DESIGN OF SEWAGE TREATMENT PLANT(STP) FOR DAYANANDA SAGAR INSTITUTE , BENGALURU

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Abstract— The Dayananda Sagar College Engineering is one of the important educational institutes in the state of Karnataka with a large number of people residing in its campus consisting of a number of laboratories of various departments, residential units, academic blocks and number of hostels. A study on wastewater characterization of treatment plant will be performed followed by the design of sewage treatment plant. The whole project study involves the analysis of pH value, total solids, total suspended solids, hardness, acidity, alkalinity, chloride, chlorine, BOD, COD, DO & turbidity. A sewage treatment plant is quite necessary to receive the hostels, college and laboratories waste and removes the materials which pose harm for general public. Its objective is to produce an environmentally-safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer). The main purpose of Sewage treatment process is to remove the various constituents of the polluting load: solids, organic carbon, nutrients, inorganic salts, metals, pathogens etc. Effective wastewater collection and treatment are of great importance from the standpoint of both; environmental and public health. Sewage/Wastewater treatment operations are done by various methods in order to reduce its water and organic content, and the ultimate goal of wastewater management is the protection of the environment in a manner commensurate with public health and socioeconomic concerns. In this report Sewage treatment techniques, factors affecting selection and design Sewage systems are discussed briefly.

Keywords - Physicochemical parameters; sewage treatment plant; wastewater collection; designing.

1) INTRODUCTION

The objective in wastewater treatment is to provide a low- cost process that is reliable meeting effluent quality standards. The contaminants in wastewater are removed by physical, chemical, and biological means. The individual methods usually are classified as physical unit operations, chemical unit processes, and biological unit processes. These operations and processes occur in a variety of combinations in treatment systems, it has been found advantageous to study their scientific basis separately because the principle involved do not change. Traditional design procedures for wastewater treatment systems attempt to minimize total capital cost by considering steady state concepts for unit processes and design guidelines. Recent work has minimized capital as well as operation and maintenance costs using a single objective function and steady state models which are flawed because plant inputs vary as much as seven-fold during a 24-hour period. This paper presents the technical aspects of the design for a sewage treatment plant with a capacity of 1000 cubic meters (m3) per day in Dayananda Sagar College of Engineering.

2) STUDY AREA

Study Area of DSCE Campus

DSCE is located in Shavige Malleshwara Hills, 1st Stage, Kumaraswamy Layout,

Bangalore, Karnataka. It is a sector of Dayananda Sagar Institutions. The institute is named after its founder, Shri R Dayananda Sagar. It is an autonomous institute affiliated to Visvesvaraya Technological University.

3) LITERATURE REVIEW

Pramod sambhaji patil et.al.(2016) studied on design of sewage treatment plant for dhule city . Some treatment units are designed like screens, grit chamber, storage tank, settling tank, aeration tank and skimming tank. The effluent can also be used for artificial recharge of ground water, flushing, foam control, fire protection, lawn sprinkling .

Murthy polasa et.al (2014) reviewed about design of sewage treatment plant for gated community. In this project three types of treatment unit operations are conducted. Like physical, chemical and biological processes. By increasing the detention time of sewage in each treatment unit increases the efficiency of removal unwanted impurities .

M. Aswathy et al.(2017) studied on analysis and design of sewage treatment plant of apartment in Chennai. This project is studied that domestic and commercial waste and removes the material with possess harm from generated public. To produce an environmental sewage fluid waste stream and solid waste suitable from disposal of use.

N. S. Ramya et al.(2015) reviewed on design of sewage treatment plant and characteristics of sewage. The growing environmental pollution need for decontaminating water results in the study of characterization of waste water especially domestic sewage. The waste water leads to developing and implementing new treatment techniques to control nitrogen and other priority pollutants.

4) FACTORS AFFECTING SELECTION AND DESIGN OF SEWAGE/ WASTEWATER TREATMENT SYSTEMS

A. Engineering factors

- Design period, stage wise population to be served and expected sewage flow and fluctuations.
- Topography of the area to be served, its slope and terrain; tentative sites available for the treatment plant, pumping stations, and disposal works.
- Available hydraulic head in the system up to high flood level in case of disposal into a river or high tide level in case of coastal discharges,
- Groundwater depth and its seasonal fluctuations affecting construction, sewer infiltration.
- Soil bearing capacity and type of strata to be met in construction and on-site disposal facilities, including the possibilities of segregating sludge and sewage and reuse or recycling of sludge water within the households.

B. Environmental factors

- Surface water, groundwater and coastal water quality where wastewater has to be disposed of after treatment.
- Odor and mosquito nuisance which affects land values, public health, and well-being, and Public health considerations by meeting the requirements laid down by the regulatory agencies for effluent discharge standards, permissible levels of microbial and helminths quality requirements and control of nutrients, toxic and accumulative substances in the food chain.

