A CASE STUDY ON THE SEWAGE TREATMENT PLANT IN A PRESCRIBED LOCALITY

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Abstract— The general construction of a sewage treatment plant doesn't differ too drastically from that of a septic tank. Just as with a septic tank, sewage flows from the property being serviced into the first chamber of the sewage treatment plant. Here, the water sits until grease, oil and scum have floated to the top and solids have settled on the bottom of the tank. Once the process of separation has taken place, the liquid travels into a second chamber which is where sewage treatment plants differ from septic tanks. This chamber is fitted with an air pump that circulates air around the chamber to encourage the growth of aerobic bacteria. This bacteria helps to break down the contaminants in the water, effectively cleaning it.The final stage of a sewage treatment plant is one last settlement tank. This final tank allows the very last solids that may remain to sink to the bottom of the tank before the effluent is discharged into a soakaway or water course. Once the treatment process has been completed and the wastewater has been treated as thoroughly as possible, it can be discharged into the environment. This is another key area where sewage treatment plants differ from sewage treatment plants. Whereas you must discharge effluent from a septic tank into a soakaway for further treatment in the ground, subject to an Environment Agency Consent to Discharge, you can discharge your effluent into local water sources straight from your treatment plant. This is because of the vastly improved effluent quality that the treatment process produces.

Keywords: Sewage, Treatment, contaminants

I. Introduction

Sewage treatment (or domestic wastewater treatment, municipal wastewater treatment) is a type of wastewater treatment which aims to remove contaminants from sewage to produce an effluent that is suitable to discharge to the surrounding environment or an intended reuse application, thereby preventing water pollution from raw sewage discharges. Sewage contains wastewater from households and businesses and possibly pre-treated industrial wastewater. There are a high number of sewage treatment processes to choose from. These can range from decentralized systems (including on-site treatment systems) to large centralized systems involving a network of pipes and pump stations (called sewerage) which convey the sewage to a treatment plant. For cities that have a combined sewer, the sewers will also carry urban runoff (stormwater) to the sewage treatment plant. Sewage treatment often involves two main stages, called primary and secondary treatment, while advanced treatment also incorporates a tertiary treatment stage with polishing processes and nutrient removal. Secondary treatment can reduce organic matter (measured as biological oxygen demand) from

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sewage, using aerobic or anaerobic biological processes.

II. SEWAGE TREATMENT PLANT

Sewage treatment plants are facilities designed to treat wastewater, ensuring it's safe to be released back into the environment. They play a vital role in maintaining public health and protecting ecosystems. The process involves several stages, including:

1. **Preliminary Treatment:** Large objects like sticks, rags, and grit are removed using screens and grit chambers.
2. **Primary Treatment:** The sewage undergoes sedimentation, where solids settle to the bottom forming sludge, while oils and grease float to the surface and are skimmed off.
3. **Secondary Treatment:** Biological processes are employed where microorganisms break down organic matter present in the sewage. This is commonly done in activated sludge systems, trickling filters, or other biological reactors.
4. **Tertiary Treatment:** This stage further polishes the water to remove remaining impurities, such as phosphorus and nitrogen. Methods like filtration, chemical treatment, or advanced biological processes are used.
5. **Disinfection:** Before discharge, the treated water is disinfected to eliminate harmful bacteria and pathogens. Chlorination, ultraviolet (UV) light, or ozonation are common methods used for this purpose.

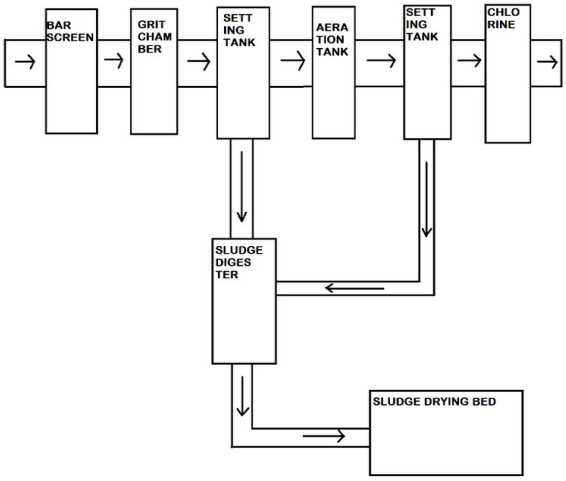
Once the water goes through these stages, it's often safe enough to be discharged into rivers, lakes, or oceans, or reused for irrigation or industrial purposes, depending on local regulations and needs. The solid waste collected during the process, known as sludge, can be further treated and used as fertilizer or disposed of safely.

