Name: M Jibran Khan

Student ID# 13933

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Exam: Final Term

Submitted to: Engineer Husnain

Q (03): What is renewable energy? Explain any three uses of renewable energy from waste water sludge?

RENEWABLE ENERGY:

- Renewable energy is energy from sources that are naturally replenishing but flow-limited; renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time.
- A renewable energy source means energy that is sustainable - something that can't run out, or is endless, like the sun. When you hear the term 'alternative energy' it's usually referring to renewable energy sources too. It means sources of energy that are alternative to the most commonly used non-sustainable sources like coal.
- In any discussion about climate change, renewable energy usually tops the list of changes the world can implement to stave off the worst effects of rising temperatures. That's because renewable energy sources such as solar and wind don't emit carbon dioxide and other greenhouse gases that contribute to global warming.
- Clean energy has far more to recommend it than just being "green." The growing sector creates jobs, makes electric grids more resilient, expands energy access in developing countries, and helps lower energy bills. All of those factors have contributed to a renewable energy renaissance in recent years, with wind and solar setting new records for electricity generation.
- For the past 150 years or so, humans have relied heavily on coal, oil, and other fossil fuels to power everything from light bulbs to cars to factories. Fossil fuels are embedded in nearly everything we do, and as a result, the greenhouse gases released from the burning of those fuels have reached historically high levels.
- Of course, renewables—like any source of energy—have their own trade-offs and associated debates. One of them centre’s on the definition of renewable energy. Strictly speaking, renewable energy is just what you might think: perpetually available, or as the U.S. Energy Information Administration puts it,

"virtually inexhaustible." But "renewable" doesn't necessarily mean sustainable, as opponents of corn-based ethanol or large hydropower dams often argue. It also doesn't encompass other low- or zero-emissions resources that have their own advocates, including energy efficiency and nuclear power.

USES of RENEWABLE ENERGY FROM WASTE WATER SLUDGE:

BIODIESEL FROM SEWAGE SLUDGE:

- Sewage sludge produced from municipal can be turned into biodiesel fuel with existing technology.
- Which can compete with refineries within a few cents of conventional diesel fuel. The demand for biodiesel has led to the search for cost-effective or biodiesel raw materials.

CONVERSION OF SEWAGE SLUDGE TO OIL AND GAS:

- Sludge can undergo chemical reactions to produce fuels that can be used to produce energy under strictly controlled conditions and extreme temperatures (450-1000 ° C). The newest innovative methods include gasification, which produces synthesis gas (similar to natural gas) and pyrolysis of bio-oil (similar to diesel oil).
- This sewage sludge fuel provides 100% of the thermal energy required to operate the sludge dryer.

USE IN AGRICULTURE:

- At present, application of sludge to agriculture seems to be a most controversial but an inexpensive technique of sludge disposal. Application of sewage sludge to agriculture has proven advantageous and inexpensive for Eco cycling nutrients for land reclamation or land reuse.

Q (02): You are working on a site which possess a different treatment plants. A group of university students visit your site. You are going to explain the trickling filter process from the schematics to these students as they cannot go near the filter due to safety and health reason. Furthermore, give an idea about its design and equations employed for designing this type of treatment plant. And before proceeding to next plant, conclude your talk on advantages and disadvantages of trickling filter.

Hello guys how are you? I wish you all are fine. I'm here to explain the trickling filter process to you. So let's go.

First I'm explaining the background of the trickling filter.

First use of fixed-film biological treatment in England (min-19th century)-wastewater distributed over beds of sand to filter particular matter and act as a medium for attachment of microbial organisms which removed most of the nonfilter able organic matter (Antonie 2018).

Sand was later replaced by stone, underdrain system caused improvement of treatment efficiency waste water trickled down over bacteria-covered stones and air passed upward providing continuous supply of oxygen to encourage aerobic biological activity. This system become known as the percolating filter in England and the trickling filter in the U.S.

