International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06 | June 2021 www.irjet.net p-ISSN: 2395-0072

DESIGN OF A SEWAGE TREATMENT PLANT FOR A HOTEL COMPLEX

SHABNA ABDUL KHADER[1], M A CHINNAMMA[2]

[1]P G student, Department of Civil Engineering, Malabar College of Engineering and Technology, Desamangalam, Thrissur, Kerala, India
[2]Professor, Department of Civil Engineering, Malabar College of Engineering and Technology, Desamangalam, Thrissur, Kerala, India

---

Abstract - *Hotels play a vivid role in the immense contribution of waste to the environment. As far today in the green era, it is essential for a hotel industry to have an effective waste management system which needs to mainly focus on reducing waste, reusing useful materials and recycling them. Every sector contributes a particular amount of waste and today due to its unawared disposal environment get affected. The commercial processes tend to generate a lot of waste and require regular maintanence and expensive waste disposal.*

For a safer environment waste water from the hotels and other uses has to be properly treated and it can also be reused. The paper focuses on the designing of a Sewage treatment plant for Geetha Govindam Divine Boutique hotel, Guruvayoor. The components is designed and bill of quantities is also prepared.

***Key Words*: Sewage Treatment Plant, MBBR media, CPCB**

1.INTRODUCTION

Hotels contribute waste water from bathrooms, kitchen, bar, laundry room, staying rooms etc. A hotel must meet the environmental regulations based on the location of hotel. As the soils water holding capacity is one of the main constraint if the water is not much absorbed. In such a situation more consideration is needed to dispose the waste water. Some of the criterias that hotels need to follow for a safe environment includes waste minimization, reuse /recycling , energy efficiency, conservation and management ,waste management, hazardous material management. For a sewage treatment plant usually includes physical unit operations, chemical unit operations and biological unit operations. Htel waste on environment tal consideration can be classified into biodegradable waste and non biodegradable waste. The biodegradable waste includes wet wastes like food waste, whereas non biodegradable includes dry wastes like plastic bottles, plastic wrapers etc.

2. STUDY AREA

Guruvayur is a pilgrimage town in the southwest Indian state of Kerala. It's known for centuries-old, red-roofed Guruvayur Temple. The site selected for the project is Geetha Govindam Divine Boutique Hotel, East nada Guruvayoor. This is a hotel which has boarding facilities loading facilities and a hotel. The waste that has to be consist of of sewage as well as sullage. Approximately 5 KLD of waste are tend to be produced and has to be treated by the proposed STP.

3. LITERATURE REVIEW

Shobhan M, Poornesh etal (2019) , studies about wastewater generated in school and colleges have to take care as it may pollute the ground water if not treated properly. This paper focuses on the design of a STP unit in Bearys Institute of Technology (BIT), Mangalore for the treatment of boy's hostel wastewater of 160 students with 135 LPCD. Physical and chemical characteristics of the wastewater samples showed a low strength in pollutant concentrations. Treatment units were planned and designed based on the existing condition. Disinfection unit was designed for destroying the pathogens and ensuring safe disposal of treated wastewater.

Pushpalatha P and Kalpana P (2016), studies about srikakulam city and designed a plant. the sewage generation in the Srikakulam 40 city area and sewage treatment plant is designed. In one day the total sewage generated was estimated 22.2 MLD considering the projected population of Srikakulam town for the next 30 years. The various components of sewage treatment plant are screening, grit chamber, primary sedimentation tank, biological reactor, secondary clarifier, activated sludge tank; drying beds. It is proposed to design the various components of sewage treatment plant considering the various standards and permissible limits of treated sewage water.

Mona A, Marwa. M.,etal (2016),studied and proposed a novel design for compact sewage water treatment plant with a capacity of 100 m3 /day. The major pollutants are SS, BOD, COD, and organic pollutants. The recommended treatment process in anaerobic activated sludge. The analysis results of the sewage water are pH average values 6-8, turbidity 12UNT, daily suspended solid 850 mg/L, BOD is760 mg/L. The proposed design for the treatment plant consists mainly of: a bar screen, aerated gas trap, aeration tank and a collection pit.

