Planning and Design of 250KLD Sewage Treatment Plant

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ABSTRACT

The main objective of this study is carried out to design of a sewage treatment plant for **VIGNANA BHARATHI INSTITUTE OF TECHNOLOGY, GHATKESAR**, as it is educational institute and also providing hostel facilities to the students and staff which in results excess of sewage is produced, to avoid this problem we are planned to construct the sewage treatment plant in our VBIT campus. This paper focuses on sewage generation in VBIT, which was estimated 250KLD considering of next 30 years. We have designed the various components of sewage treatment plant like screens, grit chamber, primary sedimentation tank, activated sludge process, sludge drying beds. It is proposed to design the various components of sewage treatment plant considering various standards and permissible limits of treated sewage water. The treated water will be used for gardening and the sludge which is generated after the treatment will be used as manure, so it increases the fertility of soil. Also reduce the ground water usage.

Keywords - Sewage treatment plant, Irrigation, Sludge, Manure, Ground water, Sedimentation**.**

1.0 INTRODUCTION

Water plays an important role in the development of any activity in the world. Due to the growth of population, consumption of water resources is more and availability is less. So the demand for water is increasing. Sewage treatment is the process of removing contaminants from waste water, primarily from household sewage. Physical, chemical and biological processes are used to remove contaminants and produce treated wastewater that is safer for the environment. A by-product of sewage treatment is usually semi-solid waste or slurry called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land. Sewage can be treated close to where the sewage is created, which may be called a decentralized system. The treatment process has a series of treating units which are categorized under primary treatment, secondary treatment and tertiary treatment.

The primary treatment removes suspended & floating solids of raw sewage. It includes screening to trap solid objects and sedimentation by gravity to remove suspended solids. This level is sometimes referred to as “Mechanical Treatment” although chemicals are often used to

accelerate the sedimentation process. Primary treatment can reduce the BOD of the incoming wastewater by 20-30% and the Total suspended solids by some 50-60%. Primary treatment is the first stage of sewage treatment.

The secondary treatment removes the dissolved organic matter that escapes primary treatment. Secondary treatment is typically performed by indigenous, water-borne micro-organisms in a managed habitat. It requires a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.

Tertiary treatment is sometimes is defined as anything more than primary and secondary treatment in order to allow ejection into a highly sensitive or fragile ecosystem. Tertiary treatment can remove more than 99% of all the impurities from sewage, producing an effluent of almost drinking water quality. Treated water is sometimes disinfected chemically or physically prior to discharge into a stream, river or wetland.

Puspalatha et.al (2016) reviewed on design approach for sewage treatment plant. A case study of srikakulam greater municipality. The present study involves the analysis of parameters like BOD, raw sewage, effluent. The construction of sewage treatment plant will prevent the direct disposal of sewage in nagavali river and the use of treated water will reduce the surface water and contaminated ground water.

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.

Chakar bhushan et al. (2017) reviewed about design of sewage treatment plant for lohegaon village, Pune. This project studied that social and environmental pollution issue due to sewage is disposed in some part of village and directly sewage drain in open land. It is used for recharging sub surface water level at lohegaon and used for irrigation purpose.

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.

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.

FLOW DIAGRAM

RAW SEWAGE → BAR SCREEN CHAMBER→ OIL &GREASE TRAPS→COLLECTION TANK→ FEED PUMP→ SBR-1&2 →FILTER FED PUMP→ FILTRATION SYSTEM → ACTIVATED CARBON FILTER→ TREATED WATER FOR GARDENING

