



How Microbes Clean Sewage

The Biological Purification Pipeline (Class 12 / NEET Concept Guide)

What exactly is 'Sewage'?

Every day, cities and towns generate massive quantities of municipal waste-water.



The Core

Human Excreta

The major component of municipal waste-water.



The Fuel

Organic Matter

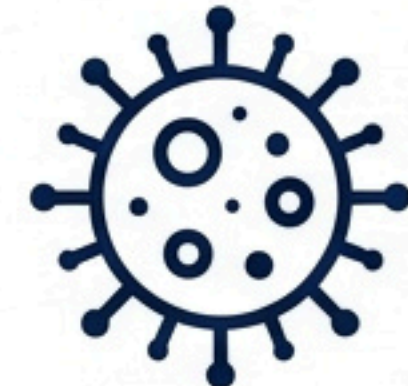
Contains extremely large amounts of organic material that depletes oxygen.



The Threat

Pathogenic Microbes

Teeming with microscopic life, many of which cause severe diseases.





The Problem

Untreated sewage cannot be discharged directly into natural water bodies like rivers and streams.

This leads to extreme pollution and a rapid increase in water-borne diseases.



The Solution

Government Intervention

The Ministry of Environment and Forests initiated the Ganga Action Plan and Yamuna Action Plan.



Goal: Build a vast network of Sewage Treatment Plants (STPs) so that **ONLY** treated sewage is discharged into rivers.

Phase 1: Primary Treatment

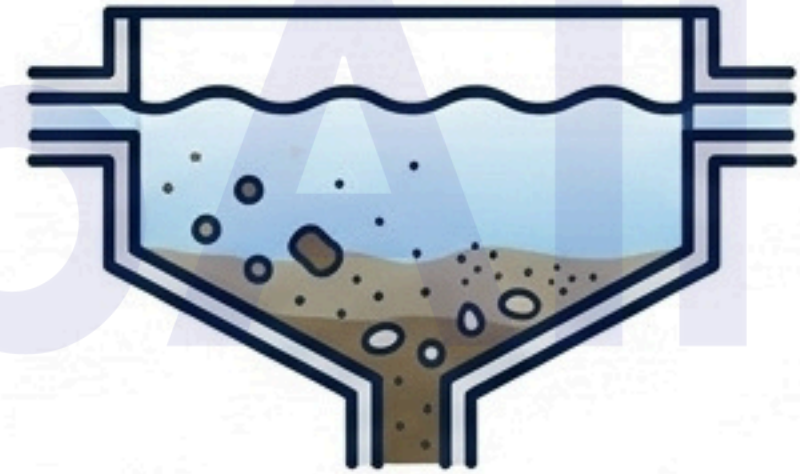
Physical Removal Only (No Biology Yet)

Step 1: Sequential Filtration



Removes floating debris (like plastics, leaves, and large trash) by passing waste through increasingly fine filters.

Step 2: Sedimentation



Removes grit (soil and small pebbles) by allowing them to naturally sink to the bottom of a large holding tank.



