International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 3.45 (SJIF-2015), e-ISSN: 2455-2585
Volume 4, Issue 4, April-2018

CHARECTERIZATION OF SEWAGE AND DESIGN OF SEWAGE TREATMENT PLANT

S.P. Salma begum[1] S.Lokesh[2], L.Chanikya[3], G.S.Krupavani[4]

[1]Civil department& JNTUA University,salma12141991@gmail.com

[2]Civil department& JNTUA University,sugurilokesh@gmail.com

[3]Civil department& JNTUA University,chanikya86@gmail.com

[4]Civil department& JNTUA University,jessicakrupa1996@gmail.com

ABSTRACT- JNTU College of engineering Pulivendula is one of major educational institute in kadapa district having a large number of people residing within campus and consisting of large number of laboratories, academic blocks and number of hostels. A study on domestic waste water characterization will be performed followed by design of sewage treatment plant. The present study involves the analysis of pH value, total solids, hardness, acidity, alkalinity, chlorine content, BOD. A sewage treatment plant is quite necessary to receive domestic and commercial waste water and removes the materials which pose harm for general public and environment. The samplings of the domestic waste from hostels have been done in Different times of the day to have an average data of the measured parameters. The average values of all parameters of sewage are found out.

KEY WORDS: BOD, sewage, environment, design, water, pollutants, sludge etc.

I. INTRODUCTION

Any educational institute definitely produces some amount of waste water because water is very essential to survive human life. As per rules & regulations of environment act 'achieving the safe and healthful environment' is the responsibility of that particular organization. To achieve the safe environment the people who residing in that place are liable to charge. If any organization fails to reduce the parameters of effluents within the standards, they are punishable in a legal manner

- Sewage includes wastes from residing units (kitchens , toilets, sinks) and from laboratories so forth that is disposed via sewers

- Storm water also a major part of sewage and it suddenly increases the load on treatment plant
- Sewage and its effluents are major pollutants of water pollution
- Sewage mainly composed of human facial matter and some solids which are very harmful to the environment
- The rapidly growing environmental pollution needs decontaminating waste water results in the study of characteristics of sewage, and treating the sewage in proper manner
- Generally treatment of sewage consists of physical, chemical & biological process to reduces or to remove the concentration of different contaminants
- After treatment of sewage some renewable energy has been produced
- The effluents from sludge drying beds can be used as fertilizer
- The present study comprises the study on quality of domestic sewage which discharging from hostels of our Jawaharlal Nehru College of Engineering Pulivendula.

II. LITERATURE REVIEW:

1. S. I. KHAN AND N. KAMAL: ASSESSMENT OF TREATMENT EFFICIENCY BY QUANTITATIVE RECOVERY OF INDICATOR BACTERIA AND PATHOGENS IN SEWAGE EFFLUENTS. 129. DEPARTMENT OF MICROBIOLOGY, UNIVERSITY OF DHAKA, BANGLADESH.

2. IS: 3025 (PART 10) – 1984 METHODS OF SAMPLING AND TEST (PHYSICAL AND CHEMICAL) FOR WATER AND WASTE WATER, PART 10 - TURBIDITY.
3. IS: 3025 (PART 15) – 1984, METHODS OF SAMPLING AND TEST

III. OBJECTIVES OF THE STUDY

The main objective of the study is to produce the safe & hygienic environment surrounding our campus. It can be done by removing the all nuisance casing elements from sewage.

- To produce the eco-friendly effluents by treating the sewage in suitable manner
- Then comparing with prescribed standards to check whether the effluents are disposable or not
- To dispose the effluents of treatment plant in a scientific manner without causing any harm to environment
- To protect the environment
- To reduce the water borne diseases and thus providing the healthful environment to the people who living in the campus & surrounding the campus
- To supply recycled water to the plants and crops
- To produce a some renewable energy which can be useful for different purposes

IV. METHODOLOGY ADOPTED

As we know that the sewerage system follows collection of sewage, treatment and disposal of sewage and its effluents respectively. For determining the required parameters of sewage, the samples are collected in the clean bottles at different durations of a day, after that all necessary tests are conducted by using water analysis equipment, turbidity meter, pH meter etc

The following test were conducted

- pH value
- Colour & Odour
- turbidity
- total hardness
- BOD
- Dissolved oxygen
- COD
- Residual chlorine
- Alkalinity
- Total solids etc.

pH value: pH means negative logarithm of hydrogen ion concentration and it can be determined either by using pH paper or by water analysis meter. Calibration is most important step in the entire process by water analysis meter.

