml for unrestricted irrigation criteria set by the national river conservation directorate (NRCD). As a matter of fact, coordinated productivity (IEa) of every STP was assessed and contrasted and efficiencies relying on influent sewage attributes. The best outcomes were obtained for STPs employing extended aeration, BIOFORE and oxidation pond treatment process thus can be safely utilized for irrigation purposes.

2.2 Various methods involved in wastewater treatment to control water pollution

S.S. Turkar et.al (2011) conducted the study and observed that due to increasing the growth of industrial sector and urban area the problem occurred related to the disposal of waste. To resolve these problem many techniques are adopted for the treatment of the water. Water get contaminated to present of various organic, inorganic and biological bacterial. For the treatment of water most of technique was adopted such as activated carbon adsorption, chemical oxidation, biological treatment etc. The activated carbon adsorption involves the phase transfer of pollutants without decomposition into another pollution related problem.

2.3 A comparative study of sewerage treatment plants with different Technologies in the vicinity of Chandigarh city.

Prerna Sharma et.al (2013) studies that Chandigarh city has a well-planned underground network of pipes for the disposal of sewerage generated in the city. The sewerage system of the city has been designed by taking into account the natural slope of the city, which is from north to south. Chandigarh city hosts three Sewerage Treatment Plants (STP's) namely: STP "Diggian" located at sector 66 of S.A.S Nagar, Punjab Territory, Mohali, based upon MBBR (Moving Bed Biofilm Reactor) technology which is at a distance of about 4km from the nearest planned sector 47, STP Raipur Kalan located at a distance of 6km from Chandigarh adjoining to railway station based upon UASB (Upflow Anaerobic Sludge Blanket) technology and STP Raipur Khurd, based upon ASP (Activated Sludge Process) technology located on Chandigarh-Ambala highway at a distance ofapproximately 8 km from Interstate Bus Terminal sector 17, 1 km from Airport and 3 km from Railway Station. These plants are designed and constructed with an aim to manage wastewater so as to minimize orremove organic matter, solids, and other pollutants before it enters a water body.

In the present study, various Physico-Chemical and Biological Parameters are evaluated and are compared with the Central Pollution Control Board (CPCB) General Standards for the Discharge ofEnvironmental Pollutants Part–A: Effluents, into Inland Surface Water according to The Environment (Protection) Rules, 1986 Schedule-VI because the Effluent from these STP's enters river Ghaggar.Also, theperformance of each STP was evaluated in terms of Removal/Reduction Efficiency. Since out of 30 MGD of STP, Mohali 10 MGD treated wastewater is reused for Irrigation purpose in various gardens and lawns of Sector: 19, 20, 21, 29, 30, 33, 34, 36, 40, 42, 43, 44, 46, 47, 48, 51 and 52 of Chandigarh city therefore Average Effluent of this STP is compared with the CPCB Effluent Discharge Standards into Land for Irrigation.

It was observed according to the results obtained that BOD value of the Effluent of STP Raipur Kalan and Raipur Khurd was not under permissible limit during the duration of the study and Average Phosphate value of Raipur Khurd was exactly up to permissible limit according to Central Pollution Control Board (CPCB) General Standards for the Discharge of Environmental Pollutants Part –A: Effluents, into Inland Surface Water according to The Environment (Protection) Rules, 1986 Schedule-VI. According to the results obtained it was also revealed that all the Physico-Chemical and Biological Parameters evaluated for STP Mohali was under permissible limit according to CPCB Effluent Discharge Standards into Land for Irrigation and also into Inland Surface-water.