**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

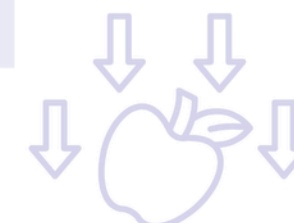
Practice Now



At prep.topall.app

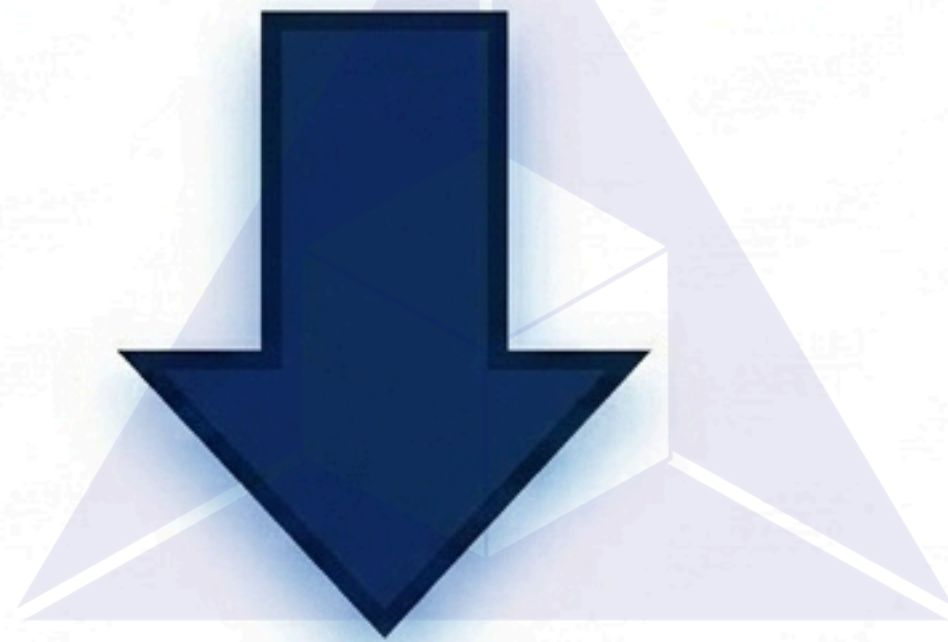
Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



The Output of Primary Treatment

Primary Sludge



All the solid materials (grit, soil, pebbles) that settle at the bottom during the sedimentation phase.

Primary Effluent



The supernatant liquid (the water remaining on top) after solids settle. This is pumped forward into the next phase.

Phase 2: Secondary Treatment (Biological)

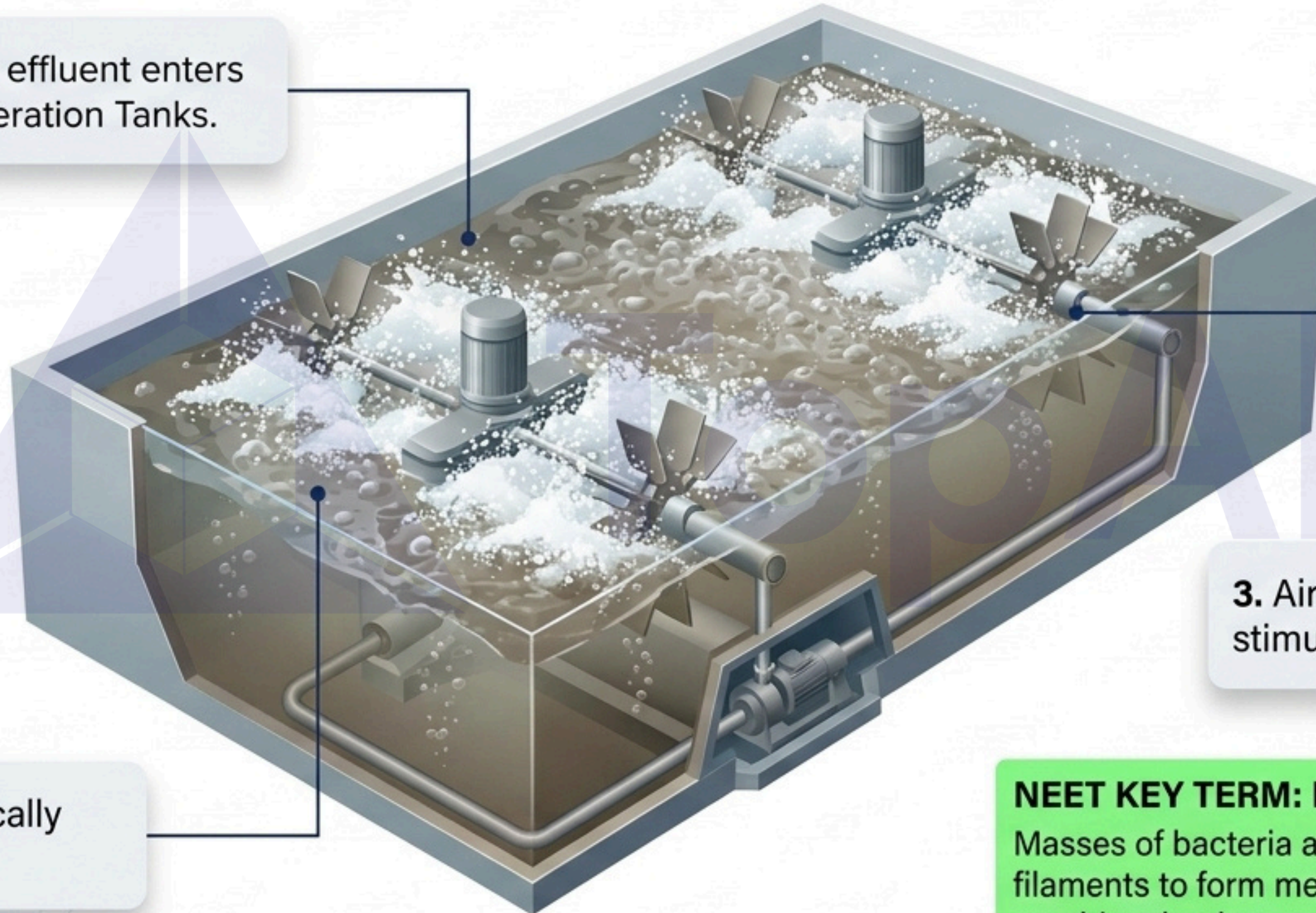
1. Primary effluent enters large Aeration Tanks.