COLOUR & ODOUR: Colour can be identified simply by vision. Generally fresh raw sewage has light brown colour, then as age of sewage increases it's getting dark black colour gradually. Odour is a physical property of sewage which means smell of sewage. Odour can be caused by both organic and inorganic particles

TURBIDITY: turbidity is a measure of suspended particles in the sample which is taken from required places. The intensity of light scattered by the sample under deified condition is compared with the intensity of light scattered by the standard reference suspension, forms the basis for determination of turbidity. Higher the intensity of scattered lights higher the value of turbidity.

TOTAL HARDNESS: Ability to form stable complexes with calcium and magnesium ions. Hardness causes corrosion and formation of scales in sewers thus reduces efficiency of a treatment plant. It is determined by titration of the sample with EDTA solution by using EBT as indicator.

BOD: It is used to measure the biodegradable organic fraction in raw sewage. It is determined by measuring the initial dissolved oxygen and final dissolved oxygen after incubating the sewage for the period of 5 days

DISSOLVED OXYGEN: DO is determined by Winkler method. It is the measure of amount of oxygen which is dissolved in the sewage. Higher DO may cause corrosion of sewers. It may be affected by temperature, presence of impurities etc

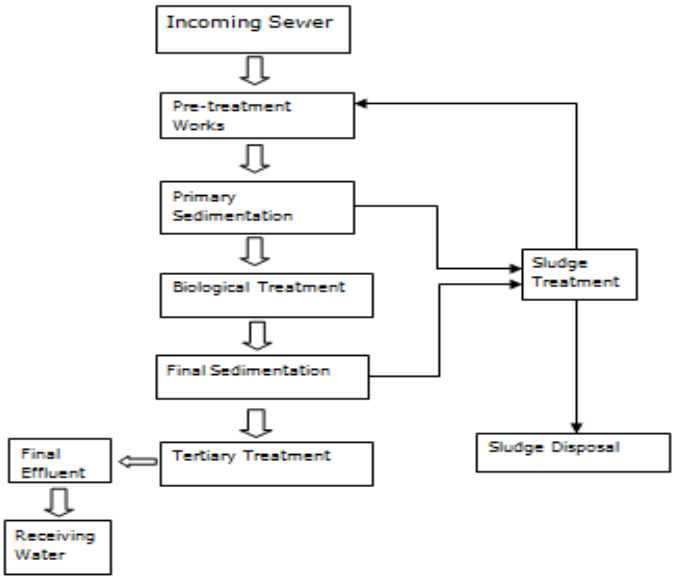
COD: COD means chemical oxygen demand which gives total amount of oxygen required to degrade both biological degradable and non degradable matter. always COD slightly more than BOD.

TOTAL SOLIDS: It is determined as the residue left after evaporating and drying the unfiltered sample. Temperature in the oven to be maintained at 103'C.Total solids includes both suspended and dissolved solids.

CHLORIDES: the amount of chlorides presence in the sample can be determined by Mohr's method. Soluble and slightly dissociated mercuric chloride is formed when chloride is titrated with mercuric nitrate.

ALKALINITY: Alkalinity can be obtained by neutralizing OH, CO_3 and HCO_3 with standard solution H_2SO_4. Titration up to PH 8.3 or disappearance of colour Shows complete neutralization of OH. Change of colour by adding methyl orange indicator will indicate alkalinity caused by OH, CO_3 and HCO_3 etc.

After that the quantity of sewage producing through our campus had been estimated then we designed the units of a treatment plant like collection pit, screenings, grit chamber, primary sedimentation tank, aeration tank, trickling filter& finally sludge drying beds.