4. Moving Bed Biofilm Reactor (MBBR)

The MBBR system consists of an aeration tank (similar to an activated sludge tank) with special plastic carriers that provide a surface where a biofilm can grow. The carriers are made of a material with a density close to the density of water (1 g/cm^3). An example is high-density polyethylene (HDPE) which has a density close to 0.95 g/cm3. The carriers will be mixed in the tank by the aeration system and thus will have good contact between the substrate in the influent wastewater and the biomass on the carriers. The MBBR system is considered a biofilm process.

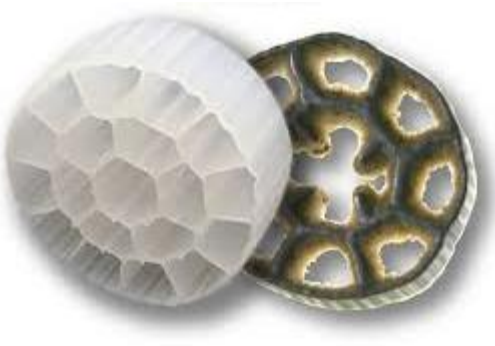

Fig -1 MBBR Media

MBBR media is one kind of new bioactive carrier as a house for attached growth bacteria in MBBR process. MBBR media also called kaldness media, it works as carrier for the growth and attachment of microorganisms are directly put into the MBBR system, the waste water go through the suspended carriers in MBBR reactor, kaldness media adopt scientific formula and blend some micro-elements in the high polymer material, which microorganisms attach 33 themselves to submerged moving biofilm carrier, forming a biofilm. Air is transferred into the water, mixing the media and water and providing oxygen to the bacteria. The MBBR media biofilm absorbs oxidizes and reduces organic and inorganic material thus providing treatment.

5. METHODOLOGY

Geetha Govindam is a divine boutique hotel with rooms allotted for mostly focusing on people came to Guruvayoor temple.Since it is a coastal area the entire environment being sandy and gravel. All aspects of climate, topography and population rates and future extensions are to be consider while designing the project. The design of STP of in Geetha Govindam includes the integral parts such as oil and grease trap, screen chamber, grit chamber, equalization tank, MBBR tank, activated carbon Filter, secondary clarifier, collection tank, septic tank etc . The waste includes the waste from hotel kitchen, customers washing and flushing and wastes from staff and other residences .The STP is designed based on MBBR process. Degree of treatment, design period, should be considered while designing. There are 10 rooms and providing 135 lpcd and aproximating the value of usage from kitchen etc 5000 m^3 / day is produced. That is 5KLD.

6. RESULTS AND DISCUSSIONS

The sewage treatment plant for Geetha Govindam Divine Boutique Hotel was designed as per Moving Bed Biofilim Reactor (MBBR) process. Size of oil and grease trap, Size of Grit chamber, size of equalization tank, size of MBBR tank, diameter and depth of collection tank, diameter and depth of secondary clarifier, size of septic tank was calculated.

Table - 1 : Size of designed components

Components	Size
Oil and grease trap	0.45 m x 0.35 m x 0.4 m
Screen chamber	2.5 m x 0.9 m x 1.2 m
Grit chamber	1.65 m x 1.65 m x 1.2 m
Equalization Tank	1 m x 0.8 m x 1.5 m
MBBR Tank	0.7 m x 0.5 m x 2.2 m
Collection Tank	3 m diametre , depth = 2.5m
Secondary clarifier	4 m diametre , depth = 4m
Septic Tank	4.4 m x 1.47 m x 2m

The components of the treatment plant like oil and grease trap, screen chamber, grit chamber, equalization tank, MBBR tank, collection tank , secondary clarifier, septic tank is designed . The oil and grease trap is of rectangular cross section, the screen chamber is of rectangular cross section, the grit chamber is of square cross section, the equalization tank is of rectangular cross section, the MBBR tanks are of rectangular cross section, collection tank and secondary clarifier is of circular cross section.