C. Process consideration

- Wastewater flow and characteristics
- Degree of treatment required
- Performance characteristics
- Availability of land, power requirements, equipment and skilled staff for handling and maintenance.

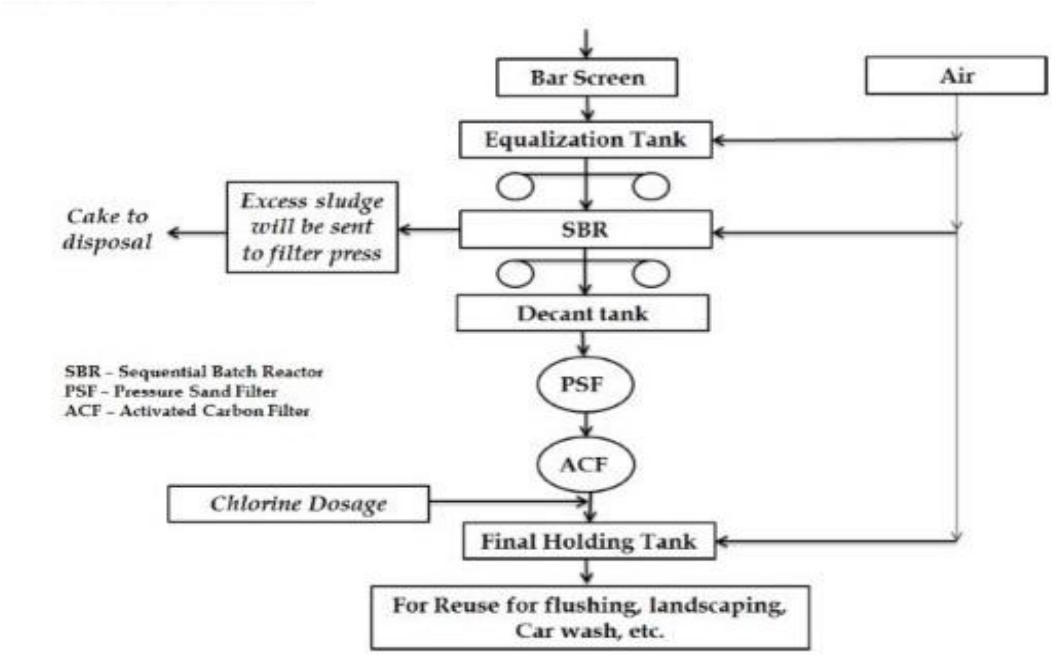
D. Cost consideration

- Capital costs for land, construction, equipment etc.

•Operating costs including staff, chemicals, fuels and electricity, transport, maintenance, and repairs etc.

5) METHODOLOGY

Flow chart for STP



6) RESULTS AND DISCUSSION

6.1) Estimation of sewage generation

The current population of DSCE has been calculated for the estimation of the total sewage generation.

Ultimate design period= 30 years.

Approximately, present population in DCSE =8500 .

Assume, after 30 years population will be 11,000 (considering, 30% population will be increase) . water consumption = 135 lpcd .

Assume, Sewage generation per day = 80% of supplied water

Total sewage generation = 8500 × 135 × 0.8 = 9,18000 l/d

We assume peak factor=3 Hence, Design flow capacity (maximum) =0.069 m^3/s

6.2) Characteristics of sewage sample

The waste water sample was collected from sump and pH, BOD,Chlorides,Sulphates and Suspended solids were measured according to standard method . The measured parameters is used to design STP. To design the STP, higher value of the measured parameters were considered.

Table 1. Characteristics of sewage sample

S.NO	Characteristics	limit	Effluent from plant
1	pH	5.5-9.0	5.5-9.0
2	BOD	100 mg/l	<20 mg/l
3	Suspended solids	200 mg/l	<30 mg/l
4	Oil &Grease	10 mg/l	<5 mg/l
5	Chlorides	600 mg/l	<400 mg/l
6	Sulphates	1000 mg/l	<250 mg/l

6.3) Designing of pumping system

The pumping station location should be selected in such a way that, it can capable of draining the entire area effectively. Here, Pumping station with horizontal pumps installed in the dry well was considered. The length of the new sewer line networks was calculated through Google Map.

Table 2. Design of coarse screen

S.NO	Design Parameter	Design Value
1	Design flow, m^3/s	0.024
2	Diameter of rising tube, m	0.1
3	Wet well depth, m	4
4	Wet well diameter, m	2
5	Length of sewer pipe, m	400

6.4) Designing of the Sewage treatment plant

A rectangular-shaped receiving chamber is designed to collect the sewage and control its flow. After that sewage is allowed to pass through a coarse screen.A screen is used to trap the floating matters such as sachets, plastic milk packets, grocery bags etc., which could disturb the impeller.