TYPICAL LAYOUT OF TREATMENT PLANT

Generally floating materials& large suspended particles are removed through screening and grit chamber then sewage is allowed to enter into primary sedimentation tank to remove all solids which having specific gravity more than that of sewage can settles and then removed by proper way. Sometimes this can be done by flocculation or by aggregation or by coagulation. Chemicals like alum, lime, ferric chloride, chlorinated copper etc are used as coagulation process.

After that the sewage is enters into trickling filter to reduce the BOD of final effluents thus BOD of effluents comes within standard limit, then the effluents from above units can be dried over sludge drying beds for required period of time. Finally treated water can be used for following purposes

- ✓ As watering to the plants
- ✓ As drinking water to the animals & birds
- ✓ As ground water charger
- ✓ We can be used for fountains
- ✓ For aquariums
- ✓ Water servicing to the college vehicles etc

The final output from the sludge drying beds can be used as fertilizers which give more reliable energy to the crops and thus we can increase the yielding of the crop.

V. RESULTS AND DISCUSSION

PARAMETER	SAMPLE VALUE	STANDARD VALUE
Ph	8.90 - 9.50	6.5 – 8.5
BOD	220 mg/l	< 30 mg/l
Dissolved oxygen	10.2mg/l	<10mg/l
Total solids	702 mg/l	< 500 mg/l
Hardness	195 mg/l	150- 300 mg/l
Turbidity	59NTU	10NTU
Alkalinity	130 mg/l	< 250 mg/l
Chlorides	320 mg/l	< 250 mg/l
COD	245 mg/l	100mg/l

After completion of determining the all required parameters and comparing with prescribed standards some parameters are slightly higher. Directly releasing this sewage into environment is very danger to the environment and human life. Hence it is quite necessary to design the treatment plant. While constructing any treatment plant money plays a key role thus we have to design a small & efficient treatment plant.

VI. DIMENSION OF TREATMENT UNITS

The following are the minimum required number of units of a sewage treatment plant.

- ❖ Collection pit
- ❖ Screening chamber
- ❖ Grit chamber
- ❖ Primary sedimentation tank
- ❖ Aeration tank
- ❖ Trickling filter
- ❖ Sludge drying beds.

Estimation of quantity of sewage producing by determining the total population within the campus

Number of people =2000

Amount of total water supply = 0.420 MLD

Average sewage generated per day = 0.85*0.42 = 0.357 MLD

= 14.875 Cu.m/hr

DIMENSIONAL PERTICULARS

1) COLLECTION PIT: provide a circular pit of having
   Surface area = 12 m^2
   Diameter = 4 m
   Depth = 5 m
2) SCREENINGS : Provide a screen having a space of 20mm at 75^0 to the horizontal and approaching velocity is 0.8m/s
3) GRIT CHAMBER :
   Surface loading rate = 400 $m^3/m^2/day$
   Detention time = 3 min
   Surface area = 0.892 m^2
   Depth = 1.2m
4) PRIMARY SEDIMENTATION TANK:
   Detention time = 3 hrs
   Surface area = 22.312 m^2
   Dimensions = 8.20m * 2.75m
   Overflow rate =16000 $l/day/m^2$
5) AERATION TANK :
   Surface area = 24.54 m^2
   Dimensions =7m*3.5m*4m
   MLSS = 2000 mg/l
   F/M Ratio = 0.2
6) TRICKLING FILTER:
   BOD load applied =54.978 kg/d
   %BOD removal = 80%
   Diameter =12m
   Hydraulic loading rate = 3.136 $m^3/day/m^2$
   Organic loading rate = 483 $g/day/m^2$
7) SLUDGE DRYING BEDS:
   Sludge generated per day = 85.68kg/day
   Time period on beds =4 days
   Provide 5 beds having 10.5m*1.7m as dimensions.

VII. CONCLUSION:

In our study the parameters of sewage which is coming out from the JNTU campus is analyzed& treatment plant of suitable dimensions is designed. And thus all parameters reduce to within standard values.

Treated water is going to use for watering the plants & some other purposes. The final effluents from the treatment plant can be used as fertilizer to increase the yielding capacity of crops.