Estimation is a technique for computing or calculating the various quantities and the expected expenditure to be incurred on a particular project. The estimation of the designed STP is done by long wall, short wall method. The abstract of estimated cost is followed as per PWD rates. The total cost for work is 680000 rupees.

Table -2: Cost of designed components

Components	Amount
Oil and grease trap	2883.53
Screen chamber	33488.315
Grit chamber	25208.71
Equalization Tank	19854.025
MBBR Tank	12452.46
Collection Tank	95000.42
Secondary clarifier	143267.25
Septic Tank	40665.2
Total	680000

The effluent after treatment is again tested and is found to be within limit.

Table – 3 : Effluent characteristics

Parameters	Influent	Effluent	Limit For Land irrigation as per CPCB (2019)
pH	5	6.5	5.5-9
TDS	350 mg/l	180 mg/l	200 mg/l
BOD	170 mg/l	10 mg/l	<30 mg/l
COD	350 mg/l	200 mg/l	<250 mg/l
Oil and grease	7 mg/l	5 mg/l	10 mg/l

The waste water after designing the components and the effluent water is taken and tested and all the test results were found to be within limits as per CPCB (2019).

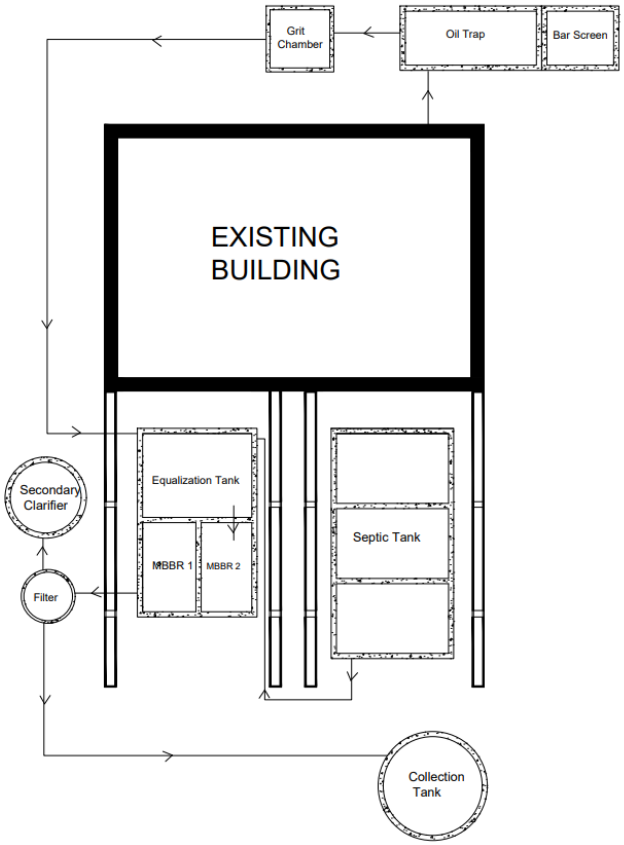

Fig -2 Designed STP

7. CONCLUSIONS

The project designs a Sewage Treatment Plant to treat sewage water from Geetha Govindam Divine Boutique Hotel, Guruvayur based on the MBBR process. The STP was designed for 5000 m^3/day. For the treatment purpose, designed the integral part of STP, ie oil and grease trap, screen chamber , grit chamber , equalization tank , MBBR tank, collection tank , secondary clarifier , septic tank .The available space requirement is limited. Detailed estimation of the designed sewage treatment plants done long wall short wall method. The abstract of estimated cost is followed as per PWD rates. The total cost for the sewage treatment plant is 680000. The effluent from the plant found with in limit of CPCB for irrigation purposes. By considering cost and efficiency of treatment, the designed STP is satisfactory

ACKNOWLEDGEMENT

First of all, I would like to thank God, the almighty for the divine grace bestowed on me and my parents for the great support.