Introduction:

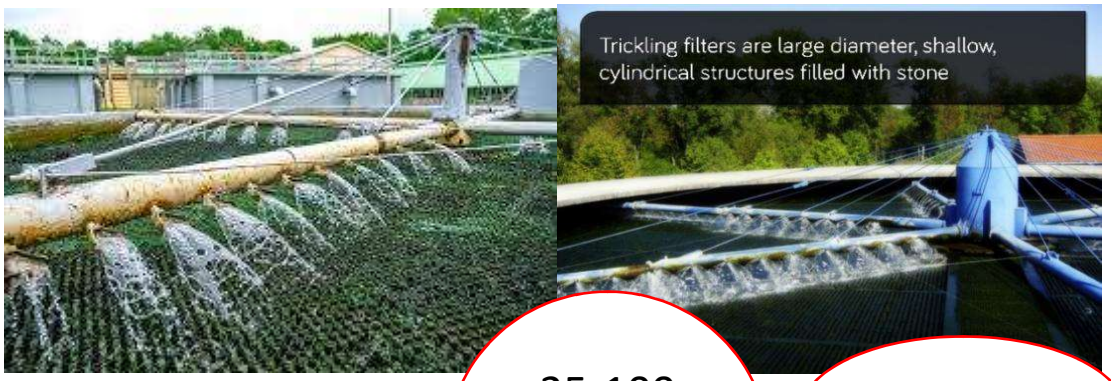
T.Fs consist of mainly four parts:

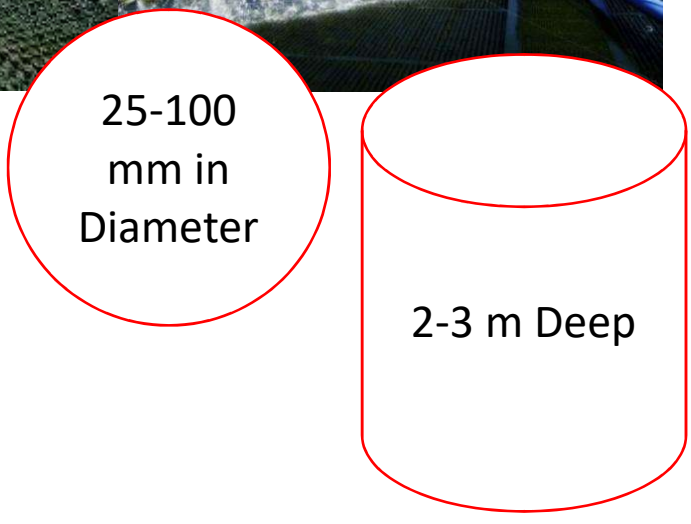
Water tight holding tank.

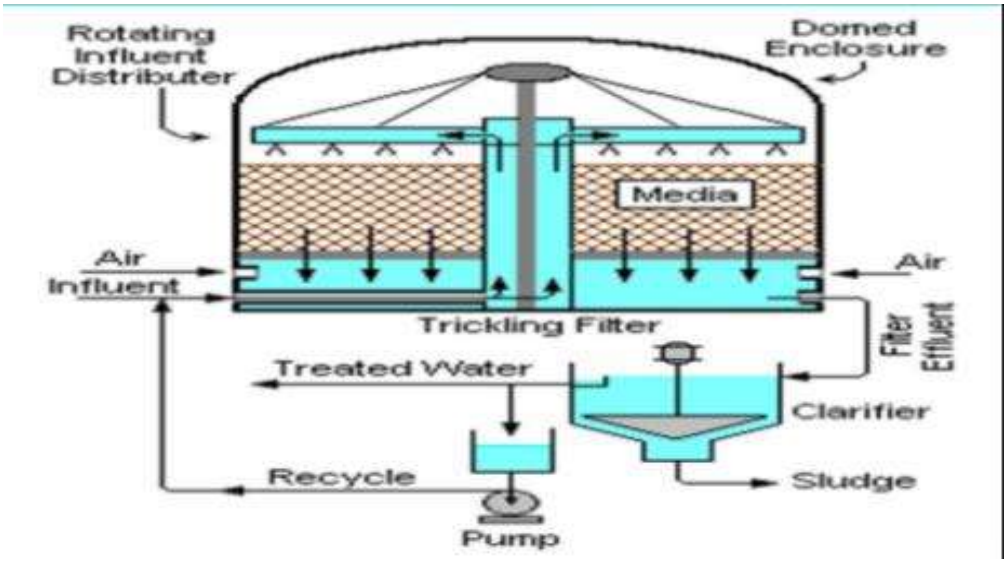
Distribution system.