Also,it was revealed from the performance study that efficiency of the three STP’s mentioned above was poor with respect to removal of TDS (Total Dissolved Solids) in contrast to the removal /reduction efficiency in other parameters like TSS (Total Suspended Solids), BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand). The order of reduction efficiency was 1.TDS(39%) 2.COD(56%) 3.TSS(76%) 4.BOD(79%), 1.TDS(46%) 2.TSS(51%) 3.BOD(73%) 4.COD(78%) and 1.TDS(55%) 2.COD(75%) 3.TSS(78%) 4.BOD(88%) respectively in Raipur Kalan STP, Raipur Khurd STP and “Diggian”Mohali STP. In comparison with each other, out of the three STP’s, “Diggian” STP Located at Mohali showed better results for the effluent, its reduction efficiency for BOD is 88% and is highest among Raipur Kalan STP and Raipur Khurd STP which is 79% and 73% respectively. From the evaluation, it is further revealed that Mohali STP based upon MBBR technology has more stable results that Raipur Kalan STP, based upon UASB technology and Raipur Khurd STP, based upon ASP technology. The order of overall performance for the technologies studied in different STP’s is 1.MBBR 2.UASB 3.ASP which proves that MBBR technology is ahead to UASB and ASP technology in the treatment of sewage. Additionally, the working principle, problems associated with the operation and maintenance of all the three STP’s is also discussed.

2.4 Performance evaluation of wastewater treatment plant based on MBBR technology- A case study of Kaithal town, Haryana (India).

Ashutosh Pipraiya (2017) study found that Moving Bed Biofilm Reactor (MBBR) technology has benefits provided by both fixed film and activated sludge processes. The MBBR process follows continuous flow patterns. Several, small in size, high-density polyethene (HDPE) carrier elements are added to provide sites for active bacteria attachment in a suspended growth medium. Moving Bed Biofilm Reactor (MBBR) process improves reliability, simplify operation and require less space than traditional wastewater treatment system. The need for wastewater treatment plants working under suitable and effective technologies is rising rapidly on a global scale, especially in those regions where availability of pure water is in the challenging phase. Moving Bed Biofilm Reactor (MBBR) technology is the summation of benefits provided by both fixed film and activated sludge processes. The MBBR process follows continuous flow patterns. HDPE media differs

MBBR technology from the Activated sludge process. The work carried out in this research presents the results of the performance evaluation of STP based on MBBR technology located in Kaithal town (Haryana) for handling and treating the domestic wastewater. The following parameter were analyzed during this study that considered TSS, pH, BOD, COD, turbidity, nitrate, phosphate, total nitrogen and total phosphorus.

2.5 Performance evaluation of sewage treatment plants based on SBR and MBBR technology.

Swati Agnihotri et.al (2019) study found that there is a huge gap exists in developing countries for the treatment and collection of household wastewater. Apart from having various wastewater treatment facilities, the discharge of pollutants is still being done into natural water bodies, as the treatment facilities often work below design standards, thus creating a negative impact on the environment. During this study, performance were examined of treatment plant which is located in Delhi, Gurgaon and Ludhiana that depended on SBR and MBBR treatment technology. These plants are designed and constructed with an aim to manage wastewater so as to minimize or remove organic matter, solids, and other pollutants before it enters a water body. In this study, samples were majorly collected at the inlet and outlet of the sewage treatment plant and analyzed for various Physical and chemical Parameters of three STP's namely STP at Behrampur, Gurgaon- 120 MLD, STP at Delhi Gymkhana Club200 KLD and STP at Village Balloke, Ludhiana- 105 KLD. The parameters were evaluated and compared with the Central Pollution Control Board (CPCB) General Standards. The performance of each STP was evaluated in terms of Removal/Reduction Efficiency and it was revealed from the performance study that efficiency of the three STP's understudy was higher with respect to removal of TSS (Total Suspended Solids) 92-96.5 %, BOD (Biochemical Oxygen Demand) 90.5-95% and COD (Chemical Oxygen Demand) 89-92%. in contrast to the removal of TDS (Total Dissolved Solids) 30-46% which was quite low. In comparison with each other, out of the three STP's, the STP located at Behrampur, Gurgaon based on SBR technology showed better results for the effluent, its reduction efficiency for BOD is 95% and is highest among the other two STP's. Overloading of the plant beyond its design capacity and poor maintenance practices were identified to be the main causes of the poor performance of the plant at Village Balloke. Given the cost of running the plant, it is essential that improvements are made to increase the performance.

