

# Final term

Name: Aazaz Ahmad

Section: B

ID No: 7705

Subject: Waste water  
Engineering

Submitted to: Engr Na deem  
ullah

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Q. NO 1

## Waste water treatment

Waste water treatment is a process used to remove contaminants from wastewater or sewage and convert it into an effluent that can be returned to the water cycle with minimum impact on the environment, or directly reused. The latter is called water reclamation because treated wastewater can be used for other purposes.

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## Protecting the Planet ::

Waste water can include contaminants from both ~~res~~ residential and commercial use. Untreated, the chemical compounds and pathogens in wastewater can harm the health of animals, plants and birds that live or near the water. It can also contaminate crops and drinking water affecting human health. Wastewater treatment is fundamental to protect the health of many different ecosystems

water, properly treated is a source of water for many purposes. Good wastewater treatment allows the maximum amount of water to be reused instead of going to waste.



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## Importance of waste water treatment

Essential for life, clean water is one of the most important natural resources on the planet. Wastewater which is basically used water is also a valuable resource, especially with recurring droughts and water shortages in many areas of the world. However, waste water contains many harmful substances and cannot be released back into the environment until it is treated. Thus, the importance of waste water treated is twofold: to restore the water supply and to protect the planet from toxins.

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We prefer rectangular tank because of following

- ① Easy to operate and low maintenance cost
- ② Easy adaption to high-rate settlers and tolerant to shock load
- ③ Commonly used in municipal and industrial application
- ④ Suited to large capacity plants.

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Q. No 2:

### Aerobic Treatment

- Low to medium strength wastewater (< 1000 ppm) e.g. Municipal Sewage, refinery waste water etc
- Relatively high capital investment
- Relatively high energy consumption
- Relatively high net sludge yield
- Typically direct discharge post-treatment
- Relatively large Foot-print

### Anaerobic Treatment

- Medium to high strength waste water (74000 ppm) e.g. food and beverage industry waste water
- Relatively low capital investment with pay back
- Relatively low energy consumption
- Relatively low net yield
- Required to full fill waste-water standard discharge requirement
- Relatively small and compact Foot-print



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## Activated Sludge Process (ASP)

- ⇒ Microorganism responsible for treatment are maintained in liquid suspension by appropriate mixing methods.
- ⇒ Main constituents of ASP are Aeration tank in which oxygen is provided for the micro-organisms to grow. This aeration also helps to keep micro-organisms in suspension.
- ⇒ Aeration tank is followed by Clarifier / Settler in which the micro-organisms from flocs and settled down at the bottom.

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⇒ Formation of floc particles, ranging in size from 50 to 200  $\mu\text{m}$  removed by gravity settling, leaving relatively clear liquid as treated effluent.

⇒ A part of settled bio flocs are recycled back to the aeration tank to maintain certain amount of micro-organisms in the system for efficient operation of the system. This is known as Recycled Activated Sludge (RAS)

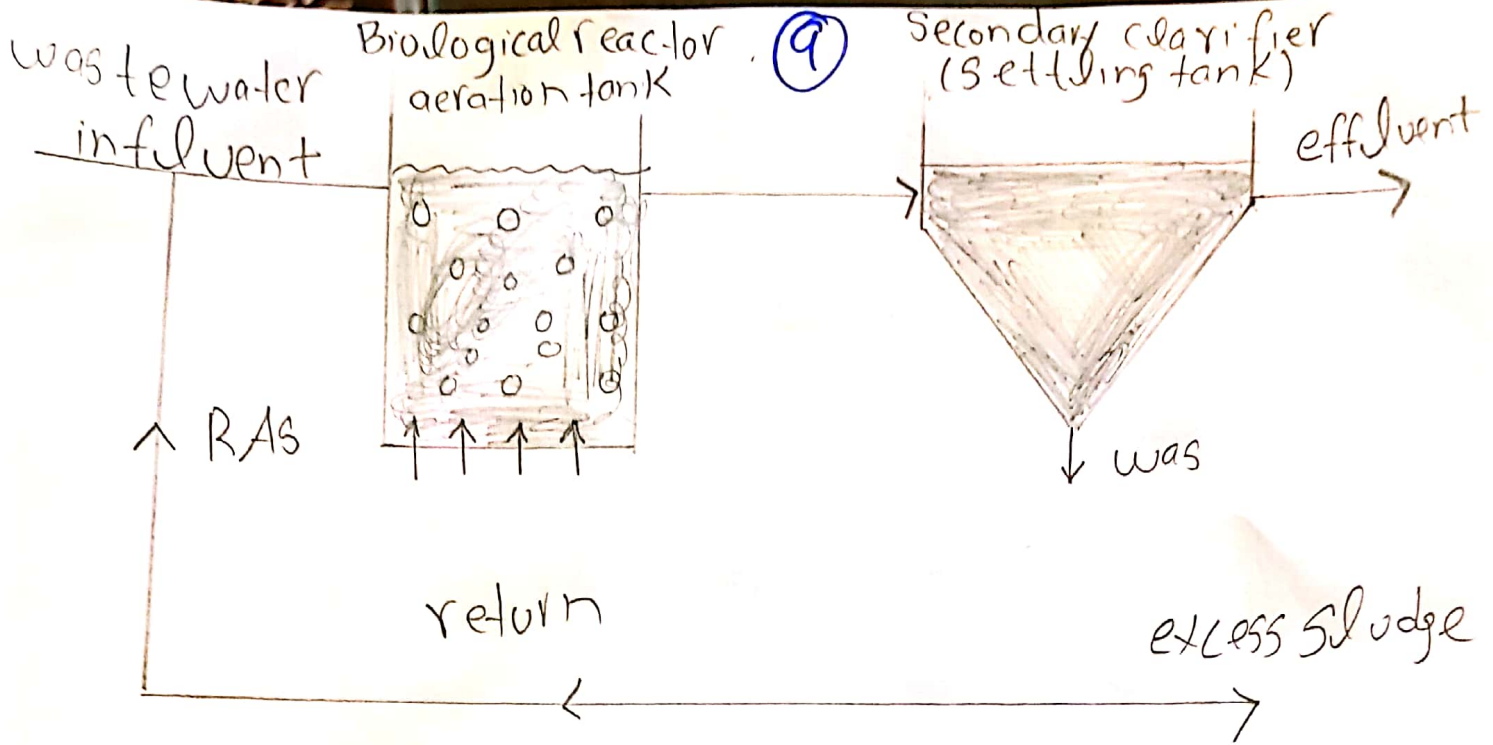
⇒ Remaining settled bio flocs are removed from the system and is termed as Wasted Activated Sludge (WAS)



