Model Representation Of Sewage Treatment Plant In FIT Campus

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Abstract— Farah Institute of Technology, Chevella is one of the most important educational institutes in the state of Telangana, with a number of people residing in its campus consisting of number of laboratories of various department, academic blocks and hostel. A study on domestic waste characterization has been performed followed by model presentation of sewage treatment plant. The present study involves the analysis of pH values, Total Solids, Total Suspended Solids, Acidity,Alkalinity,Chloride,BOD, Electric Conductivity, DO. A sewage treatment plant is quite necessary to receive the domestic and commercial 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 solids waste (or treated sludge) suitable for disposal or reuse.

Keywords— BOD_5, Total solids,Sewage,STP,DO.

I. INTRODUCTION

Water is a vital resource that is used, misused, and wasted in society. Once water has been used, it becomes wastewater, which has its own characteristics and impact on the environment. Waste water is liquid waste discharged by domestic residences, commercial properties, industry, agriculture, which often contains some contaminants that result from the mixing of wastewater from different sources. Based on its origin wastewater can be classed as sanitary, commercial, industrial, agricultural or surface runoff. Term wastewater need to be separated from the term Sewage, The terms "sewage" and "Sewerage" are sometimes interchanged [1].Sewage is contaminated with feces or urine. The sewage generates from residence, hospitals, offices, industries etc. Sewage includes domestic, municipal, or industrial liquid waste products disposed off, usually via a pipe or sewer (sanitary or combined), Domestic sewage contains a wide variety of dissolved and suspended impurities and is the primary source of pathogens (disease causing microorganisms) and putrescible organic substances. Because pathogens are excreted in feces, all sewage from cities and towns is likely to contain pathogens of some type, potentially presenting a direct threat to public health. Putrescible organic matter presents a different sort of threat to water quality during recent years; there has been an increasing awareness and concern about water conservation all over the world. Hence, a new approach towards achieving sustainable development of water resources has been developed internationally.

II. OBJECTIVES

The principal objective of waste water treatment is generally to allow human and industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment. An environmentally-safe fluid waste stream is produced. No danger to human health or unacceptable damage to the natural environment is expected. Sewage include household waste liquid from toilets, baths, showers, kitchens, sinks and so forth that is disposed of via sewers.

The objectives of the study are:-

1. Influent characteristics of FIT Campus.
2. Model Representation of Sewage Treatment Plant.
3. Effluent Characteristics of FIT Campus.
4. To determine various parameters of treated effluents like pH, Electric Conductivity, TDS Alkalinity, Acidity , Total Solids, DO, BOD_5, Chloride.

III. LITERATURE REVIEW

KAVITA N. CHOKSI et.al: "*To Evaluate The Performance Of Sewage Treatment Plant: A Case Study"* The trend of urbanization in India is exerting stress on civic authorities to provide basic requirement such as safe drinking water, sanitation and infrastructure. The rapid growth of population has exerted the portable water demand, which requires exploration of raw water sources, developing

treatment and distribution systems. The study is based on the environmental engineering. The efficiency of the Anjana Sewage Treatment Plant, Surat will be worked out during the entire project. The selected parameters are pH, Turbidity, TSS, TDS, COD and BOD. A waste water treatment plant with Activated Sludge Process as biological treatment method has been considered for performance evaluation. The overall performance of the existing was satisfactory [2].

SONAJE N P et.al: "*Modeling Of Wastewater Treatment Plant Design for Pulp and Paper Industry: A Review"* Pulp and paper industry is responsible for large discharge of highly polluted effluents. The modeling environment of wastewater treatment plant includes several mathematical techniques, interactive graphic displays, and user-friendly interfaces. In view of the multiple factors and parameters affecting the wastewater treatment plant design, a trial-and-error design procedure is commonly used until each treatment unit's design has been adjusted to the targeted effluent and sludge characteristics which are time consuming and complex. However, in order to take advantage of the possibilities offered by the software's, it is necessary to create the suitable software adjusted to the specific requirements of their application area. Considering these factors and necessity this paper took the review of the existing literature of the modeling processes and various software's available for the design of wastewater treatment plants for pulp and paper industry [3].

