IQRA NATIONAL UNIVERSITY
DEPARTMENT OF CIVIL ENGINEERING
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Discipline: BS Civil Engineering SECTION: A

Course Title: Wastewater Engineering

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Q1. What is wastewater treatment and its importance? Why rectangular tanks are preferred over circular tanks for removal of settleable solids during preliminary treatment?

Ans. **WASTEWATER TREATMENT**

Wastewater 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.

Wastewater treatment, also called sewage treatment, the removal of impurities from wastewater, or sewage, before they reach aquifers or natural bodies of water such as rivers, lakes, estuaries, and oceans. Since pure water is not found in nature (i.e., outside chemical laboratories), any distinction between clean water and polluted water depends on the type and concentration of impurities found in the water as well as on its intended use.

IMPORTANCE WASTEWATER 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, wastewater contains many harmful substances and cannot be released back into the environment until it is treated. Thus, the importance of wastewater treatment is twofold: to restore the water supply and to protect the planet from toxins.

RESTORING THE WATER SUPPLY

Look at a global drought map and you will see that many areas of the world simply do not have enough water. All communities, especially areas with water scarcity, need to ensure they have good water treatment processes in place so that treated water can either be reused or returned to the water cycle, but never wasted.

PROTECTING THE PLANNET

Wastewater can include contaminants from both residential and commercial use. Untreated, the chemical compounds and pathogens in wastewater can harm the health of animals, plants and birds that live in 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.

REMOVAL SETTLEABLE SOLIDS DURING PRELIMINARY TREATMENT

The shape of rectangular clarifiers provides a longer path for the wastewater flow and suspended solids to travel, and subsequently longer detection time which warrants less short circuiting and more sludge settling feed/peripheral overflow circular clarifiers. In addition, flow

distribution among several clarifiers is usually more even and after requires less head loss for rectangular clarifiers.

Q2. What is the difference between aerobic and anaerobic wastewater treatment? Briefly describe Activated Sludge Process with diagram?

Ans. **Difference between aerobic and anaerobic wastewater treatment**

AEROBIC WASTEWATER TREATMENT

1. Aerobic wastewater treatment is a biological wastewater treatment process which uses an oxygen rich environment
2. Bacteria involved the aerobic wastewater treatment are aerobes.
3. Air is circulated in aerobic wastewater treatment tanks.
4. Aerobic wastewater treatment does not produce methane and carbon dioxide.
5. Aerobic wastewater treatment requires energy. Hence, they are less energy efficient.
6. Activated sludge method, trickling filter, rotating biological reactors, and oxidation ditch are examples of aerobic wastewater treatment.