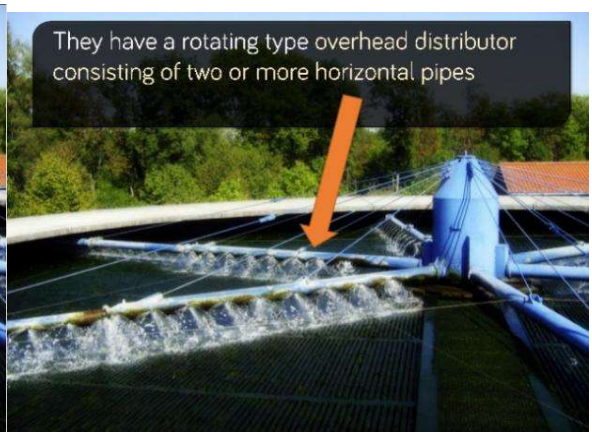
Filter media (0.1 – 0.2mm or 30 – 80 mm).

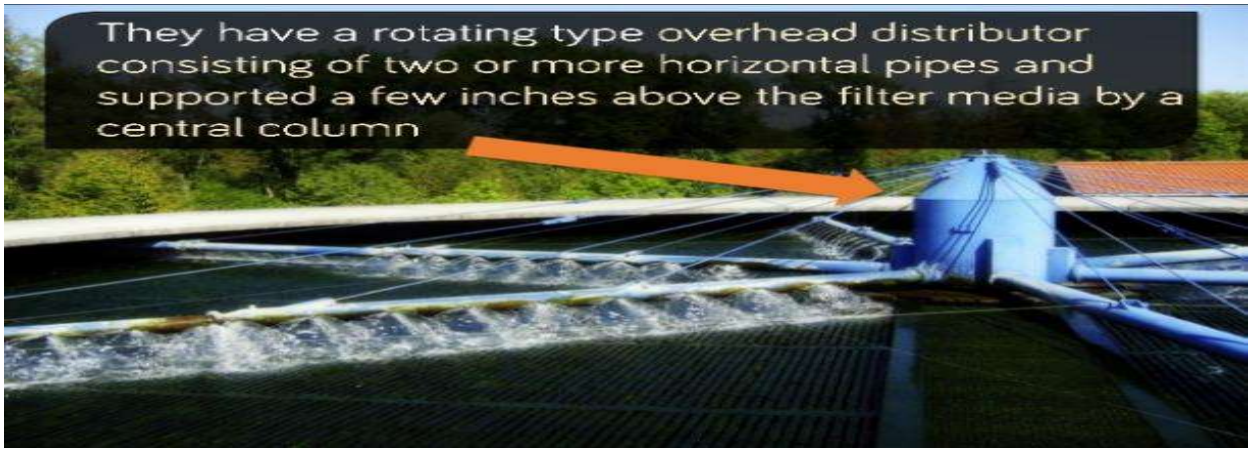
Underdrainage system (One-half full & Maintain 600 to 900 mm/Sec Velocity).