IV. MATERIALS AND METHODOLOGY

A. Sample collection:

Sewage was collected from FIT Campus and Hostel. The samples are collected daily in between 9:00 am to 10:30 am to carrying out the test for at least a week. The reason we collect the sample at this timing was because the concentration of waste water was very high, and all the works like cleaning, bathing, washing sand latrine are mostly done in this timing. The samples were collected in different cans from two different sources (FIT campus and Hostel). The collected samples were then taken to laboratory for daily analysis in order to determine the quality of the waste water.

B. Physico-Chemical methods of analyzing wastewater:

Based on literature review and the objectives for the present study, the experiments were carried out by the following procedures as described (Table 1). The analyses of wastewater were carried out according to standards prescribed by APHA, AWWA and WEF [4].

TABLE I. METHODS AND INSRUMENTS USED FOR ANALYSIS OF WASTEWATER

Sl .No	Parameter	Method used	Equipment used
1	pH	Electrometric	pH meter
2	Color	Visual observation	
3	Electric conductivity	Electrometric	Conductivity meter
4	BOD_3 @ 20°C	Dilution method	Volumetric glassware
5	Total Solids	Gravimetric method	Gooch Crucible
6	Dissolved Solids	Gravimetric method	Gooch Crucible
7	Suspended Solids	Gravimetric method	Gooch Crucible
8	Chloride	Dilution method	Titrant

C. Important parameters:

- *pH*

The pH value of water is defined as the log of reciprocal of hydrogen ion concentration in water. Mr. Sorensen gave the expression for pH in the year 1909A.D.

$pH = \log10 (1/ H^+)$

It follows that if the pH value is found to be less than 7 it will become acidic in nature, and if its value is found to be more than 7 then it will become alkaline in nature.

- *Color*

The color which is observed during sample collection is noted down. Fresh domestic sewage has a slightly soapy and cloudy appearance depending upon its concentration. As time passes the sewage becomes stale, darkening in color with a pronounced smell due to microbial activity.

- *Total solids*

The term solids refers to the matter either filterable, in filterable that remains as a dried up sediment residue when heated at high temperatures and dried. Further categorization depends on the temperatures at which the wastewater has been ignited. The various types of solids, which will be usually present in wastewater or spent water or
Sewage, are:
1. Total Solids (TS).
2. Total Suspended Solids (TSS).
3. Total Dissolved Solids (TDS).

- *Alkalinity*

It is the capacity of solution to neutralize an acid. it is an important parameter to measure the sensitivity of any water source towards acidic inputs[5]. The method implied is applicable to the determination of

alkalinity in water and waste water. The applicable value is 0.5 to 500 mg/l alkalinity as $CaCO_3$.

- *Acidity*

Acidity is a measure of the capacity of water to neutralize bases. Acidity is the sum of all titration acid present in water sample. Strong minerals acids, weak acid such as carbonic acid, acetic acid present in the water sample contribute to acidity of water. Usually dissolved carbon dioxide (CO_2) is the major acidic component present in the unpolluted surface water.

- *Conductivity*

This is a parameter which is used to determine the impurities present in water which is caused due to the presence of ions. The major factors which cause the parameters are the mobility of these ions. The presence of inorganic compounds in the water makes them good conductors and the presence of organics make them bad conductors. They are majorly studies because they bring out a change in the waters which have to be boiler feed and to be used as cooling agents.

- *Dissolved Oxygen (DO)*

The method followed for the detection of DO in water samples is the Azide modification method. One of the most important water quality parameters is the amount of dissolved oxygen present. The DO levels in natural and wastewater depend on the physical, chemical & biological activities in the water body.

- *Biochemical Oxygen Demand (BOD_5)*

The biochemical oxygen demand is measure of oxygen utilized by microorganisms during biological oxidation of organic matter. BOD_5 is the amount of oxygen required by stabilizing biologically decomposable organic matter by the microorganisms in a waste under aerobic conditions.

- *Chloride*

Natural water sources contain small amounts of chloride ions. These ions present in a water source can be attributed to the distribution of salts deposits, discharging of effluent from chemical industries, oil well operations, Sewage discharge, irrigation discharge, contamination from refuge, inland sea water intrusion in coastal areas. This chloride ion concentration may affect the ground water by percolation and direct contamination of surface water.

