International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

Proposed Design of Sewage Treatment Plant for Kadodara Town Located At South Gujarat Region

Sejalkumar J Patel[1], Sagar Chauhan[2], Heri Patel[3], Shahid Patel[4], Prapti Tailor[5]

[1]Head of department, Civil Engineering Department, FETR Bardoli, Gujarat, India.
[2, 3, 4, 5] Student, Civil Engineering Department, FETR Bardoli, Gujarat, India.

Abstract - *Kadodara is situated on NH-08 16.6 km away from Surat and 20 km away from Bardoli. Due to rapid industrialization of kadodara population is increasing day by day. Recently it has been given a status of municipality. Considering growth it has become essential to provide STP for the future requirement and in the present work effort has been made to design STP to cater the need of up to the year of 2041 of town for which population forecasting, sampling and analysis, selection of site, degree of treatment required, design of treatment unit and estimation of the cost will be under taken. The samples were collected from the various locations and samples were tested to measure various parameters like BOD,COD, TSS,TDS, pH, Chlorine content etc., The work also involve selection of treatment unit/ method based on efficiency and cost. The chlorination process will also apply to the treated water to reduce the dependency on precious ground water and to decrease the burden on environment.*

Key Words: **Population forecasting, Site selection, BOD, COD, Biological Treatment**

1. Introduction

Figure 1. Location of kadodara

Kadodara is medium town in the Surat district in the Indian state of Gujarat. Kadodara is a junction of NH 6 and NH 8 and is on the middle way on Surat-Bardoli road. Due to tremendous growth of diamond and textile business the land values are increase in Surat as well as Kadodara is just 17 km away for Surat, industry related to this business shifted to Kadodara due to better availability of transportation and availability of industrial land and sources, Because of that the growth of the industries people are migrated to Kadodara, hence population is increases day by day.

1.1 Objective

- To study demographic profile and population forecasting of study area.
- To determine quality and quantity of waste water by local habitant.
- To analyze quality of waste water by conducting different tests.
- To propose suitable method of treatment based on test results.
- To design all treatment units.
- To propose design of sewage treatment plant with detailed cost estimation.

2. Population forecasting

Table 1. Population forecasting

Forecasting Method	Population in year 2011	Population in year 2041
Arithmetic increase method	10495	61018
Incremental increase method	14819	61028
Geometric increase method	27336	192164

The larger value of population is obtained from Geometric increase method hence this method to be taken to calculate quantity of sewage generated.

2.1 Quantity Of sewage

- A/c to IS 1172:1993 for communities population greater than 1,00,000 water requirement per day taken between 150-200 lpcd
- Kadodara is also an industrial town,15% of taken lpcd(i.e 200 lpcd) is allotted to treat ETP treated waste water from some industries in special cases.
- Total requirement of water shall be 230 lpcd.
- Capacity of STP= $(230\times0.8\times192164)/10^6$ = 36 MLD

3. Site Selection

Figure 2. Map of kadodara

Table 2. Difference between two plots

Sr. no	Criteria	Plot 218	Plot 13
1	Area of plot	60 acre	40 acre
2	Access to the site on existing road	Easily accessible	Easily accessible
3	Site outside the flooding Zone	Yes	Yes
4	Proximity of residence	More	Less than Plot 218
5	Traffic and dust pollution	No	No
6.	Topography of site	Good	Good
7.	Type of soil	Same	Same
8.	Site drain Condition	Very good	Very good
9.	Concentration of people	More	Less
10.	Proximate distance from disposal are	Very near	Very near
11.	Land acquisition	Semi Govt	Govt

According to the above data plot no. 13 is suitable site for STP.

4. Sampling and Testing

First sample collection (monsoon)

Sample 1- From closed drainage

Sample 2- From open drainage near to the Bridge

Second sample collection (winter)

Sample 1- From closed drainage

Sample 2- From open drainage near to the Bridge

Figure 3. Locations of sampling

4.1 Test results

Table 3. Test results for Monsoon season

Sr. no	Parameters	Results(Monsoon)		Highest value
		Sample 1	Sample2	
1	pH	7.3	7.19	7.3
2	BOD(mg/l)	154.18	148.36	154.18
3	COD(mg/l)	360	350	360
4	TDS(mg/l)	641	764	764
5	TSS(mg/l)	250	267	267
6	Temperature (ºC)	29.5	29.7	29.7
7	Chloride(mg/l)	9.96	14.95	14.95

Table 4. Test results for Winter season

Sr .no	Parameters	Results(winter)		Highest value
		Sample 1	Sample2	
1	pH	7.2	8.03	8.03
2	BOD(mg/l)	209.4	215.27	215.27
3	COD(mg/l)	450	430	450
4	TDS(mg/l)	756	698	756
5	TSS(mg/l)	210.79	247.2	247.2
6	Temperature (ºC)	27.74	28.5	28.5
7	Chloride(mg/l)	19.93	17.44	19.93

*pH, TSS, Temperature, TDS are measured by using instrument Hac.

