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Application of Combined Slow Sand Filter And Up Flow Anaerobic Sludge Blanket Reactor in Gery Water Treatment

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Abstract: The flow of wastewater is up to 36 kld, for the emergency purpose, we have designed the plant to 40 kld. We have setup a pilot plant of capacity 25 liters and can treat water at rate of 2.25 liters per hour. This project aims to design the treatment plant by using Filters and up flow Anaerobic Sludge Blanket technology for the enhanced technology. By analyzing the characteristics of the wastewater the adequacy of the design is checked and the necessary unit process and operations of the treatment system are designed.

Keywords: Grey water,filter system,UASB, treatment.

I. INTRODUCTION

Developing countries such as India are undergoing a massive migration of their population from rural to urban centers. New consumption patterns and social linkages are emerging. Modern urban living brings on the problem of waste, which increases in quantity, and changes in composition with each passing day.. Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water. The goal is to produce water fit for a specific purpose. Most water is purified for human consumption (drinking water) but water purification may also be designed for a variety of other purposes, including meeting the requirements of medical, pharmacology, chemical and industrial applications. . In general the methods used include physical processes such as filtration, sedimentation, and distillation, biological processes such as slow sand filters or activated sludge, chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light. The purification process of water may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, fungi and disease The standards for drinking water quality are typically set by governments or by international standards.

II. OBJECTIVES

- Conventional and economical treatment suggested for the wastewater produced from the SVCET hostel.
- To analyze the quality of wastewater generated from SVCET Men's hostel.
- Grey water is treated as usable water which can used for various domestic purpose other than drinking, cooking.

III. TECHNICAL OPTIONTS

A. Liquid wastes:

The liquid wastes are from the bathrooms, toilets and that of the kitchen water. It contains food wastes, soap foam, dissolved and suspended materials in the water. Water from both places toxic in nature. They are differentiated by color due to toxity, as black and Grey water.

Table

S.no	Categorization of waste	Types of waste	Sources of wastes
1	SOLID WASTES	Food Wastes (cooked and uncooked wastes) Plant leaves	From dining hall and kitchen (Hostel mess) Dried leaves in all over study area
2	LIQUID WASTES	Grey water Black water	Bathroom , Kitchen Toilets

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no1.CATEGORIZATION OF WASTES

B. Grey water:

Grey water is wastewater generated from domestic activities such as laundry, dishwashing, and bathing, which can be recycled on-site for uses such as landscape irrigation and constructed wetlands. Grey water differs from water from the toilets which is designated sewage or black water to indicate it contains human waste. Grey water is specifically wash water. That is, bath, dish, and laundry water excluding toilet wastes and free of garbage-grinder residues.

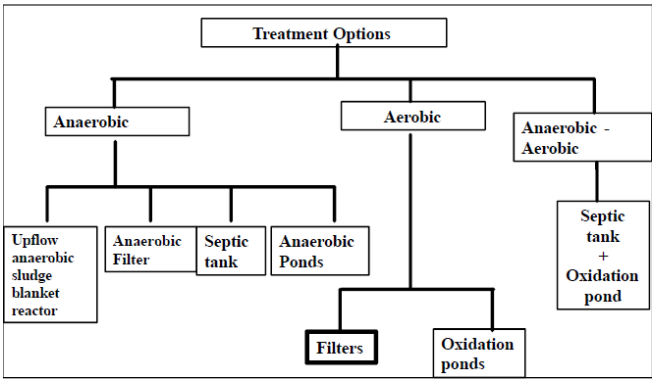

Fig.no 1. Various Grey Water Treatment options

C. Filter System

- Screening is done as an initial process.
- Sedimentation tank is used to coarsely screen out oils/greases and solids.
- Our sequencing tank removes the physical factors as color, odour and undesirable tastes.
- Economically attractive option for grey water reuse because it requires minimal maintenance and chemicals.