D. Methodology:

Before one starts with the modeling of a waste water treatment plant one must have a very clear understanding of the concept of what wastewater is and what its treatment means. In simplest word, it can be said that wastewater is nothing, but the used water or liquid waste generated by the community due to its various activities, and contains the impurities in excess of the permitted/the regulated statutory limits. Technically, however, waste water can be defined as any water or liquid that contains impurities or pollution in the form of solids, liquid or gases or their combination in such a concentration that is harmful if disposed in the environment.

- Impurities in waste water are mainly due to the presence of solids in the water. The solids may be organic or inorganic in nature and may be present in suspended, colloidal or in the various form of their combinations.
- The prescribed limit or acceptable level of concentration of impurities or pollutants is laid down by the local authorities such a municipality or state pollution control board (SPCB) or central pollution control board (CPCB) in India.
- The final discharge of wastewater will normally be either into the body of water or onto the land. The receiving bodies of water may be streams, lakes, pond, canals, rivers, seas, estuaries, etc.

E. Working procedure:

The waste water arising from hostel, college and other part of campus is pumped into a common receiving/ collection tank. In order to remove the floating materials and coarse solids from waste water, the waste water is passed through a device with clear opening of uniform size called as “screen”. The waste water is passed into the sedimentation basin or settling basin, mainly to remove heavier coarse particles and relatively dry suspended dry solids called grit chamber. As the waste water contain oil, grease and other small floating matters such as fats, vegetables, debris, fruits skin etc. The waste water is pump to the skimming tank which is placed after the collection tank and screen, grit chamber. After skimming tank the waste water is pass through the primary sedimentation tank where 60-70% of suspended solids and 30-40% of BOD are removed. It acts as the main treatment units. Further the waste water is drawn into the aeration tank where oxygen is provide in order to remove H_2S and CO_2 gas and increase the DO, preventing the septic condition of sewage. After aeration, the waste water is pass into a secondary sedimentation tank where considerable length of over flow is desirable where large volume of suspended solids are removed. The waste water from secondary sedimentation tank is passed through filter chamber consisting of layer of sand, gravels, pebble. Here these act as trio films and favours decomposition of organic matters. After filtration, the waste water is pumped into disinfection chamber where disinfectants are closed in order to kill micro organisms. These at last effluents are collected into distribution chamber from which the effluents are distributed (Fig: 1).

V. RESULT AND DISCUSSION

The quality of sewage and the trial information got from the sewage by the sewage treatment plant. Initially the samples were collected from the hostel and college campus of FIT from two different manholes, and are analyzed on various parameters in college laboratory (Fig: 1-9). The characteristics of sewage used in the study are given in Table II.