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These types of sewage treatment plants have many advantages over other types:

- Longer ~~empty~~ emptying intervals
- Less 'bad' sludge to remove
- They tend to be odourless throughout the process
- They re-seed themselves with beneficial bacteria
- Very reliable
- Simple process
- Inexpensive servicing
- No moving parts within the plant
- No need to top-up with extra bacteria



## Activated Sludge Process (ASP)

- APS involves production of activated mass of micro-organisms capable of stabilizing waste water under aerobic conditions
- In aeration tank, contact time is provided for mixing and aerating influent waste water with microbial suspension generally referred to mixed liquor suspended solids (MLSS)

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→ Typically 99.1% of suspended solids and upto 90.1% of dissolved organics are removed by Activated Sludge process

→ The main drawback with ABS is its high electricity consumption particularly for aeration



Q. No 3:

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Ans

## Assimilative Capacity:

Assimilative capacity refers to the ability of the environment or a portion of the environment

(such as a stream, lake, air mass or soil layer) to carry waste material without adverse effect on the ~~env~~ environment or on users of its resources.

→ Although waste water is properly treated before it is disposed of the natural water stream still it has impurities/pollutants that need to be removed or made

them less effective. So that the  
receiving water bodies may not  
become unsuitable for use  
of cause damage to the  
aquatic life.

Help in waste water  
treatment

1) Dilution

It is process which reducing  
the the concentration

2) Dispersion:

Dispersion is the distribution  
of pollutants

3 Sunlight

Sunlight facilitates  
biological decomposition



Q.NO (04)

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Ans

## Sludge Management

Sludge management is one of the most difficult and challenging tasks of wastewater treatment plants due to its high water content and poor dewaterability and strict regulation for sludge reuse or disposal. One of the recent goals of wastewater treatment plant is to develop more environmentally friendly processes to reduce the volume of sludge for disposal and to convert sludge into bioenergy. Energy recovery of the sludge into biogas, syngas and bio-oil which can

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be further converted to electricity, mechanical energy and heat. In this Chapter, method for energy recovery from wastewater sludge in the forms of bio-oil and bio-gas are reviewed. An overview of different sludge types and the common methods for measuring their characteristics and bio-oil production from sludge through hydrothermal treatment reaction pathways and the effects of various operating parameter such as reaction temperature and time, the presence of a catalyst, feed stock type, water-to-biomass

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ratio, and water at sub / supercritical condition are discussed. In addition some available hydrothermal processes in pilot or demonstration scales are introduced



# Advantages of Sludge treatment

- It reduce pathogens and volume to be disposed
- ~~Pre~~ protects wildlife aquatic life and also prevents diseases.
- Sustainable management of organic waste
- Reduction of order and diseases causing agents
- Producing Bio-gas.
- Diverse can be used for one household up a huge plant

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- Removes organics
- oxidation and Nitrification achieved
- Biological Phosphorus removal
- Solids / Liquid Separation
- The most ~~used~~ widely used waste water treatment
- Capable of removing  
-97% of suspended solid

Q. No 5

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Ans

## Environmental Impact Assessment (EIA)

A formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and to enhance positive effects.

EIA thus has three main functions

- to predict problems
- to find ways to avoid/mitigate them, and
- to enhance positive effects



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The most important parameters to be considered for a local wastewater treatment plant are parameter:

## 1 Biochemical Oxygen Demand (BOD)

The BOD is the amount of oxygen consumed by aerobic micro-organisms to break down the organic matter present in the wastewater. It is the BODs which is the actual measured parameter and is an indication of the amount of organic matter consumed within 5 days as from testing. This is used. This value is used to measure

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the efficiency of a treatment plant in term of organic matter removal. High BOD values are undesirable and would effect the ecologic cycle by reducing the normal dissolved oxygen to critical ~~low~~ levels for sustaining aquatic life.

## 2) Chemical Oxygen Demand (COD)

The COD is an alternate measure of the amount of organic matter.

The amount of oxygen used up by a strong oxidising agent is measured. This value is of greater importance when evaluating waste water from industries since these ~~efflu~~ effluents tend to be toxic to ~~mico~~ microorganisms there by affecting the validity of BOD results



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### 3) Total Suspended Solids (TSS)

The TSS is measured to indicate the amount by mass of fine suspended particles. Effluent discharged in the water courses must contain low level of TSS since TSS causes turbidity affecting the amount of light to aquatic plants and also visual pollution.

### 4) Total Kjeldahl Nitrogen

Wastewater usually contains high levels of nitrogen containing compounds. The nitrogen exists mostly in free forms organic nitrogen.

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ammonia and reduced nitrogen.

The TKN value hence indicates the amount of nitrogen of all these 3 forms. TKN is useful in monitoring the plants.