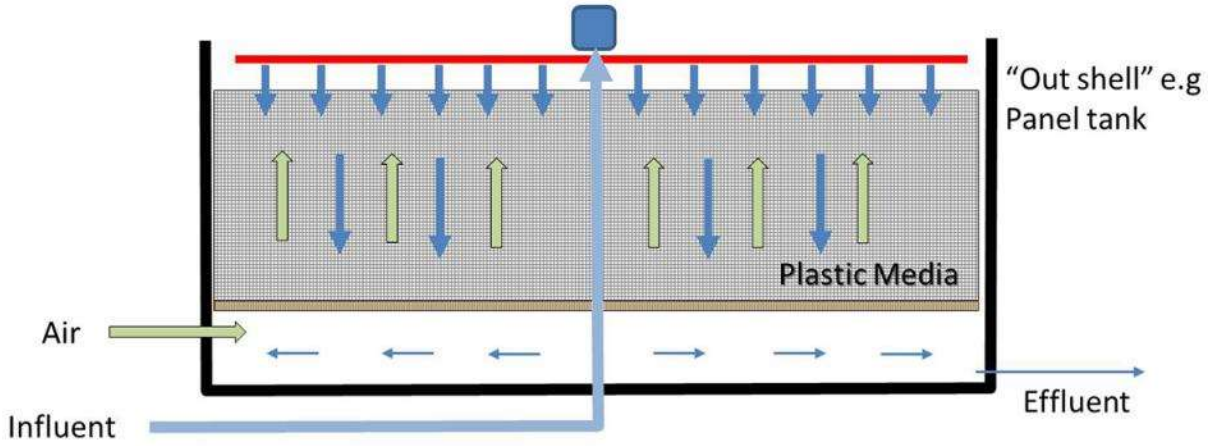






Construction

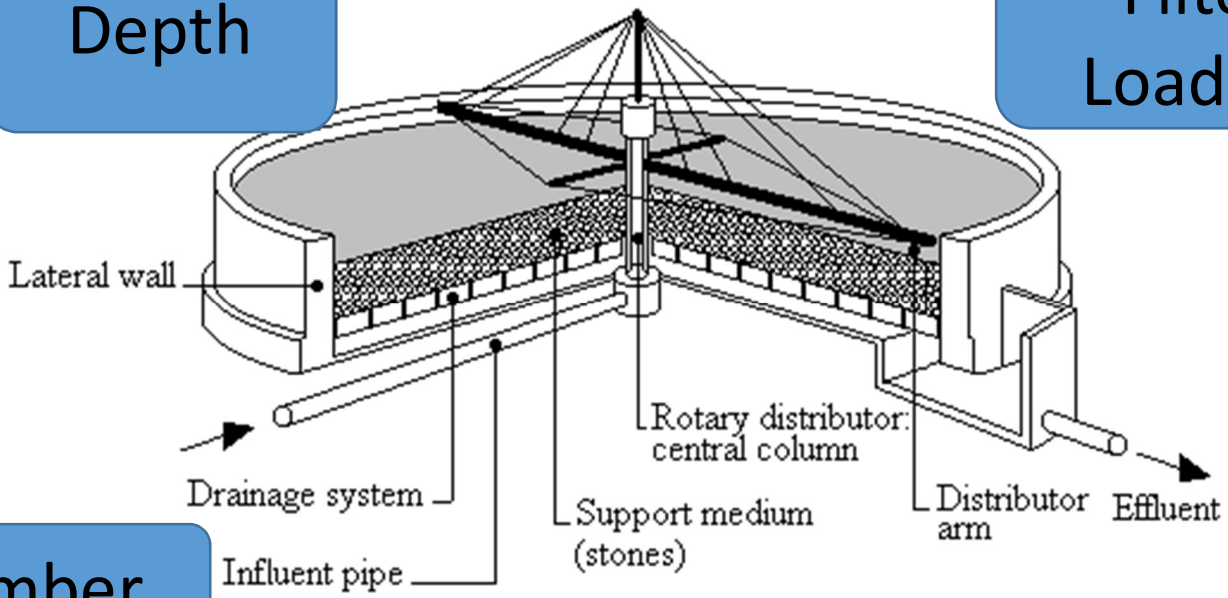
Working Principle:



Design of Trickling Filter:

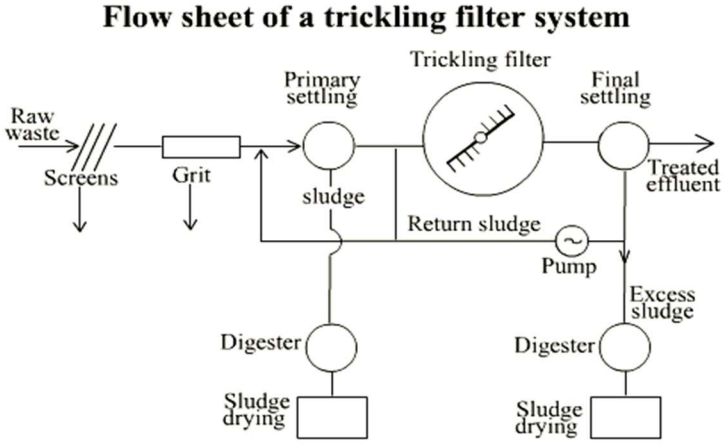
Depth

Filter Loading



Number

Trickling Filters: Process Schematic



Trickling Filters: Design Equations

Generally trickling filter design is based on empirical relationships to find the required filter volume for a designed degree of wastewater treatment. Types of equations:

1. NRC equations (National Research Council of USA)
2. Rankins equation
3. Eckenfilder equation
4. Galler and Gotaas equation

NRC and Rankin's equations are commonly used. NRC equations give satisfactory values when there is no re-circulation, the seasonal variations in temperature are not large and fluctuations with high organic loading. Rankin's equation is used for high rate filters.

NRC equations: These equations are applicable to both low rate and high rate filters. The efficiency of single stage or first stage of two stage filters, E_2 is given by

$$E_2 = \frac{100}{1+0.44(F_{1.BOD}/V_1.Rf_1)^{1/2}}$$

Where,

E2= % efficiency in BOD removal of single stage or first stage,

F1.BOD= BOD loading of settled raw sewage in single stage of the two-stage filter in kg/d,

V1= volume of first stage filter, m3,

Rf1= Recirculation factor for first stage.

- Efficiency Estimation:

$$E = \frac{Y_i - Y_o}{Y_i} X\ 100$$

- Recirculation Factor Calculation:

$$F = \frac{1+R}{(1+0.1R)1^2}$$

Where,

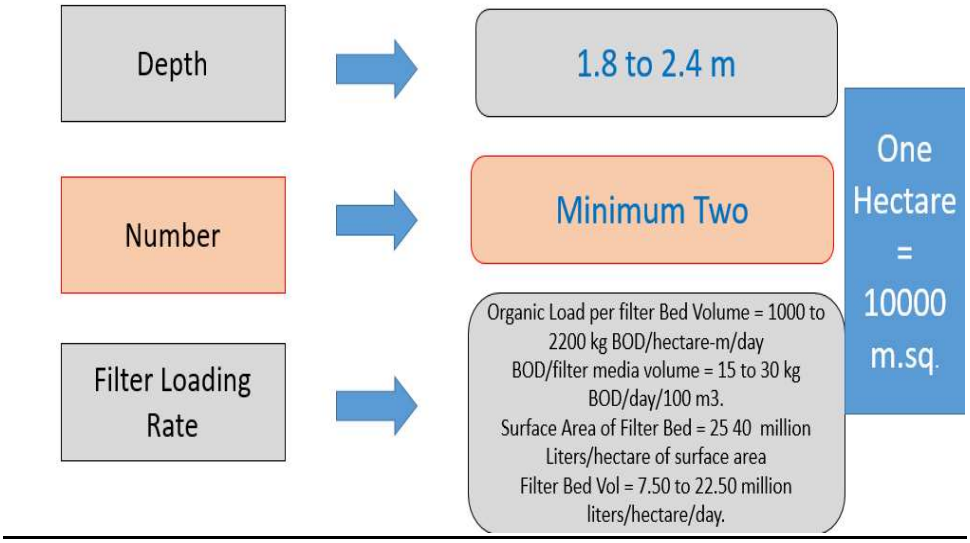
Yi = Influent BOD load to TF

Yo = Effluent BOD from TF.