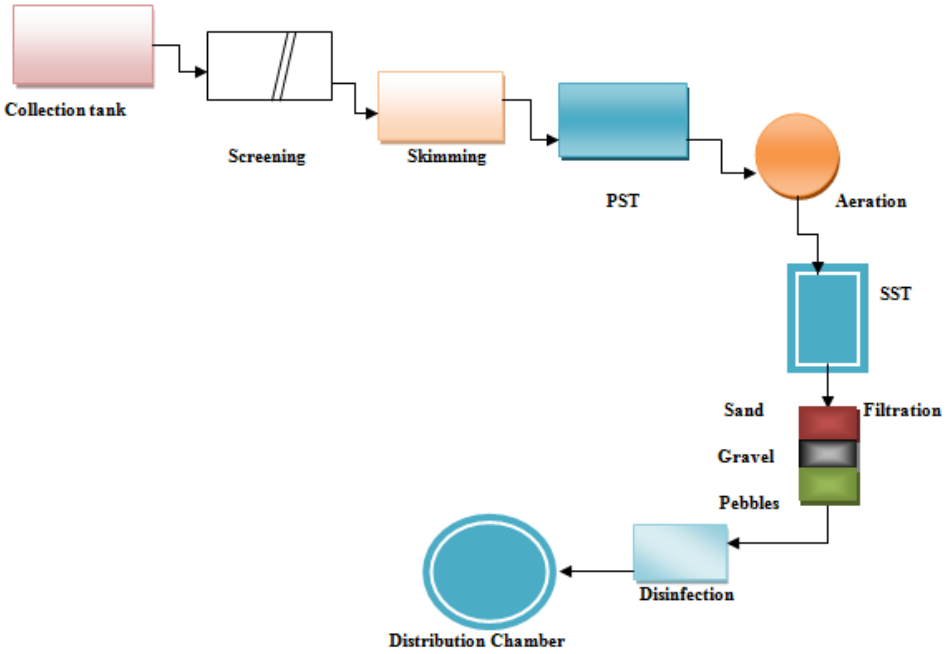

Fig 1: Flow chart of sewage treatment plant

Table II: Initial Characteristics of waste water

Sl. No	Parameters	Unit	Values Obtained
1	pH	-	7.67
2	Electric Conductivity	Micro Siemens/ cm	1514
3	Alkalinity	mg/L	298
4	Acidity	mg/L	136
5	Chloride	mg/L	79.40
6	BOD	mg/L	105
7	Total Solids (TS)	mg/L	1200
8	Dissolved Solids (DS)	mg/L	744
9	Suspended Solids (SS)	mg/L	800