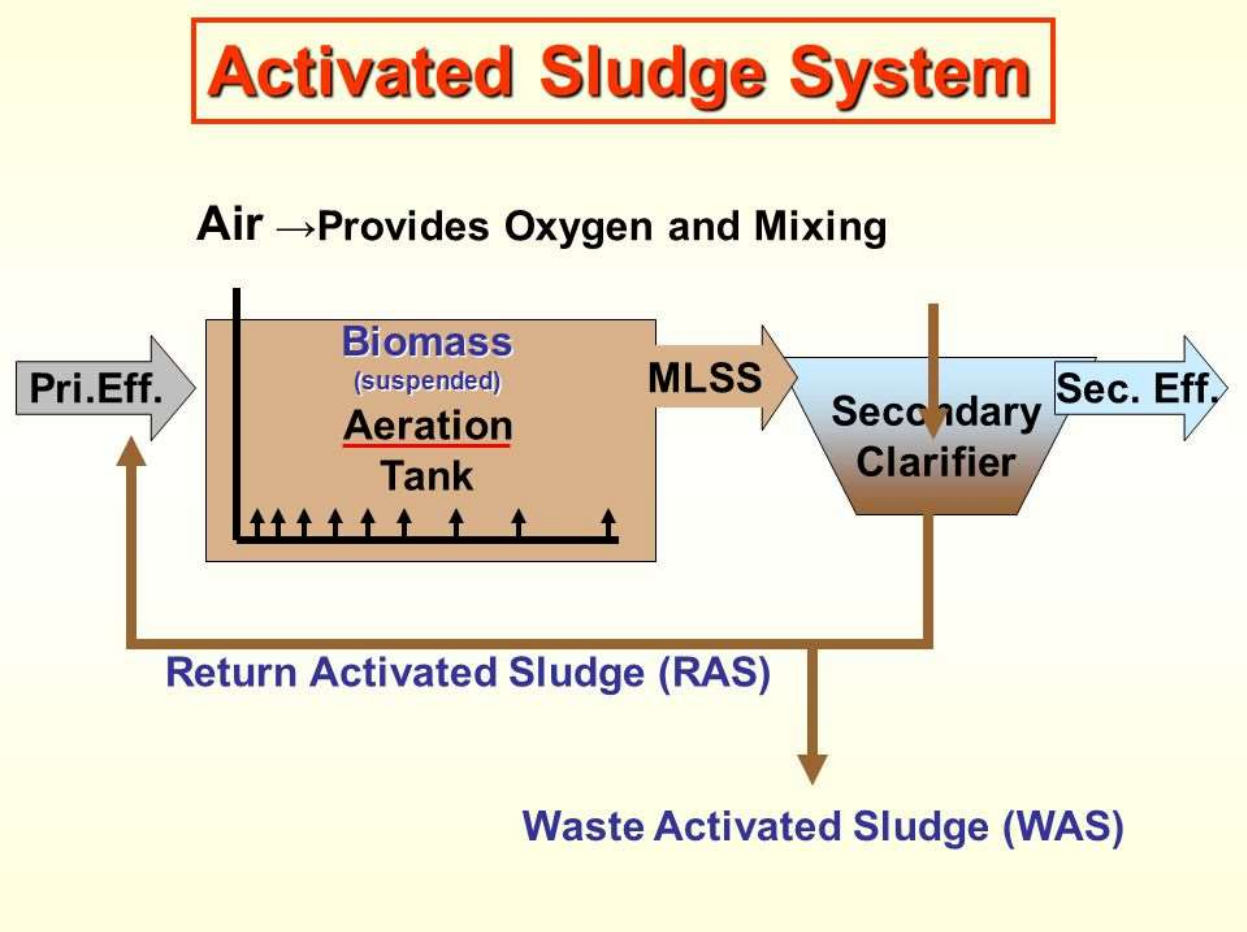
ANAEROBIC WASTEWATER TREATMENT

1. Anaerobic wastewater treatment is a process where anaerobic organisms break down organic material in an oxygen absent environment.
2. Bacteria involved the anaerobic wastewater treatment are anaerobes.
3. Air is not circulated in anaerobic wastewater treatment tanks
4. Anaerobic wastewater treatment produces methane and carbon dioxide.
5. Anaerobic wastewater treatment is an energy efficient process.
6. Anaerobic lagoons, septic tanks, and anaerobic digesters are examples of anaerobic wastewater. Treatment

ACTIVATED SLUDGE PROCESS

The activated sludge process is a type of wastewater treatment process for treating sewage or industrial wastewaters using aeration and a biological floc composed of bacteria and protozoa.

In this step, the wastewater receives most of its treatment. Through biological degradation, the pollutants are consumed by microorganisms and transformed into cell tissue, water, and nitrogen. The biological activity occurring in this step is very similar to what occurs at the bottom of lakes and rivers, but in these areas the degradation takes years to accomplish.



Q3. What is meant by assimilative capacity of receiving water bodies? How does it help in wastewater treatment?

Ans. **ASSIMILATIVE CAPACITY OF RECEIVING WATER BODIES**

Assimilative capacity of receiving water bodies refers to the ability of a body of water to cleanse itself; its capacity to receive wastewaters without deleterious effects and without causing damage to aquatic life or humans who consume the water. It is level to which water body or nature control the toxicity without affecting the aquatic life.