2.6 Review on SBR Treatment technology of industrial wastewater.

Nadeem A Khan et.al (2019) studied that Industries got an ideal place in the Indian economic development and from them, effluent generated got a high degree of contaminations. Membranes can be used in SBR for wastewater treatment. These can be used for the treatment of industrial wastewater and to increase efficiency. Diffuser added in design, mutability operation, and the sporadic suction method was put in the system, so as to run for a long time.BOD removal potency up to 98% and stable suspended solid effluent was obtained by modified SBRs. As element was consumed for the synthesis of recent cells owing to the low inflowing concentration, the removal rate maybe 96%. Phosphorus removal was low attributable to the limitation of an organic process. A removal potency 80% was reached when SBR optimized. Processes like sequencing batch reactor (SBR) technology enhance the mineralization of the industry wastewaters containing toxic compounds have good efficiency. In a various research, principles of SBR, modified SBR technology, parameters on SBR system and modified SBR's for industries wastewater treatment has been reviewed.Nowadays,forward osmosis natural process of the chemical potential of two chemicals in contact with themembrane. The high concentration solution is drawn solution while water will flow from the low concentration solution to the draw solution side to gets solute equilibrium.Forward osmosiscan be used for sludge dewatering influent containing a high concentration of substrates and heavymetals. A meaningful attempt on this processwas carried out by using cellulose triacetate. Forward osmosis membrane and Nacl dissolve solute with high water flux and high nutrient rejection.

2.7 Moving Bed Biofilm Reactor: A Best Option for Wastewater Treatment

Magnesh Gulhane et.al (2015) carried out the study in which they examined the waste-water using the Moving bed biofilm reactor (MBBR) technology. The purpose of the study to analyzed the performance and operation of using MBBR technique which is based on the attached growth process. The final result indicated the removal efficiency of biochemical oxygen demand (BOD) was 86%, chemical oxygen demand (COD) was 84% and total solid (TS) was 81% at the speed of 10 rpm.

2.8 Treatment of pre-treated textile wastewater using Moving bed biofilm reactor

Anju Francis et.al (2015) studies that control of water contamination is a serious research area these days. Now a day's, the manufacturing industries such as textile industries becoming one of the substantial contamination causing industries. The natural mixes which are shaded speak to a minor to a minor division of natural parts of wastewater yet their shading cause's unfortunate appearance. The method adopting for treatment of manufacturing wastewater are costly, generate the large amount of sludge and contained the toxic chemicals. The effluent discharge have high amount of COD and low amount of BOD in it. So it is not possible to provide a solitary treatment to textile industrial wastewater. So, for manufacturing (textile) wastewater suitable method is chemical pretreatment is follow by biological treatment. For pretreatment advanced oxidation process is suitable. Among different oxidation form, fluidized-bed fenton process is selected because in this process sludge output is less. The results are optimized using Box Behnken method the removal of COD was 86% and BOD was 81.5% observed.

2.9 Assessment of the efficiency of sewerage treatment plants

Ravi Kumar et al. (2010), carried out the study in which they mentioned that Bangalore city have two have two wastage water treatment plant which is located at Nellakedaranahalli village of Nagasandra and Mailasandra village in Karnataka. Basically, the objective behind to construction these treatment plant to reduces the organic or inorganic particle and other type of pollutant before disposing into the water body. During the study, it was found that efficiency of these treatment plant was poor to remove the total suspended solids, BOD, COD, etc. the treatment plant located in Nagasandra had removal efficiency of TDS was 28.45%, BOD was 97.6%, TSS was 99% and COD was 91.60%. whereas, treatment plant in Mailasandra had removal efficiency of TDS was 20.01%, TSS was 94.51%, BOD was 94.98% and COD was 76.26%.