Table 5. Final Results

Sr. no	Parameters	Limits	Results
1	pH	5.5-9	8.03
2	BOD(mg/l)	30	215.27
3	COD(mg/l)	250	360
4	TDS(mg/l)	100	764
5	TSS(mg/l)	100	267
6	Temperature (ºC)	25.7 ºC	29.7
7	Chloride(mg/l)	4 – 10 mg/l	19.93

*Sewage disposal limits are obtained from GPCB manual

5. Methodology

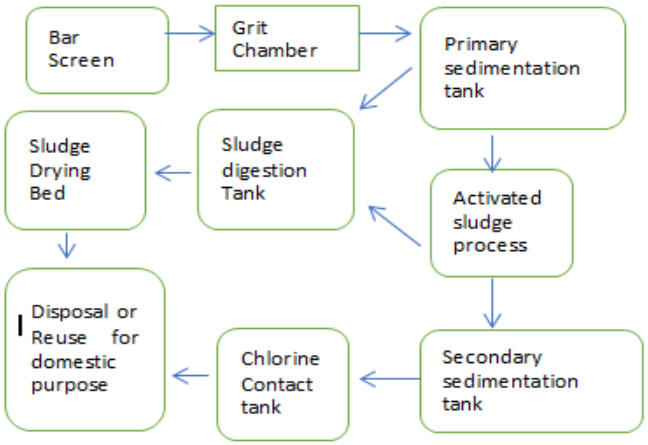

Figure 4. flow diagram of STP

5.1 Classification Of Sewage Treatment Plant Methods

PRELIMINARY SEWAGE TREATMENT

This treatment reduces the BOD of the wastewater, by about 15 to 30%. Examples of preliminary operations are:

• Screening provided for the removal of debris and rags.

• Grit chamber provided for removal for the elimination of coarse suspended matter that may cause wear or clogging of equipment.

PRIMARY SEWAGE TREATMENT

In primary treatment, a portion of the suspended solids and organic matter is removed from the wastewater. This removal is usually accomplished by physical operations such as sedimentation in Settling Basins. The liquid effluent from primary treatment, often contains a large amount of suspended organic materials, and has a high BOD (about 60% of original). The organic solids, which are separated out in the sedimentation tanks (in primary treatment), are often stabilized by anaerobic decomposition in a digestion tank or are incinerated, The residue is used for landfills or as a soil conditioner. The principal function of primary treatment is to act as a precursor to secondary treatment.

SECONDARY SEWAGE TREATMENT

Secondary treatment involves further treatment of the effluent, coming from the primary sedimentation tank and is directed principally towards the removal of biodegradable organics and suspended solids through biological decomposition of organic matter, either under aerobic or anaerobic conditions. In these biological units, bacteria will decompose the fine organic matter, to produce a clearer effluent. The treatment reactors, in which the organic matter is decomposed (oxidized) by aerobic bacteria are known as Aerobic biological units; and may consist of:

(i)Aeration tank: The activated sludge process is the most common option in secondary treatment. Aeration in an activated sludge process is based on pumping air into a tank, which promotes the microbial growth in the wastewater. The microbes feed on the organic material, forming flocs which can easily settle out.

(ii)Secondary sedimentation tank: They are used to settle out the biological material flowing from the secondary treatment.

TERTIARY/ ADVANCED SEWAGE TREATMENT AND WASTEWATER RECLAMATION

Advanced wastewater treatment, also called tertiary treatment is defined as the level of treatment required beyond conventional secondary treatment to remove constituents of concern including nutrients, toxic compounds, and increased amounts of organic material and suspended solids and particularly to kill the pathogenic bacteria.

(i)Sludge digestion Tank: Sludge digestion is a biological process in which organic solids are decomposed into stable substances.

(ii)Chlorine contact tank: To remove harmful pathogenic bacteria and make it possible for human touch.