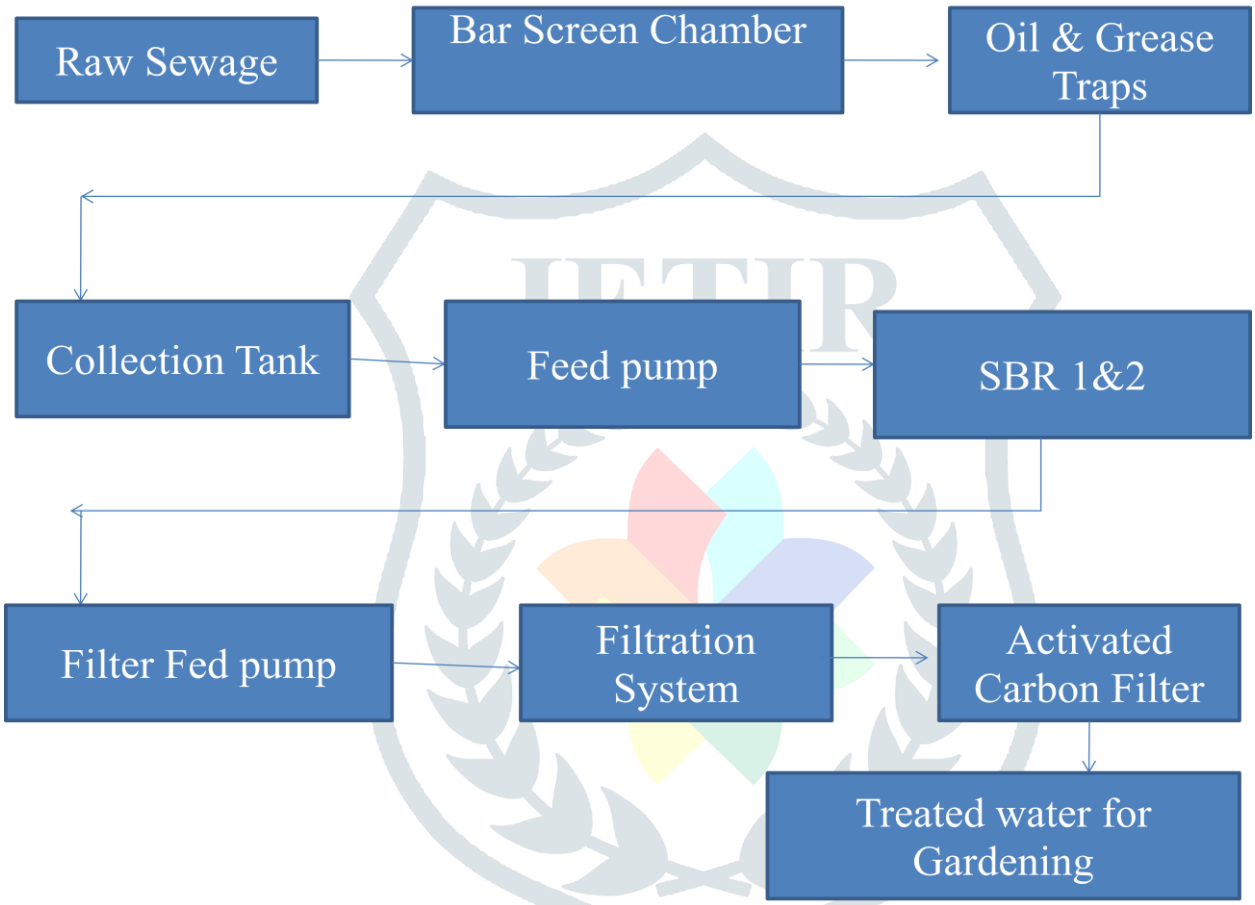


Fig 1: Flow chart of the process done in STP

2.0 Planning and Design of STP:

In this paper the treatment technologies adopted for treating sewage are as follows: A. Activated Sludge Process B. Chlorination C. Filtration Sewage treatment is the process

of removing contaminants from wastewater and house hold sewage, both runoffs (effluents), domestic, commercial and institutional. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. 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 .The treatment of waste water is not only important for our own health but also to keep our environment clean and healthy.