2.10 Performance evaluation of Moving Bed Bio-Film Reactor technology for the treatment of domestic wastewater in Industrial Area at MEPZ (Madras Exports Processing Zone), Tambaram, Chennai, India

Ravichandran.M and Joshua Amarnath.D (2012) carried out a study on Madras Exports processing zone, it is an industrial unit that installed at Tambaram, Chennai developed under the Ministry of Commerce and industries, Government of India is discharging domestic wastewater generated by the workers and treated in the 1.0MLD capacity Sewage Treatment Plant with Moving Bed Bio-film Reactor.

In this study, the performance of MBBR technology in removal of Biological Oxygen Demand and suspended Solids have been evaluated by testing the raw sewage and treated effluent at various situations like normal weather condition, heavy organic shock loading, dilution with stormwater, when artificial aeration is disturbed due to power failure. The test results showed that the removal efficiency of BOD5 and SS from the domestic wastewater in normal weather condition in more than 98%, the efficiency of MBBR has not been affected due to heavy Organic shock loading and the efficiency is about 90% in the disturbance of artificial aeration. The efficiency has been brought to this level by improving the surface area per unit volume of the carrier element as designed by the M/s Anox Kaldnes, a Norway company. It is suggested that the Moving Bed Biofilm Reactor technology could be used as an ideal and efficient option for the treatment of domestic wastewater, when the available area is minimum.

2.11 Performance Evaluation of 137 MLD Sewage Treatment plant at Kasna

Faheem et.al (2016), carried out the study in which they observed the performance of 137 MLD sewage treatment plant that located at Kasna, Greaternoida. This treatment plant used the sequencing batch reactor to treat the wastewater. Performance of this plant is a necessary factor to be monitored as the treated effluent is used for irrigation and drinking purposes. The performance evaluation will also help for the improved understanding of design in STP. In this study samples were majorly taken from inlet and outlet of the treatment plant. After it, samples were examined for the water quality parameters such as pH, BOD, COD, TSS, and total nitrogen. Actual efficiency of the 137 MLD STP will be assessed by collecting samples for the period of 1 month (1st Dec 2015 to 31st Dec 2015).

The conclusions drawn from this study will outline the need for continuous monitoring and performance analysis by removal efficiencies of each and every unit of STP.

CHAPTER 3

METHODOLOGY

The methodology adopted for present study includes the following

3.1 Site selection and point of sampling.

Samples for their examine were collected from the two STP's that are mentioned below

1. 137 MLD STP in kasna, greaternoida
2. 15 MLD STP in Ecotech II greaternoida

The major area from where the sample collected:

1. Final Outlet of kasna STP
2. Final Outlet of Ecotech II STP

3.2 Collection of Samples

The samples are taken in the month of February and March to the examine their physical and chemical parameters.

3.3 Parameter Analyses

Physio-chemical parameter

This parameter consists of the analyses of pH, temperature, TSS (Total suspended solid), COD (chemical oxygen demand) and BOD (biochemical oxygen demand)

3.4 Method for parameter analyses

1. pH

Method: electrometric method of pH determination.

Procedure

- Before use, remove the electrode from strorage solution rinse and blot dry with a soft tissue paper.
- Calibrate the instrument with a standard buffer solution.
- Once the instrument is calibrated remove the electrode from standard solution.

- Dip the electrode in the sample whose pH has to be measured.
- Stir the sample to ensure homogeneity and to minimize CO_2 entrainment.
- Note down the reading from the pH meter.

2. Temperature

Method: Digital thermometer is used for analyses of temperature

Procedure

- Take 100ml of sample in a conical flask.
- Put the digital thermometer into the beaker that contains the sample.
- The instrument shows the reading in Celsius (◦c).

3. Total suspended solids (TSS)

Method: Membrane filtration method

Procedure

- Take 50ml of sample in gooch crucible.
- Place the gooch crucible on the glass fiber apparatus.
- Switch on the electrical supply.
- Liquid passes in the glass fiber.
- Solids remains on the asbestos layer.
- Weigh the empty gooch crucible before experiment and after drying the crucible at about 103°C in an oven to 15 min.

