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Section # C.

Q:1. What is Wastewater treatment and its importance? Why rectangular tanks are preferred over circular tank for removal of settleable solids during preliminary treatment?

Ans: ***WASTEWATER TREATMENT:***

Wastewater treatment consist of applying known technology to improve or upgrade the quality of a wastewater.

A process to convert wastewater which is water no longer needed or suitable for its most recent use into an effluent that can be either returned to the water cycle with minimal environment issues or reused.

Wastewater treatment involves collecting the wastewater in a centralized or decentralized location (Wastewater Treatment Plant) and subjecting the wastewater to various treatment processes.

- ***IMPORTANCE:***

Wastewater if properly treated, is an important resource and can be used for various purposes including irrigation, lawn watering, car washing, flushing toilets and landscaping etc.

Water is scarcity is the major problem that is faced all across the world. Although the 2/3rd of the earth crust is make up of water but all of this water is not available for drinking and for other human activities. It has been found of that 97% of the total water is salty that is not good for the human health and animal's and remaining 3% of the water is freshwater and will be use for drinking.

The demand of fresh and clean water deliver to our homes is increasing day by day as there is more home is established day by day. In the coming situation there will be very shortage coming of freshwater.

OBJECTIVES:

The principal objective of wastewater treatment is generally to allow human and industrial effluents to be disposed off without causing danger to human health or unacceptable damage to the natural environment.

CONDITION OF QUESTION:

Removal of scum and floating solids is almost always easier with rectangular clarifiers, which are known to provided more effective scum/foam trapping via rotating scum troughs. It is generally accepted that scarper speed greater than 6 feet (1800 mm)/min can cause re-suspension of settled solids.

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

Ans: Following are the difference between the aerobic and anaerobic wastewater treatment:

Aerobic Wastewater Treatment	*Anaerobic Wastewater Treatment*
Aerobic wastewater treatment is a biological wastewater treatment process which uses an oxygen rich environment.	*Anaerobic wastewater treatment is a process where anaerobic organisms break down organic materials in an oxygen absent environment.*
Bacteria involves the aerobic wastewater treatment are aerobes.	*Bacteria involves the anaerobic wastewater treatment are aerobes.*
Air is circulated in aerobic wastewater treatment tanks.	*Air is not circulated in anaerobic wastewater treatment tanks.*
Aerobic wastewater treatment does not produce methane and carbon dioxide.	*Anaerobic wastewater treatment produces methane and carbon dioxide.*
Aerobic wastewater treatment requires energy. Hence, they are less energy efficient.	*Anaerobic wastewater treatment is an energy efficient process.*
Active slug method, trickling filter, rotating biological reactors and oxidation ditch are examples of aerobic wastewater treatment.	*Anaerobic lagoons, septic tanks and anaerobic digesters are the examples of anaerobic wastewater treatment.*

Activated Sludge Process:

Most commonly used secondary treatment process:

- *Microbes, mainly aerobic heterotrophic bacteria are involved.*

Designed to remove (soluble) biodegradable organic matter:

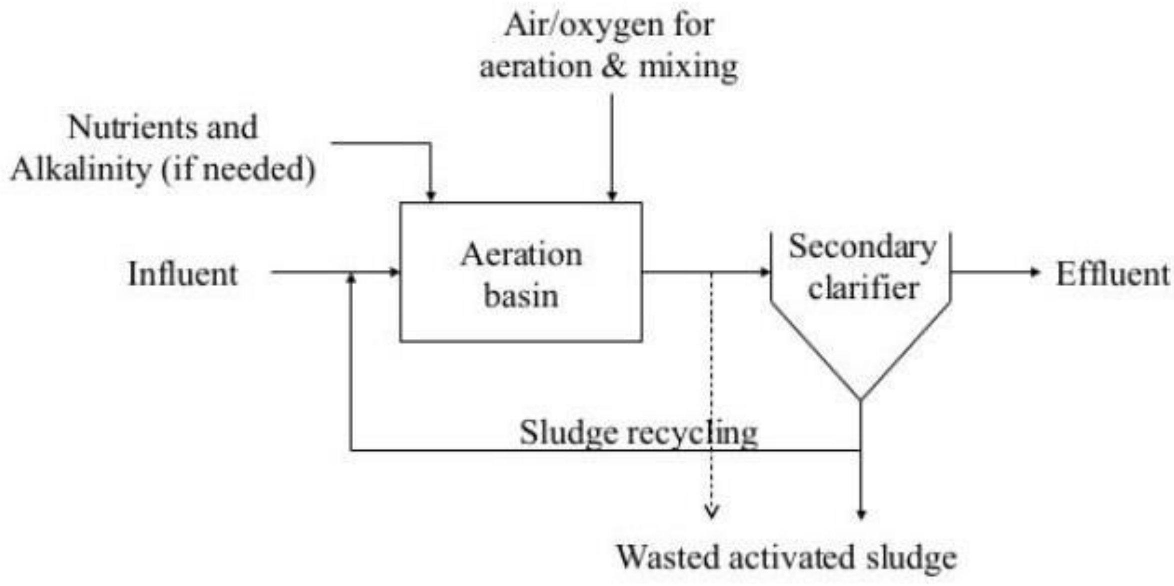
- *Removal of nutrients, TSS, pathogens and heavy metal is coincidental.*