In a sewage treatment plant, the activated sludge process is a biological process that can be used for one or several of the purposes like oxidizing

carbonaceous biological matter, oxidizing nitrogenous matter: mainly ammonium & nitrogen in biological matter, removing phosphate, driving off entrained gases such as carbon dioxide, ammonia, nitrogen generating a biological floc that is easy to settle, generating a liquor that is low in dissolved or suspended material. The process involves air or oxygen being introduced into a

mixture of screened and primary treated sewage or industrial wastewater combined with organisms to develop a biological floc which reduces the organic matter content of the sewage. The combination of wastewater and biological mass is commonly known as mixed liquor. In all activated sludge plants, once the sewage or wastewater has received sufficient treatment, excess mixed liquor is discharged into settling tanks and the treated supernatant is run off to undergo further treatment before discharge. Part of the settled material, the sludge, is returned to the head of the aeration system to re-seed the new sewage entering the tank. This fraction of the floc is called return activated sludge. Excess sludge is called surplus activated sludge is removed from the treatment process to keep the ratio of biomass to food supplied in the wastewater in balance, and is further treated by digestion, either under anaerobic or aerobic conditions prior to disposal. Activated sludge refers to biological treatment processes that use a suspended growth of organisms to remove BOD and suspended solids. The process requires an aeration tank and a settling tank. Clarifiers are settling tanks built with mechanical means for continuous removal of solids being deposited by sedimentation. Disinfection of sewage is necessary for healthy rivers and streams .Microorganisms are present in large numbers in sewage and waterborne disease outbreaks have been associated with sewage-contaminated water supplies.

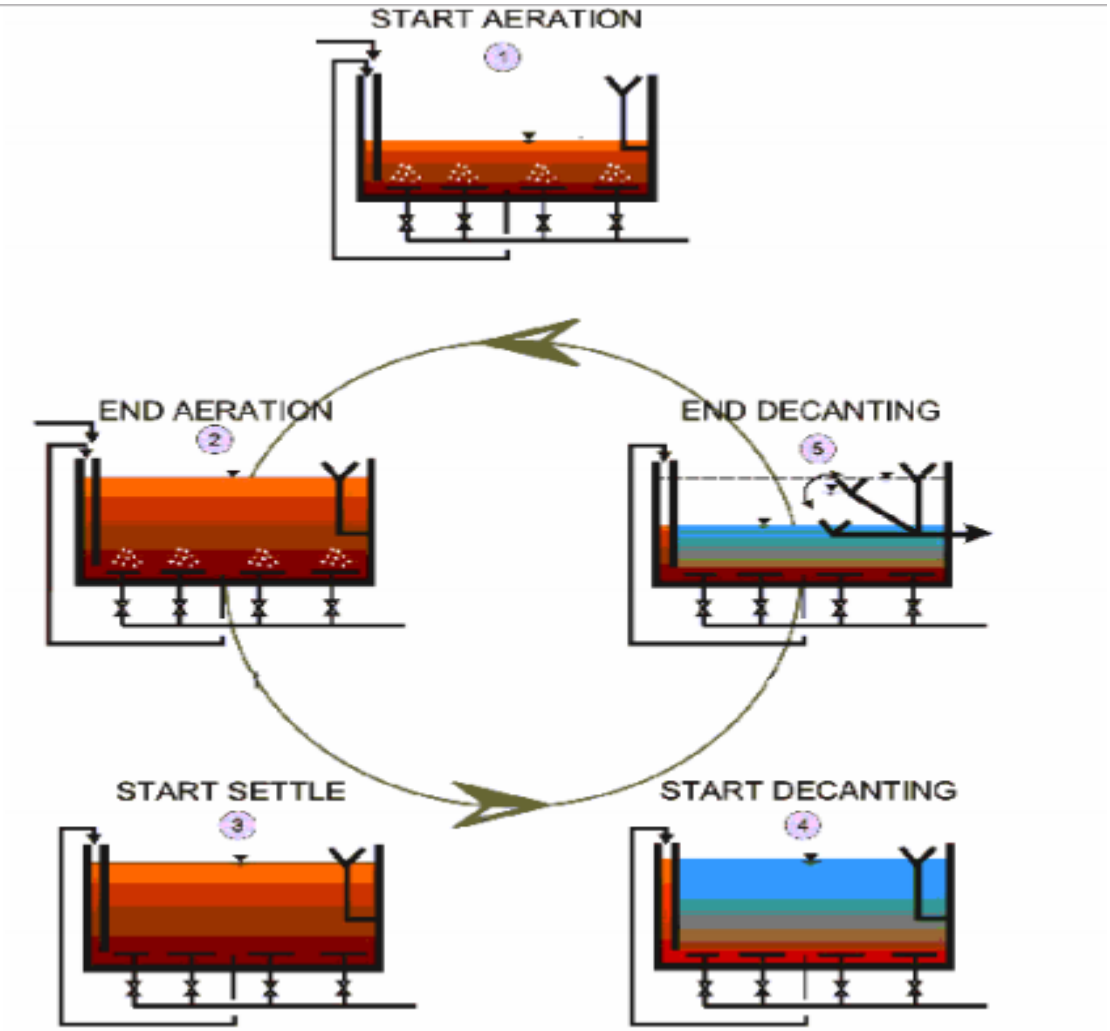
SBR Technology:

SBR technology makes use of charging, aeration, rest phase, clear water extraction. In the charging process primary treatment is done and the solid substances are retained. In the process of aeration water cleared from solid substances is sent in to the air by pressure and gets purified by oxygen present in air. A rest phase now follows during which live sludge rests at bottom. This allows the clear water zone to form on the top of the SBR tank. The purified water after this process can be sent into the tank and can be used for gardening etc.

SBR is a SEQUENTIAL BATCH REACTOR process. It provides highest treatment efficiency possible in a single step biological process. SBR – System is operated in a batch reactor mode which eliminates all the inefficiencies of the continuous processes. A batch reactor is a perfect reactor, which ensures 100% treatment. Two modules are provided to ensure continuous treatment. The complete process takes place in a single reactor, within which all biological treatment steps take place sequentially. NO additional settling unit / secondary clarifier is required. The complete biological operation is divided into cycles. Each

cycle is of 3 – 5 hrs duration, during which all treatment steps take place.

These phases in a sequence constitute a cycle, which is then repeated.



3.0 Data considered for the planning of STP:

Plant capacity : 250KLD

The characteristics of sewage taken as follows

pH: 6-7

TSS: 200mg/l

BOD5: 300-350mg/l

COD: 450-500mg/l

The characteristics of treated sewage shall be as follows

pH: 7-8

TSS: 100mg/l

BOD5: 30mg/l

COD: 100mg/l

Based on the above particulars following components shall be provided considering SBR Technology employed in the STP.

Table 1:

S.NO	Description	Qty	UOM
1	Bar screen chamber	1	NO
2	Oil & Grease removal tank	1	NO
3	Raw sewage collection tank	1	NO
4	Sequential Batch	2	Nos

	Reactor (CBR)		
5	Treated water tank	1	NO
6	Sludge drying beds	4	Nos
7	Electical panel room cum plant room	1	NO

Table 2:

S.NO	Description	Qty	UOM
1	Bar screen	1	No
2	Feed pumps	2	Nos
3	Air blowers	2	Nos
4	Air grid &diffusers for SBR & collection tank	1	Lot
5	Filter feed pumps	2	Nos
6	Filtration systems	1	No
7	Activated carbon filter	1	No
8	Hypo dosing system	1	No
9	Sludge pump	1	No
10	Inter connecting piping & fittings	1	Lot
11	Electrical panel board	1	No
12	Design, drawing ,erection &commissioning of the plant	1	No

CONCLUSION

The problems associated with wastewater reuse arise from its lack of treatment. The challenge thus is to find such low-cost, low-tech, user friendly methods, which on one hand avoid threatening our substantial wastewater dependent livelihoods and on the other hand protect degradation of our valuable natural resources. The use of constructed wetlands is now being recognized as an efficient technology for wastewater treatment. Compared to the conventional treatment systems, constructed wetlands need lesser material and energy, are easily operated, have no sludge disposal problems and can be maintained by untrained personnel. Further these systems have lower construction, maintenance and operation costs as these are driven by natural energies of sun, wind, soil microorganisms, plants and animals. Hence, for planned, strategic, safe and sustainable use of wastewaters there seems to be a need for policy decisions and coherent programs encompassing low-cost decentralized waste water treatment technologies, bio-filters, efficient microbial strains, and organic / inorganic amendments, appropriate crops/ cropping systems, cultivation.

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