III. ADVANTAGE OF SEWAGE TREATMENT PLANT

1. Used to develop method for the treatment of toxic compound.
2. Improving the design and operation of biochemical treatment system used for degradation of toxic compounds.
3. Improving of public health, sanitation, soil integrity and the conservation of fresh water resources.

Fig:1: Sewage Treatment plant

Block diagram of sewage treatment plant:



IV. Design of Screening

Screening Design is an experimental design where the objective is to identify significant factors from a large list of potential factors by running a smaller or minimum number of experiments. These designs get completed within a shorter time and reasonable cost.

Screening designs are used for screening a large number of process or design parameters to identify the most important parameters that will have significant impact on the process performance. Once the key parameters are identified, subsequent experimentation can be performed using these parameters to understand and analyze the nature of interactions among them using full/fractional factorial designs and response surface methods, if necessary. Plackett–Burman (P–B) designs allow the experimenters to evaluate a large number of process/design parameters in a minimum number of trials (i.e. with minimum budget and resources). One of the stringent assumptions experimenters make is the unimportance of interactions in the early stages of experimentation.

Figure 2: Screening

V. Design of Grit chamber

Grit chambers are of two types: mechanically cleaned and manually cleaned. In mechanically cleaned grit chamber, scraper blades collect the grit settled on the floor of the grit chamber. The grit so collected is elevated to the ground level by several mechanisms such as bucket elevators, jet pump and air lift. The grit washing mechanisms are also of several designs most of which are agitation devices using either water or air to produce washing action. Manually cleaned grit chambers should be cleaned at least once a week. The simplest method of cleaning is by means of shovel.

VI. Design of Skimming Tank

A skimming tank is a chamber so arranged that the floating matter like oil, fat, grease etc., rise and remain on the surface of the waste water (Sewage) until removed, while the liquid flows out continuously under partitions or baffles.

It is necessary to remove the floating matter from sewage otherwise it may appear in the form of unsightly scum on the surface of the settling tanks or interfere with the activated sludge process of sewage treatment. It is mostly present in the industrial sewage. In ordinary sanitary sewage, its amount is usually too small.

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X. Design of Aeration Tank

Aeration tank liquid depths should be not less than 10 feet or more than 30 feet; horizontally mixed tanks shall have a depth of not less than 5.5 feet. 2. All tanks shall have a freeboard of not less than 18 inches; if mechanical surface aerators are used, minimum freeboard shall be not less than 3 feet.

XI. WATER PUMP:

A pump is a machine used to move, compress, or transfer water. There are a number of different types of pumps available: jet pumps, centrifugal pumps, gear pumps, peristaltic pumps, gravity pumps, and impulse pumps. All of them are useful across a number of different industries. For use in daily life, the most

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commonly used category of pump is the water pump of the centrifugal variety.
Water pumps are a vital tool for various residential, light commercial or agricultural jobs and especially in rural areas, it can play a critical role. A water pump can drain water from a basement or shallow flooded areas, drain and fill a swimming pool or dam, or alternatively can also be utilized in the irrigation needed for agriculture.

The main function of Water pumps is to get rid of excess water or transfer water between two points. Water pumps fall into 2 different categories which are centrifugal pumps and the positive displacement design type.

XII. BATTERY:

A battery is a device consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to include devices composed of a single cell.

XIII. FUTURE SCOPE:

As per future perspective of this project, the characteristics of different units designed in this project can be compared with alternate treatment efficient can be calculated for designing of STP (Sewage Treatment Plant).
For example - We choose activated sludge process in secondary treatment, but any other treatment processes like trickling filters, aerated lagoons, oxidation ponds, RBCs etc. can also be taken as secondary treatment unit and is designed. The design values & other parameters related to it are compared and the graphs are plotted accordingly. The best alternative should be selected as the final one.

XIV. CONCLUSION:

1. The waste water has high BOD, Turbidity and total dissolved solids. Our aim is to make this water safe for disposal in natural environment or to use it for other purposes.
2. The DO content of waste water recorded is found to be low value due to the presence of higher organic matter and an increased BOD and COD.
3. This increased BOD and COD value indicate the polluted nature of the discharge. We've to treat it at least below to 20ppm.
4. Higher quantity of inorganic nutrients like nitrogen & phosphorus was found present in the waste water.
5. The waste water has a Ph range of 7.5-8.5
6. Most Probable Number value was higher again indicating the polluted nature of the waste water.
7. Disposal without any treatment in to fresh water body may impose the danger of eutrophication as well as serious problems of health and hygiene.
8. Long term leaching of waste water may alter the soil characteristics as well as may influence the quality of ground water.
9. The treated wastewater can be utilized for purposes like gardening, washing vehicles and cleaning garages, etc.

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