Calculation

Total suspended solids

$$=\frac{(weight\ of\ gooch\ crucible+residue)-(weight\ of\ empty\ gooch\ crucible}{volume\ of\ sample\ taken} X1000$$

4. Biochemical Oxygen Demand (BOD)

Method: Winkler titration

Procedure

- Prepare dilution water by adding the following per litre of required dilution water. Then aerate to oxygen saturation (approx. 1 hr)

  1 ml phosphate buffer,

  1 ml magnesium sulfate solution,

  1 ml calcium chloride solution,

  1 ml ferric chloride solution,

  1 ml of settled raw sewage seed.

- Set up three seeded dilution water blanks. Always siphon dilution water into BOD bottles to avoid entrapping air bubbles.
- Prepare three dilutions for each sample.
- Measure the initial DO of each diluted sample and blank using a calibrated DO probe.
- Incubate blanks, the remaining samples at 20°C for five days.
- After five days incubation, measure DO in each bottle by DO probe and calculate BOD_5 as follows

$$BOD_5 = \frac{(D_1 - D_2) - (B_1 - B_2)f}{p}$$

Where: D_1 = initial DO of sample, mg/l

D_2 = final DO of incubated sample after 5 days, mg/l

B_1 = DO of seed control before incubation, mg/l

B_2 = DO of seed control after incubation, mg/l

P = decimal volumetric fraction of sample used

$$f = \frac{volume\ of\ dilution\ water\ in\ sample}{volume\ of\ BOD\ bottle}$$

Note : only consider dilutions where : (1) depletion is ≥ 2mg/l and (2) final DO ≥ 1 mg/l. if more than one dilution satisfies (1) and (2) above, selects dilution with greatest DO depletion.

5. Chemical Oxygen Demand(COD)

Method: Closed Reflux Titrimetry

Procedure

- Take the sample less than 50ml and dilute to 50ml in a refluxing flask.
- Now added 1g of $HgSO_4$ and 5ml of H_2SO_4 (in which 1gm of silver sulphate is present in every 75ml acid).
- Add slowly to dissolve $HgSO_4$ and Cool the mixture. Add 25ml of 0.25N $K_2Cr_2O_7$ solution and again mix. Attach the condenser and start the cooling water.
- Add the remaining acid agent 70ml through the open end of the condenser. Mix the reflux mixture. Apply the heat and reflux the mixture for 2 hour and cool.
- Dilute the mixture to about 300ml and titrate excess of dichromate with standard ferrous ammonium sulphate using Ferroin indicator. The color changes from yellow to green blue and finally red. Record ml of titrant used.
- Reflux in the same manner a blank consisting of distilled water, equal to the volume of sample and the reagents. Titrate as for sample. Record the ml of titrant used.

Calculation

$$\text{COD} = \frac{\left((\text{A}-\text{B})\text{C X 8 X1000}\right)}{\text{ml of sample}}$$

Where: A = ml of ferrous ammonium sulphate used for blank.

B = ml of ferrous ammonium sulphate used for sample.

C = normality of ferrous ammonium sulphate solution

Table 3.1 Central pollution control board (CPCB) general standards for the discharge of environmental pollution according to the environment (protection) rule, 1986 schedule –VI part A: Effluents

Parameter	Inland surface water	Public sewer	Land for irrigation	Marine/coastal area
Colour and odour	-	-	-	-
Suspended solids	100mg/l	600mg/l	200mg/l	(a) for process Waste water (b) For cooling water effluent 10 percent above total suspended matter of influent.
Particle size of suspended solids	Shall pass 850 micron IS Sieve	-	-	(a) Floatable solids, max. 3 mm. (b) settleable solids, max 856 microns
pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
Temperature	Shall not exceed 5°C above the receiving water temperature	-	-	Shall not exceed 5°C above the receiving water temperature
Oil and grease	10 mg/l	20mg/l	10mg/l	20mg/l