I express my deep sense of gratitude to Prof. Chinnamma MA, M. Tech Coordinator and co author, Department of Civil engineering, for providing me the best facilities and

atmosphere for the creative work guidance and encouragement.

Also, I express my sincere of gratitude to Assistant Prof. Anitha K, Ass. professor, Department of Civil engineering, for providing me the best facilities and atmosphere for guiding me and providing help for the completion.

REFERENCES

1. Rajat P, Dr V K Sethi etal (2018), " Design of a Sewage Treatment Plant for a locality in Bhopal To Recycle The Liquid Waste", International Journal of Engineering Sciences and Research Technology, volume 7 , No1
2. M Bharghavi, E Ananta Rao etal (2018), " Analysis and Design of Sewage Treatment Plant: A Case Study on Vizianagaram Municipality", SSRG International Journal of Civil Engineering, Vol 5 ,Issue 4
3. Shobhan M, Poornesh etal (2019) , "Design of a Sewage Treatment Plant At Bearys Institute Of Technology,Manglore", IOSR Journal of Environmental Science, Toxicology and Food Technology, Volume 13, Issue 5
4. Deepa G, Abhishek etal (2017), " Design And Analysis of Sewage Treatment Plant" , The Engineering Journal of Application and Scopes,. Volume 2 ,issue 1
5. Pushpalatha P and Kalpana P (2016), " Design Approach For Sewage Treatment Plant : A Case Study of Srikakulam Greater Municipality, India",The IndianJournal of Environmental Science ,Volume 12, issue 9
6. Jayasree D, Sangeta I etal (2012), " Review on Waste water Treatment Technologies", International Journal of Research and Technology(IJERT), Volume 1, Issue 5
7. Mona A, Marwa M etal (2016), " Sewage Treatment Plant Using Diffused Air System", ARPN Journal of Engineering and Appiled Sciences, Volume ii , No 17
8. RamKumar K , Suman M (2014), "Characteristics of Waste Water in Sewage Treatment Plant of Bhopal" , Journal of Chemical and Pharmaceutical Researches , Vol 3 , issue 6
9. Ibrahim A, Sadi Esther O. Adebitan(2014), "Waste Water Recycling in the Hospitality Industry", Academic Journal of Interdisciplinary Studies MCSER Publishing, Rome-Italy, Volume 3, issue 7
10. "Sizing of oil and grease traps", Urban Environmental Management System Project ,Issue 3, August 2004
11. Harlan H,Bengtson (2017),"Biologic Waste water Treatment Design Calculations"
12. S.shree samal (2015) , "Design of Sewage Treatment Plant", IOSR Journal of Civil and Mechanical Engineering, Vol 13,issue 5 , page 25-30
13. S. Majumder,Poornesh (2019), "Cost Estimation and Specification of STP at BIT campus" , article
14. James MC, Joshuaboltz (2011), Moving Bed Biofilm Reactor Technology : process , Application , Design and Performance , Water Environment research
15. Demet A, Joerg K (2008), Article in Water Science & Technology
16. S Gautam, S Ahmed, A Dhingra (2016), "Cost effective treatment technology for small size sewage treatment plants in India " , International journal of Scientific & Industrial Research , Vol 76, April 2017, pp.249-254
17. B. Balaji, Dr. P. Mariappan Dr. S. Senthamilkumar(2014) "Technology Options For Sewerage System". International journal of engineering research and technology(IJERT)
18. M Makowska (2014) "Orginal research treatment of septic tank effluent in Moving Bed Biological Reactors with Intermittent Aeration", Journal of Rural Water Supply and Sanitation, Vol 18, No.6 (2009), 1051-1057.
19. Ananth S Kodavasal , The STP Guide , Design Operation and Maintanence , 1st Edition
20. Santhosh Kumar Garg , Sewage Disposal and Air Pollution Engineering, 36 th Edition
21. Metcalf , Eddy : Waste Water Engineering Treatment And Reuse , 4 th Edition