Usually clarified sewage (primary effluents) is treated:

- *Primary treatment is omitted in case of small flows and low TSS sewage and in hot climates (to avoid/control odour problems).*
- *SBR, oxidation ditches, aerated lagoons, contacted-stabilization processed. May not required primary treatment.*

Treatment involves conversion of soluble organic matter into biological flocs and their removal as secondary sludge. Includes an aeration tank and a secondary tank:

- *Aeration and mixing, and sludge recycling are additional features.*



Activated Sludge Process

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

Ans: ***ASSIMILATIVE CAPACITY OF RECIVING WATER BOBIES:***

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.

- ***HELP IN WASTEWATER TREATMENT:***

A classical example of assimilative capacity is to ability of a stream to accept moderate amount of biodegradable waste.

Bacteria in a stream in a stream utilize oxygen to degrade the organic matter present in a such a waste causing the level of dissolved oxygen on the stream to fall, but the decrease in dissolved oxygen causes additional oxygen to enter the stream to fall enter from atmosphere.

A stream can assimilate a certain amount of waste and still maintain a dissolved oxygen level high enough to support a healthy population of fish and other aquatic organisms.

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

Ans: ***SLUDGE:***

Sludge refers to the residual, semi-solid material left from, municipal wastewater or industrial wastewater treatment processes.

Sustainable sludge handling may be defined as a socially acceptable, cost-effective method that meets the requirement of efficient recycling of resources while ensuring that harmful substances are not transferred to humans or the environment i.e. water, air or soil.

Sludge Handling Processes:

1. Primary operations.

2. Thickening.

3. Stabilization.

4. Dewatering.

5. Heat drying.

1) Primary Operations:

This process includes:

i) Grinding: It includes particles size reduction

ii) Screening: It includes removal of fibrous materials.

iii) Degritting: It includes removal of sand or other inorganic materials.

iv) Blending: It includes making the sludge homogenous.

v) Storage: It ensures flow equalization in the system.

2) Sludge Thickening:

Sludge thickening is undertaken to increase percentage of solid content in sludge by removing a portion of liquid fraction.

Volume reduction of approximately 30 – 80% can be reached with sludge thickening.

Various methods of sludge thickening are:

i. *Gravity thickening.*

ii. *Flotation thickening.*

iii. *Rotatory drum thickening.*

3) Sludge Stabilization:

Sludge Stabilization is undertaken to reduce pathogens, eliminate offensive odors, minimize production of usable gas (methane).

Methods of stabilization are:

i. Alkaline Stabilization.

ii. Anaerobic Digestion

4) Dewatering:

Dewatering is undertaken to reduce the moisture content of sludge.

Compared to thermal (evaporative processes) for water reduction, mechanical dewatering is often selected due to its low energy requirement.

Centrifugation is the method used for separating liquids of different densities, thickening slurries.

5) Heat Drying:

It involves the application of heat to evaporate water and to reduce the moisture content of bio solids.

Advantage of this method is to reduce product transportation costs, improve storage capability, and marketability.

Direct drying involves the wastewater solids come into contact with hot gases, which cause evaporation of moisture. Dryers such as rotary dryers and fluidized bed dryers are used.

- ***Sludge Disposal:***

Sewage sludge contains both compounds of agricultural value and pollutants:

i. *Agriculture value- organic matter, nitrogen, phosphorus and potassium.*
ii. *Pollutants- heavy metals, organic pollutants and pathogens.*

- ***Methods of Sludge Disposal:***

1. Land fill.

2. Agricultural use.

3. Other methods.

1. Land fill:

A site for the disposal of waste materials by burial and is the oldest form of waste disposal. Problem with this method is that many landfills are filling up, and towns are having trouble finding places to put new ones.

2. Agriculture Purpose:

- ***Advantages:***

1. Utilization of nutrients contained in the sludge, i.e. phosphorus and nitrogen.

2. Utilization of organic substances contained in the sludge for improvement of the humus.

3. Soil improvement.

4. The cheapest disposal route.

- ***Disadvantages:***

1. Major investments in storage facilities as sludge can only be spread on farmland a few times a year.

2. Dependency on the individual farmers and considerable administration of agreements.

3. Lack of knowledge as to the content of organic micro pollutants and pathogenic organisms in sludge and their impact on the food chains.