Total residual chlorine	1.0mg/l	-	-	1.0mg/l
Ammonical nitrogen	50mg/l	50mg/l	-	50mg/l
Total Kjeldahl nitrogen	100mg/l	-	-	100mg/l
Free ammonia	5.0mg/l	-	-	5.0mg/l
Biochemical oxygen demand (3 days at 27°C)	30mg/l	350mg/l	100mg/l	100mg/l
Chemical oxygen demand	250mg/l	-	-	250mg/l
Arsenic	0.2	0.2	0.2	0.2
Mercury	0.01mg/l	0.01mg/l	-	0.01mg/l
Lead	0.1mg/l	1.0mg/l	-	2.0mg/l
Cadmium	2.0mg/l	1.0mg/l	-	2.0mg/l
Hexavalent chromium	0.1mg/l	2.0mg/l	-	1.0mg/l
Total chromium	2.0mg/l	2.0mg/l	-	2.0mg/l
Copper	3.0mg/l	3.0mg/l	-	3.0mg/l
Zinc	5.0mg/l	15mg/l	-	15mg/l
Cyanide	0.2mg/l	2.0mg/l	0.2mg/l	0.2mg/l
Selenium	0.05	0.05	-	0.05
Fluoride	2.0mg/l	15mg/l	-	15mg/l
Nickel	3.0mg/l	3.0mg/l		5.0mg/l
Dissolved phosphate	5.0mg/l	-	-	-
Sulphide	2.0mg/l	-	-	5.0mg/l

Phenolic compounds	1.0mg/l	5.0mg/l	-	5.0mg/l
Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
Manganese	2mg/l	2mg/l	-	2mg/l
Iron	3mg/l	3mg/l	-	3mg/l
Vanadium	0.2mg/l	0.2mg/l	-	0.2mg/l
Nitrate nitrogen	10mg/l	-	-	20mg/l
Radioactive materials: a) Alpha emitters micro curie mg/l b) Beta emitters micro curie mg/l	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{-7}	10^{-7} 10^{-6}

CHAPTER 4

RESULT AND CONCLUSION

4.1 Results

Table 4.1: characteristics of effluent of two STP in the February month.

Parameters	**Kasna STP**	**Ecotech II STP**
pH	7.52	7.86
TSS	8mg/l	7mg/l
BOD	7.82mg/l	8.3mg/l
COD	36mg/l	37mg/l
Temperature	18.7°C	19.4°C

Table 4.2: characteristics of effluent of two STP's in the march month.

Parameter	**Kasna STP**	**Ecotech II STP**
pH	8.24	8.67
TSS	7mg/l	6mg/l
BOD	8.1mg/l	8.5mg/l
COD	32mg/l	36mg/l
Temperature	24.7°C	25.2°C

Table 4.3 shows the comparison results of two sewage treatment plant with the CPCB standards of effluent that discharge into water:

Parameter	**Kasna STP**	**Ecotech II STP**	**Comparison of results with CPCB standards of effluent discharge into water**
pH	7.75	8.27	Lower than permissible limit
TSS	7.5mg/l	6.5mg/l	Lower than permissible limit
BOD	7.96mg/l	8.4mg/l	Lower than permissible limit
COD	34mg/l	36.5mg/l	Lower than permissible limit
Temperature	21.7°C	22.3°C	Lower than permissible limit

4.2 CONCLUSIONS

The study conducted for the comparison of two sewage treatment plant parameter with Central Pollution Control Board effluent standard the following conclusion are

- Physical and chemical parameter estimated for Kasna and Ecotech II STP was lower than the permissible limit. These limits successively follow the CPCB standard of effluent discharge.
- The average BOD effluent from kasna plant was 7.96mg/l and from Ecotech II was 8.4mg/l which is acceptable and under the plant limit.
- The average COD effluent from Kasna plant was 34mg/l and from Ecotech II was 36.5mg/l which is also acceptable.
- The average TSS effluent from Kasna plant was 7.5mg/l and from Ecotech II was 6.5mg/l which is acceptable.
- The average pH at outlet was 7.75 while Ecotech II was 8.27.

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- Table 3.1 taken from CPCB

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- Fig 3 is taken from http://www.hnbc.in/pdf/sewage-treatment/sbr/15-MLD-STP-at-Ecotech-II-Greater-NOIDA.pdf.
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