Table 3. Detailed design of Receiving Chamber and Medium Screen

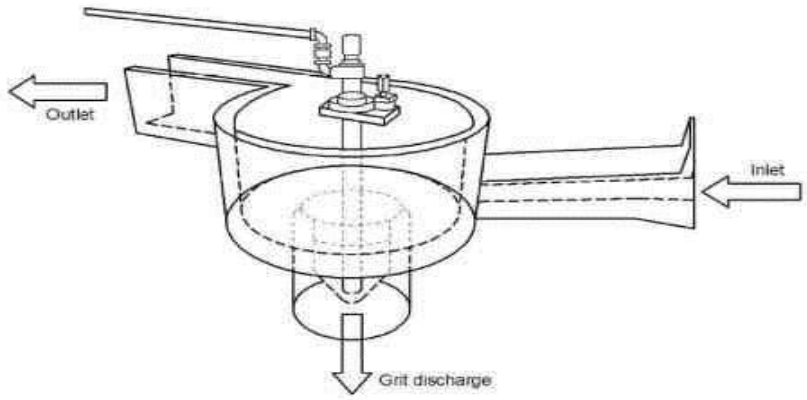
S.NO	Design parameter	Design Value
1	Design flow, m^3/s	0.069
2	Size of the receiving chamber, m	2x4x3
3	Number of screen	2
4	No. of clear opening	3
5	Width of channel for medium screen, m	0.7
6	Depth of channel for medium screen, m	0.6
7	Head loss through screen in normal condition, m	0.0015
8	Head loss on 50% clogging, m	0.0064

6.5) Designing of a Grit Chamber

Grit chambers are basin to remove the inorganic particles to prevent damage to the pumps, and to prevent their accumulation in sludge digestors.

Table 4. Detailed design of Grit Chamber for STP

S.NO	Design parameter	Design Value
1	Design flow, m^3/s	0.069
2	Width of Grit chamber, m	3
3	Depth of Grit chamber, m	2
4	Assume, Kinematic Viscosity of Effluent, m^2/s	O.000011
5	Assume, Particle Diameter, m	0.000150
6	Settling Velocity, m/s	0.02

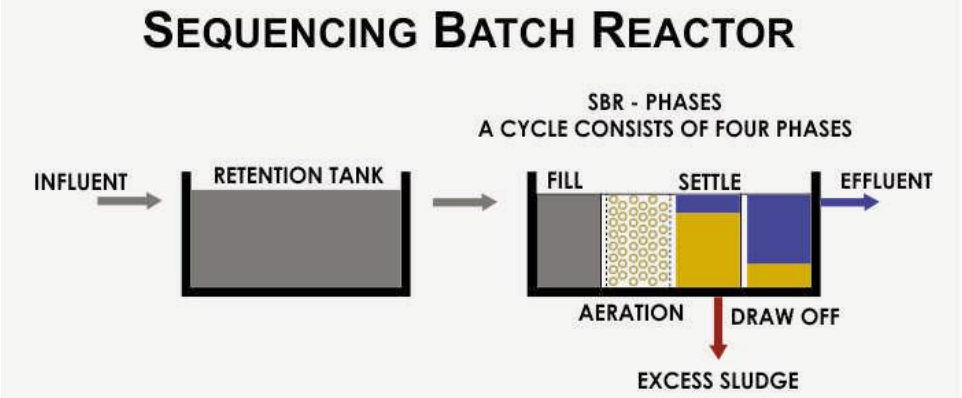


6.6) Dimensions and parameters of Sequencing Batch Reactor (SBR)

Sequencing batch reactor (SBR) is a fill-and-draw activated sludge treatment system. Although the processes involved in SBR are identical to the conventional activated sludge process, SBR is compact and time oriented system, and all the processes are carried out sequentially in the same tank. SBR system is the upgraded version of the conventional activated sludge process, and is capable of removing nutrients from the wastewater.

Table 5. Detailed design of SBR.

S.NO	Design parameter	Design Value
1	Flow conditions	Peak flow
2	Number of basins	2
3	Volume of each basin, m^3	450
4	Length, m	12
5	Width, m	7
6	Bottom Water Level, m	2.75
7	Maximum Water Level, m	5.5
8	Depth of the SBR, m	6
9	Sludge Retention Time, d 16	16
10	sludge Production,kg dry solids/d	136



7) CONCLUSIONS

The ultimate goal of wastewater treatment is the protection of the environment in a manner commensurate with public health and socio-economic concerns. Based on the nature of wastewater, it is suggested whether primary, secondary and tertiary treatment will be carried out before final disposal.The results obtained from the study suggest that the conventional activated sludge has low degree of flexibility and treatment efficiency: however ,the attached growth technologies are remarkably superior in pollutant elimination even of low HRT from residential waste water.

Therefore the project that we took in relating the design and analysis has been successfully carried out and completed with the requiring details and information that is related and hence the process, nature, requirements, sample and tests which has been in accordance to the project has been conducted by our team.

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