Fig.no 2. Filtration units

D. Grey water Treatment System

Raw grey water → Primary treatment →
Secondary treatment → Tertiary treatment

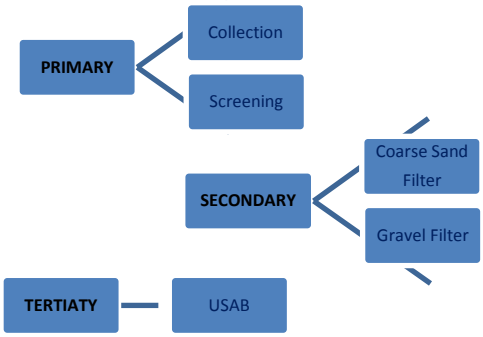

Fig.no 2 Treatment process

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E. Up flow Sludge Anaerobic Digestion

The waste water flows into the bottom of an anaerobic up flow tank. The sludge blanket is kept in suspension. A layer of gravel is introduced over the blanket and the water is allowed against gravity. Chemicals like BOD, COD gets reduced and TSS also gets reduced. The UASB reactor is a methanogen (methane-producing) digester that evolved from the anaerobic clarigester. A similar but variant technology to UASB is the expanded granular sludge bed (EGSB) digester. Wastewater flows upwards through the blanket and is processed (degraded) by the anaerobic microorganisms. The upward flow combined with the settling action of gravity suspends the blanket with the aid of flocculants. The blanket begins to reach maturity at around 3 months. Small sludge granules begin to form whose surface area is covered in aggregations of bacteria. The blanketing of the sludge enables a dual solid and hydraulic (liquid) retention time in the digesters. Solids requiring a high degree of digestion can remain in the reactors for periods up to 90 days. UASB reactors are typically suited to dilute waste water streams (3% TSS with particle size >0.75mm).

Fig.no 3. UASB Reactor

IV. TEST PROCEDURE

A. A.Total Solids (TS)

- Take an evaporating dish (made of silica ,porcelain or platinum) of at least 100 ml capacity .Ignite at 550+ /-50 degree in hot air oven for about 10 minutes and cool in desiccators and weigh.
- Evaporate 100 ml of unfiltered sample in the evaporating dish on water bath till the sample gets evaporated.
- Take final weight after cooling in desiccator.

$$\text{Total solids} = [(A-B) \times 106] / V$$

Where
A = Final weight of dish in g
B= Initial weight of dish in g
V= Volume of sample taken in ml

B. Total Dissolved Solids (TDS)

- Take an evaporating dish (made of silica ,porcelain or platinum) of at least 100 ml capacity .Ignite at 550+ /-50 degree in hot air oven for about 10 minutes and cool in desiccator and weigh.
- Evaporate 100 ml of filtered sample in the evaporating dish on water bath till the sample gets evaporated.
- Take final weight after cooling in desiccators.

Total solids = [(A-B) x 106] / V
Where
A = Final weight of dish in g
B= Initial weight of dish in g
V= Volume of sample taken in ml

C. Total Suspended Solids (TSS)

TSS = TS-TDS
Where,
TSS = Total Suspended Solids
TS = Total Solids

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TDS = Total Dissolved Solids

D. *Chemical Oxygen Demand (COD)*

- Take 20 ml of sample in COD flask add 10 ml of 0.25N potassium dichromate solution.
- Add a pinch of Silver sulphate and Mercuric sulphate powder
- Add 30 ml of Sulphuric acid.
- Keep the entire setup in COD digester for two hours and after digestion is over cool the flask and add distilled water and make final volume to 140 ml.
- Add 2-3 drops of ferroin indicator mix thoroughly and titrate with 0.1N ferrous ammonium sulphate.
- Run a blank with distilled water using same quantity of chemicals.
- COD in mg /l = [(b-a)N of ferrous ammonium sulphate x 1000 x 8] / ml of sample.
  Where
  a = ml of titrant with sample
  b= ml of titrant with blank