Although wastewater is properly treated before it is disposed of to the natural water streams still it has impurities / pollutants that need to removed or make them less effective so that the receiving water bodies may not become unsuitable for use or cause damage to the aquatic life.

A water body's assimilative capacity is related to flow conditions and nutrient loads during a given period of time or over a range of expected variations in these conditions. Understanding assimilative ability requires determining the watershed 's potential contaminant levels to decide whether a water source can meet pre-determined requirements for its ecological role and designated use.

ASSIMILATIVE CAPACITY HELP TO WASTEWATER TREATMENT

Assimilative capacity is very helpful in wastewater treatment plants as to clear the waste from the wastewater. As the contaminated water joins the natural water body, there are two process i.e. Dilution and Dispersion occurs in assimilative Capacity of Receiving Bodies. Dilution is the process of reducing the concentration of pollutants in receiving water, usually simply by mixing with more quantity of water and Dispersion is the distribution of pollutants in relatively large area of water. Hence as a result the concentration of contaminant in water reduces that’s why it is very helpful in wastewater treatment.

Q4. Briefly describe sludge management and its advantages in wastewater engineering?

Ans**. SLUDGE MANAGEMENT**

Sludge Management deals with all kinds of sludge including sewage, fecal, waterworks, and industrial sludge. The objectives of the sludge management are to advance knowledge and transfer scientific and technical information on all aspects of sludge management, including production, characterization, stabilization, digestion, thickening, dewatering, thermal processing, agricultural reuse, production of usable materials, and ultimate disposal.

Sludge, biosolids, and fecal sludge are generated during management of wastewater and the contents of latrines. The direct disposal of untreated sludge is not desirable because it:

1) has odors
2) is comprised primarily of water which makes transport and disposal expensive
3) contains harmful environmental pollutants and pathogens

Several processes can decrease pathogen concentrations in sludge:

1) stabilization
2) thickening
3) dewatering
4) other processes that include composting. Stabilization uses biological, chemical, and/or thermal processes to reduce organic matter, water content, and odors and also provides some pathogen reduction

Thickening and dewatering can reduce volume and increase the concentration of total solids. Thickening is performed prior to stabilization while dewatering is the final method of volume reduction before ultimate disposal of stabilized sludge (drying beds and mechanical processes). Other methods of sludge processing including composting, heat drying, and combustion.

SLUDGE MANAGEMENT ADVANTAGES IN WASTEWATER ENGINEERING

1. These harmful elements may require thermal treatment to control the spread of diseases or toxins. Sewage sludge managment reduces volume (up to 90%) and weight (up to 75%) and breaks down dangerous substances such as pathogens and toxic chemicals.

2. In large treatment plants, high quantities of sludge are used as a source of energy used to produce steam when fed through a turbine.

3. Significant quantities of precious metals may be recovered from urban waste after it goes through the sewage sludge management process.

4. Sustainable management of organic waste.

5. Producing bio gas and Reduction of odor and disease-causing agents.

Q5. Define Environmental Impact Assessment (EIA)? In your opinion, what parameters should be considered while conducting EIA for newly proposed wastewater treatment plant?

Ans**. ENVIRONMENTAL IMPACT ASSESSMENT (EIA)**

Environmental assessment (EA) is the assessment of the environmental consequences (positive negative) of a plan, policy, program, or actual projects prior to the decision to move forward with the proposed action.

Or

Environmental Impact Assessment is defined as an activity designed to identify the impact on the bio-geophysical environment, on man and well-being of legislative proposals, projects, policies, operational procedures and to interpret and communicate information.

EIA is a systematic process of identifying future consequences of a current or proposed action.

EIA FOR NEWLY PROPOSED WASTEWATER TREATMENT PLANT

Parameters that should be considered while conducting EIA for newly proposed wastewater treatment plant are,

1. Water and Groundwater
2. Soils & Geology air Quality
3. Noise and Vibration
4. Climate
5. Flora and Fauna
6. Protected Areas

7. Human Beings
8. Landscape
9. Cultural Heritage (Archaeology and Architecture)

THE END