3. Other Methods:

1. Ocean Disposal – Dumping or controlled release of sewage sludge into marine water.

2. Distribution and Marketing – The give-away, transfer, or sale of sewage sludge or sewage sludge product in either bagged or bulk form.

3. Surface Disposal – A controlled area of land where only sewage sludge is placed for a period of one year or longer. Sludge placed in this area is not provided with a daily or final cover.

- ***Effluent Reuse:***

1.Land scape Irrigation.

2.Agriculture Irrigation.

3.Ground water Recharge.

4.Street washing.

5.Fire Fighting.

6.Non-portable domestic uses.

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:***

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human- health impacts, both beneficial and adverse.

Environmental Impact Assessment (EIA) is a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. By using EIA both environmental and economic benefits can be achieved, such as reduced cost and time of project implementation and design, avoided treatment/clean-up costs and impacts of laws and regulations.

- ***PARAMETR TO BE CONSIDERED WHILE CONDUCTING EIA FOR NEWLY PROPOSED WASTEWATER TREATMENT PLANT:***

Although legislation and practice vary around the world, the fundamental components of an EIA would necessarily involve the following stages:

- *Screening to determine which projects or developments requires a full or partial impact assessment study;*
- *Scoping to identify which potential impacts are relevant to assess (based on legislative requirements, international conventions, expert knowledge and public involvement), to identify alternative solutions that avoid, mitigate or compensate adverse impacts on biodiversity (including the option of not proceeding with the development, finding alternative designs or sites which avoid the impacts,*

incorporating safeguards in the design of the project, or providing compensation for adverse impacts), and finally to derive terms of reference for the impact assessment;

- *Assessment and evaluation of impacts and development of alternatives, to predict and identify the likely environmental impacts of a proposed project or development, including the detailed elaboration of alternatives;*
- *Reporting the Environmental Impact Statement (EIS) or EIA report, including an environmental management plan (EMP), and a non-technical summary for the general audience.*
- *Review of the Environmental Impact Statement (EIS), based on the terms of reference (scoping) and public (including authority) participation.*
- *Decision-making on whether to approve the project or not, and under what conditions; and*

  Monitoring, compliance, enforcement and environmental auditing. Monitor whether the predicted impacts and proposed mitigation measures occur as defined in the EMP. Verify the compliance of proponent with the EMP, to ensure that unpredicted impacts or failed mitigation measures are identified and addressed in a timely fashion.

The purpose of the assessment is to ensure that decision makers consider the environmental impacts when deciding whether or not to proceed with a project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made".

EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather they require *decision makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts.*

Environmental Impact Statement (EIS) should contain the following information's/data:

- *Description of proposed action (construction, operation and shut down phase) and selection of alternatives to the proposed action.*
- *Nature and magnitude of the likely environmental effects.*
- *Possibility of earthquakes and cyclones.*
- *Possible effects on surface and ground water quality, soil and air quality.*
- *Effects on vegetation, wild life and endangered species.*
- *Economic and demographic factors.*
- *Identification of relevant human concerns.*

ENVIROMENTAL IMPACT ASSESMENT AND MITIGATION MEASURES:

The first attempt to assess the environmental impacts was done within the "Initial Environmental Examination – IEE level study". Using the basic data from this Study, following the general recommendations for elaboration of the environmental impacts, using updated information and large amount of new data and taking into consideration all media and their interaction, detailed Environmental Impact Study was prepared. In order to assess in more details possible impacts during construction, operation phase and post operation phase (closure) or some changes which are planed in the view of capacity or technology, of the access roads, main collectors, the siphon and the WWTP, following phases and activities have been taken in consideration:

a) ***Construction Phase:***

- *Construction of the access roads and main collectors (left and right river bank);*
- *Construction of the siphon structure across the River Vardar;*
- *Preparatory works at the location of the WWTP (tree cutting, humus removal and flattening of the location) and excavation works;*

- *Transport and disposal of surplus excavated material;*
- *Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles);*
- *Disposal of construction waste;*
- *Installation of the equipment;*
- *Construction of accommodation facilities for the workers (water supply, sewerage, waste disposal).*

b) <u>Operation Phase:</u>

- *Treatment technology/ operation of the equipment for sewerage treatment and effluent production;*
- *Operation of equipment for sludge production (digester, drying beds and biogas production);*
- *Sludge (with dangerous substances) disposal on temporary storage at WWTP site.*