6. Conclusion

- Considering the population growth, recently awarded municipality status and industrialization it is now high time to install STP for Kadodara town.
- Proposed STP design is functional, efficient, easy to operate.
- A Detailed RCC design of units is prepared on the basis of which detailed estimation has been worked out of proposed STP which seems reasonable.

Table 6. Design of units

Sr. no	Unit	Dimension	No.
1	Collection chamber	Dia– 6m, d-3	1
2	Approach channel	L–2m,b0.675m, d–0.75m	2
3	Bar screen	Bar-10*50mm, space–25mm	2
4	Grit chamber	L– 20m, b-1.5m, d-1m	2
5	Primary Sedimentation Tank	Dia– 24m, d-5.95m	2
6	Aeration Tank	L-21m, b-18.5m, d-4m	4
7	Secondary Sedimentation Tank	Dia– 24m, d-5.95m	2
8	Chlorine contact tank	Dia-18M, D-3M	1
9	Sludge digestion tank	Dia-21M, D-8M	1
10	Filter press		2

Table 7. Estimation with help of detailed RCC design

Unit	No	Quantity of steel(kg)	Formwork (m^2)	Concrete Work (m^3)
Collection chamber	1	958.42	88.61	12.73
Approach channel	2	28.93	34	3.135
Grit chamber	2	397.292	43	8.5
Primary sedimentation tank	2	21820.66	1099.69	392.69
Aeration Tank	4	29568.98	631.7	396.55
Secondary sedimentation tank	2	21820.66	1099.69	392.69
Sludge digestion tank	1	44803.98	1658.66	1202.48
Chlorine contact tank	1	5260.37	861.06	69.05

Table 8. Costing of units

Sr. no	Unit	No	Material cost(INR)
1	Collection chamber	1	3,43,076/-
2	Approach channel	2	41,432/-
3	Bar screen	2	-
4	Grit chamber	2	1,37,690/-
5	Primary Sedimentation Tank	2	65,55,690/-
6	Aeration Tank	4	1,47,52,796/-
7	Secondary Sedimentation Tank	2	65,55,690/-
8	Chlorine contact tank	1	7,35,006/-
9	Sludge digestion tank	1	85,74,993/-
10	Filter press	2	5,90,000/-

*This cost includes concrete work, formwork and steel reinforcement with contractor's profit.

Total Cost = Total cost - 38,246,941/-INR

REFERENCES

Books:

[1] 1- Waste water treatment concept and design approach by G.L. karia and R.A. Christian.

[2] 2- Waste water treatment plant planning design and operation by syed R. Qasim

[3] 3- Waste water engineering treatment and reuse by Metcalf & Eddy,Inc.

[4] 4- Design of reinforced concrete structure by H.J Shah

[5] 5- Estimation and costing by B.N Dutta

IS Code:

[6] 1- IS 456-2000

[7] 2- IS 3370 (part-3)

[8] 3- IS 1172-1993

Papers:

[9] Performance evaluation of 9 mld sewage treatment plant at gurgaon and

[10] cost effective measures in treatment process- Mohan Singh Negi and Vaishali Sahu.

[11] Sewage treatment and reuse - a step towards water conservation-Shrirang Vrushali and Chatterjee Kaustav.

[12] Performance Evaluation of 25MLD Sewage Treatment Plant (STP) at Kalyan - Prachi N. Wakode, Sameer U. Sayyad.

[13] Site suitability evaluation for sewage treatment plant in Nagercoil municipality, Tamil Nadu using remote sensing techniques.- Benujah. B. R,and Mrs. G. Devi.

[14] Treatment of domestic waste water using natural flocculants- Narmadha D.and Mary Selvam Kavitha V J.

[15] Design of Sewage Treatment Plant for Dhule City-Prof. Pramod Sambhaji Patil, Shaikh Hujefa, Nemane Rahu Mujawar Sumer, Deo Prasad, Chaudhari Shivprasad.

[16] Wastewater Treatment by Effluent Treatment Plants-Rakesh Singh Asiwal, Dr. Santosh Kumar Sar*, Shweta Singh, Megha Sahu.

[17] Micro Hydro Electricity Generation in S.T.P, A Case Study of S.T.P, Salawas- Jodhpur Karan Bhandari and Ojas Pravin Rahate.

[18] Design & Performance Evaluation of Wastewater Treatment plant D tirumala -G. Chandrakant, P.Jaswanth, S.Teja reddy, G.Kiranmai.

[19] A Case Study on Waste Water Treatment Plant, CETP (Common Effluent Treatment Plant)-Prof. Hangargekar P.A. and Mr. Takpere K.P.