A. *Effluent characteristics of waste water:*

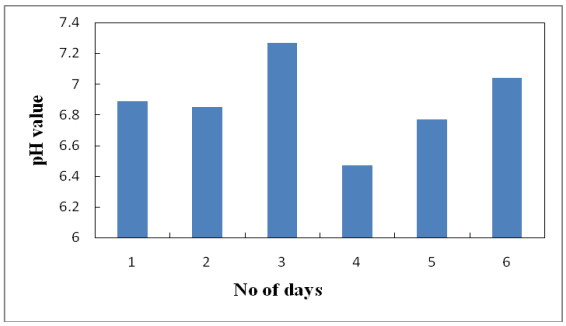

Fig: 1 variation of pH

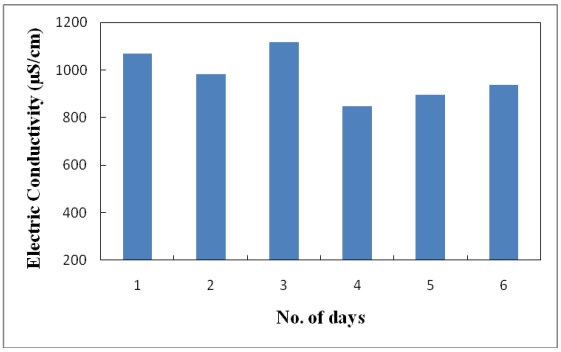

Fig: 2 variation of EC

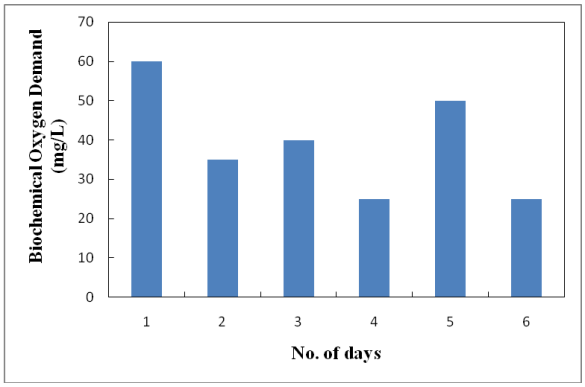

Fig: 3 variation of BOD_5

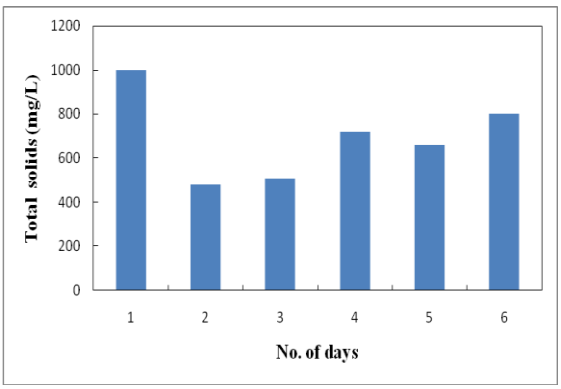

Fig: 4 variation of Total solids

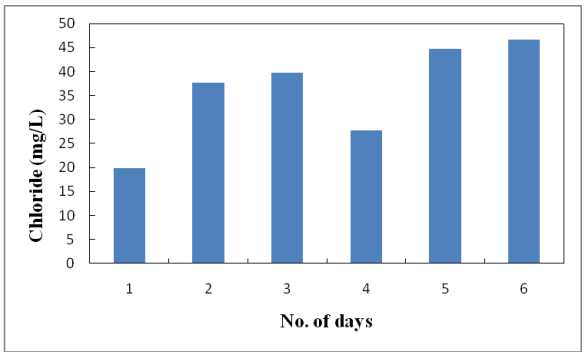

Fig: 5 variation of chloride

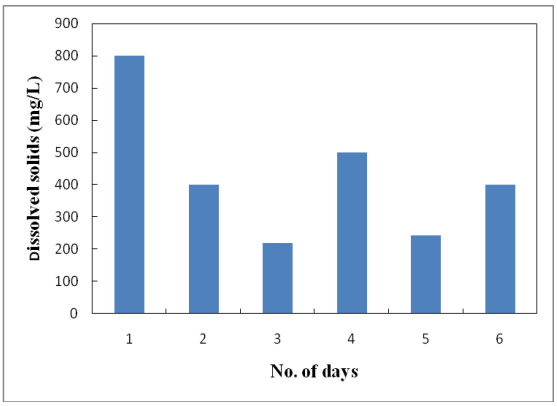

Fig: 6 variation of Dissolved solids

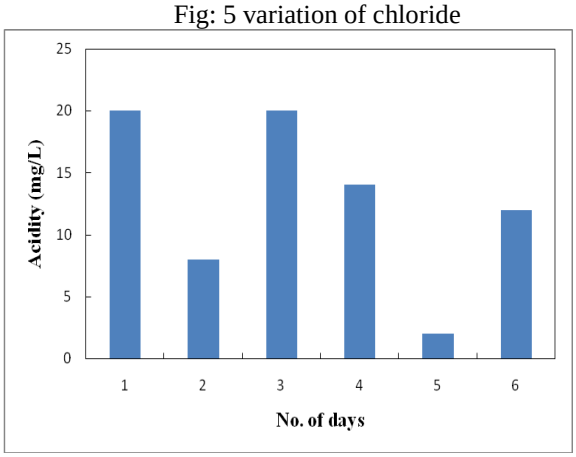

Fig: 7 variation of Acidity

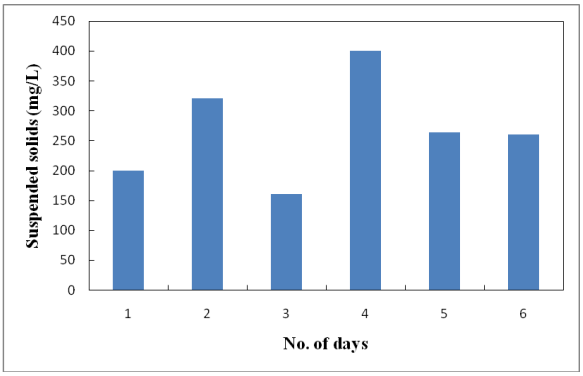

Fig 8: variation of Suspended solids

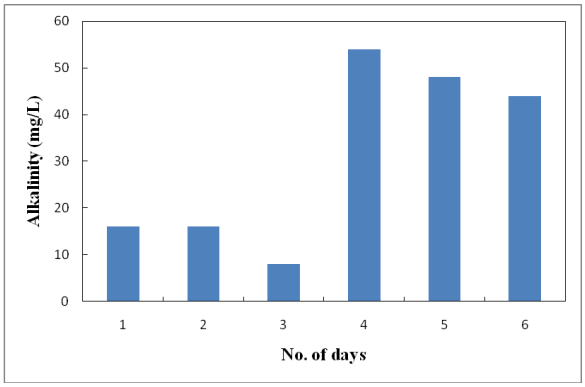

Fig 9: variation of Alkalinity

VI. CONCLUSION

1. The average values of physical and chemical characteristic of waste water are experimentally found out.
2. The pH ranges from 6.47 to 7.27, the conductivity ranges from 846µS/cm to 1070 µS/cm.
3. Total solids, suspended solids, dissolved solids ranges from 480 mg/L to 800 mg/L, 220mg/L to 800mg/L, 160 mg/L to 400 mg/L respectively.
4. BOD values ranges from 25 mg/L to 60mg/L, chloride ranges from 19 mg/L to 46.65 mg/L. BOD reduction was 62%.
5. Acidity ranges from 2 mg/L to 20 mg/L, alkalinity from 8 mg/L to 54 mg/L
6. Overall 32% to 40% of treatment is done.

VII. SCOPE OF THIS STUDY

- Modification can be done in the secondary treatment to enhance the treatment efficiency.
- The lab scale sewage treatment plant can be design for larger scale.

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