Where,

R = Recirculation percentage

Trickling Filter Design:



Trickling Filters: *Pros & Cons*

- **Advantages:**
  - They can remove about 80% of suspended solids and about 80% BOD.
  - It requires less electricity power to run mechanical equipment.
  - The moisture content of sludge obtained from this is high as 90%
  - It is simple cheap and does not required any skilled supervision.
- **Disadvantages:**
  - High capital costs.
  - The loss of head through the filter system is high thus making the automatic dosing.
  - Final settlement in human's tank necessary.

Q (01): You are a giving convincing a client regarding wastewater treatment in a housing society which in future will accommodate up to a million residents in future. Also you are in favor of having a wastewater treatment plant in that colony. How are you going to convince the party regarding the waste water treatment? And your preferred choice.

Briefing My Client Regarding Waste Water Treatment Plant in a Housing Society:

Hello sir I'm here to guide you about wastewater treatment plant and giving some good ideas about treatment plant, and brief you for why wastewater treatment is necessary and which type of treatment plant is good for this housing society. We are doing our best for you.

So first of all I explain what is wastewater & wastewater treatment and why it is necessary?

Wastewater:

There are two types of wastewater - greywater and black water.

Greywater is household water from baths, showers, hand basins and washing machines that does not include toilet discharge.

Blackwater is from toilets. Wastewater from your kitchen sink is also treated as black water in onsite wastewater systems, because it can be highly contaminated with food particles, cooking oil and grease.

Wastewater Treatment:

It is a process used to convert wastewater into an effluent that can be returned to the water cycle with minimal environmental issues

Instead of disposing of treated wastewater it is reused for

Various purposes, which is knows as water reclamation

During the treatment process, pollutants are removed or broken down

The infrastructure used for wastewater treatment is called a wastewater treatment plant or a sewage treatment plant in the case of municipal wastewater

Why it is Necessary?

The major aim of wastewater treatment is to remove as much of the suspended solids as possible before the remaining water, called effluent, is discharged back to the environment. As solid material decays, it uses up oxygen, which is needed by the plants and animals living in the water.

It's a matter of caring for our environment and for our own health. There are a lot of good reasons why keeping our water clean is an important priority:

FISHERIES: Clean water is critical to plants and animals that live in water. This is important to the fishing industry, sport fishing enthusiasts, and future generations.

WILDLIFE HABITATS: Our rivers and ocean waters teem with life that depends on shoreline, beaches and marshes. They are critical habitats for hundreds of species of fish and other aquatic life. Migratory water birds use the areas for resting and feeding.

RECREATION AND QUALITY OF LIFE: Water is a great playground for us all. The scenic and recreational values of our waters are reasons many people choose to live where they do. Visitors are drawn to water activities such as swimming, fishing, boating and picnicking.

HEALTH CONCERNS: If it is not properly cleaned, water can carry disease. Since we live, work and play so close to water, harmful bacteria have to be removed to make water safe.

- Decaying organic matter and debris can use up the dissolved oxygen in a lake so fish and other aquatic biota cannot survive;
- Excessive nutrients, such as phosphorus and nitrogen (including ammonia), can cause eutrophication, or over-fertilization of receiving waters, which can be toxic to aquatic organisms, promote excessive plant growth, reduce available oxygen, harm spawning grounds, alter habitat and lead to a decline in certain species;
- Chlorine compounds and inorganic chloramines can be toxic to aquatic invertebrates, algae and fish;

- Bacteria, viruses and disease-causing pathogens can pollute beaches and contaminate shellfish populations, leading to restrictions on human recreation, drinking water consumption and shellfish consumption;
- Metals, such as mercury, lead, cadmium, chromium and arsenic can have acute and chronic toxic effects on species.
- Other substances such as some pharmaceutical and personal care products, primarily entering the environment in wastewater effluents, may also pose threats to human health, aquatic life and wildlife.