E. *Biochemical Oxygen Demand (BOD*)

- Prepare a dilution water in a glass container bubbling compressed air in distilled water for about 30 minutes
- Add 1 ml each of phosphate buffer, magnesium sulphate, calcium chloride and ferric chloride solutions for each liter of dilution water and mix thoroughly.
- Neutralize the sample to pH around 7.0 by using NaOH or H2SO4.
- Since the DO in sample is likely to be exhausted, it is usually necessary to prepare a suitable dilution of sample according to expected BOD range.
- Prepare dilution in bucket or large glass trough, mix the contents thoroughly.
- Keep one set of bottles in BOD incubator at 20 degree for 5 days, and determine the DO in another set immediately.
- Determine DO in sample bottles, immediately after 5 days of incubation.
  Similarly for blank 2 BOD bottles for dilution water. In one,determine the DO content and the other incubate with the sample to determine DO after 5 days.

  BOD = [D0 – D5] x dilution factor

F. Turbidity

- Connect the instrument to 230 V A.C mains using the 3 pin plug.
- Switch on the instrument and allow it to be in on position for 10 minutes.
- Take distilled water in a sample bottle and place it in the turbidity meter. With the help of zero knob adjust the reading to zero in the meter this is called zero adjusting.
- Shake thoroughly the standard turbidity suspension and take it in the sample tube and place it in the turbidity meter.
- With the help of calibration knob adjust the reading of the meter to read the value of the turbidity of suspension. Now the instrument is calibrated.
- In the similar way take the sample whose turbidity is to be determined in a sample tube, place it in the turbidity meter and read the meter. The reading shows the turbidity value of the sample.
- Make the above observations with the help of some other standard turbidity suspension also mean value of turbidity for the given sample.

Fig.No.4 Turbidity meter

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V. RESULT AND DISCUSSION

The sample was collected from manhole and the test was conducted on the sample to find the necessary parameters like COD, BOD, Oil & Grease, Total solids and pH. The testing was done in Chemistry Lab & Environmental Lab in Civil Department of SVCET

A. Testing of samples before Up flow Anaerobic sludge blanket reactor in treatment.

Test for the samples	Result obtained	Permissible values as per govt. Noms
pH	5.36	6.5-8.5
TURBIDITY	233NTU	1-5NTU
HARDNESS	620ppm	Around 50 ppm
BOD	257mg/lit	10-100mg/lit
COD	280mg/lit	Less than 5mg/lit
TSS	2238mg/lit	Around 20mg/lit
TDS	1630mg/lit	A few hundred mg/lit

B. Testing of samples after up flow anaerobic sludge blanket reactor treatment.

Test for the samples	Result obtained	Permissible values as per govt. Noms
pH	6.85	6.5-8.5
TURBIDITY	4NTU	1-5NTU
HARDNESS	120ppm	Around 50 ppm
BOD	42mg/lit	10-100mg/lit
COD	60mg/lit	Less than 5mg/lit
TSS	172mg/lit	Around 20mg/lit
TDS	430mg/lit	A few hundred mg/lit

VI. CONCLUSION

In college men's hostel utilizes around 40 kLD of water daily and around 80 percent of that water is wasted, that is, 36 kLD. That is the amount of Grey water produced. We have designed the tank for a capacity of 40 kLD. The pilot plant has a capacity of 25 liters and can treat water at rate of 2.42 liters per hour. The three filters can filter the Grey water to normal domestic water which can be used for gardening and flushing purposes. The water we have treated lies in the range of government norms. We get a high efficiency of the chemicals removed in every time we run the plant. The efficiency we get is around 80 percent. So, we can use the water for the above mentioned purposes. As per the UNEP report world- wide brine water provides more than 30% of urban water supply. Keeping this in mind, this project aims to develop a upgraded Grey water treatment plant, by which the water will be converted in to usable resources and the extraction of virgin water for gardening and flushing in toilet purposes. It also prevents the pollution of fresh water, land by which discharging the untreated Grey water would also be avoided. Our earth works very hard to recycle the waste water produced by us. We still keep on adding chemicals to that water and make the work harder. Let's use treatment plants and help our earth in making the work easier.

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