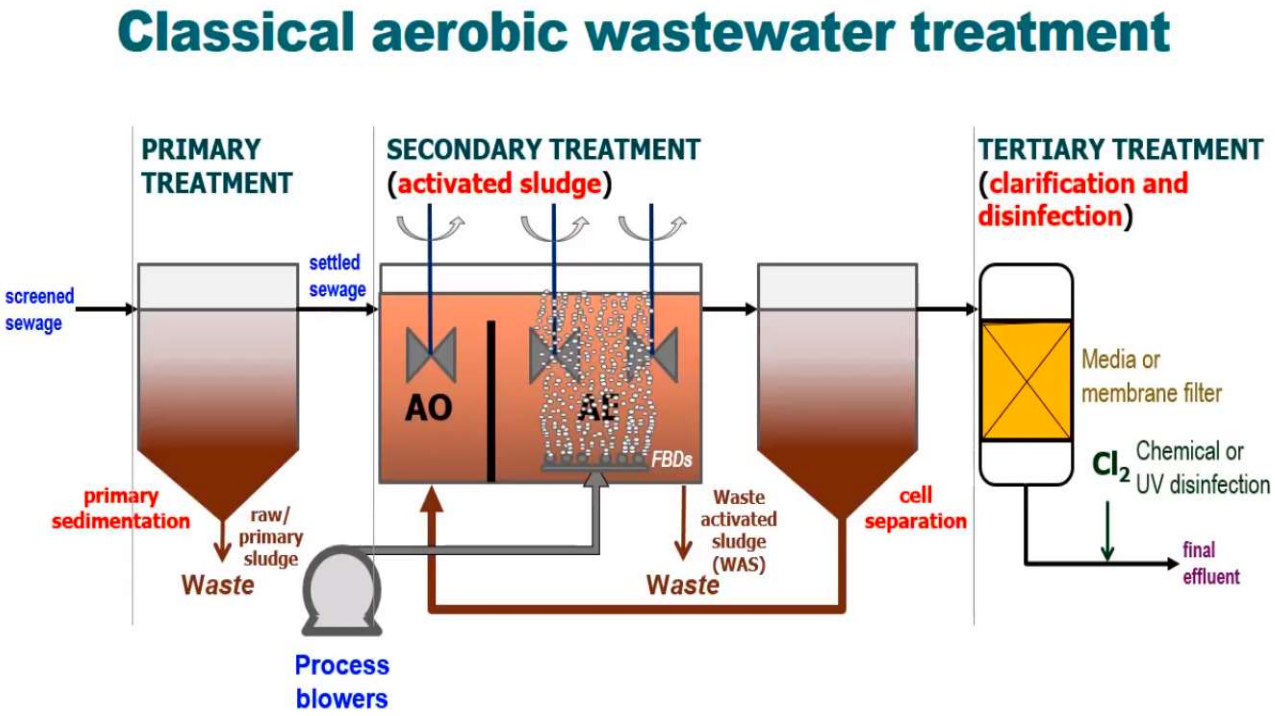
There are many type of wastewater treatment plants. But sir in my opinion aerobic wastewater treatment plant is suitable and good for this housing society colony because this is a residential area.

We suggest you aerobic wastewater treatment plant because of their advantages which are further explain next.

Aerobic Wastewater Treatment Plant:

- Aerobic processes use bacteria that require oxygen, so air is circulated throughout the treatment tank
- These aerobic bacteria then break down the waste within the wastewater
- Some systems utilize a pretreatment stage prior to the main treatment to reduce the chance of clogging the system
- Electricity is required for system operation

Process:



- Pre-treatment stage to remove large solids and other undesirable substances
- Aeration stage, where aerobic bacteria digest biological wastes
- Settling stage allows undigested solids to settle, forms a sludge that must be periodically removed from the system
- Disinfecting stage, where chlorine or similar disinfectant is mixed with water, to produce an antiseptic output.

Advantages:

- Minimum odor
- Large BOD removal providing a good quality effluent
- High rate treatment with less land requirement

- Final discharge may contain DO(dissolved oxygen) which reduces the immediate OD (oxygen demand) on receiving water

Disadvantages:

- Energy cost of aeration at an adequate rate to maintain the DO levels needed
- Some organics can't be efficiently decomposed aerobically
- These biologically non-reactive components mainly composed of insoluble materials can account for up to 70% COD
- Reduction in storage capacity of lagoons and/ or ponds.

According to our research and survey this treatment system is best for housing society of colony.

Thank You!