2. Water is mechanically agitated constantly.

3. Air is pumped in to stimulate aerobic growth.

NEET KEY TERM: Flocs

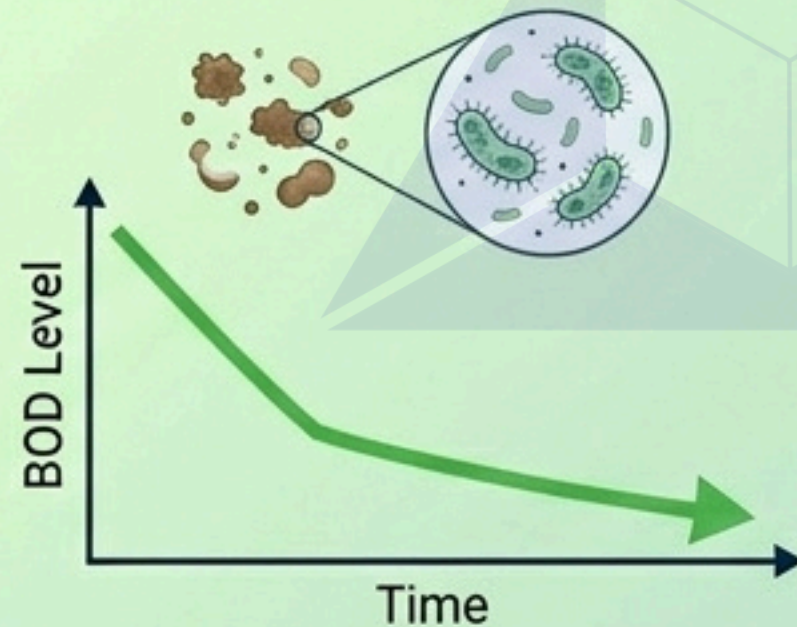
Masses of bacteria associated with fungal filaments to form mesh-like structures. These aerobic microbes grow vigorously and consume the major part of the organic matter.



The Core Principle: BOD & Activated Sludge

Biochemical Oxygen Demand (BOD): The amount of oxygen that would be consumed if all the organic matter in 1 liter of water were oxidised by bacteria. It is an indirect measure of organic matter.

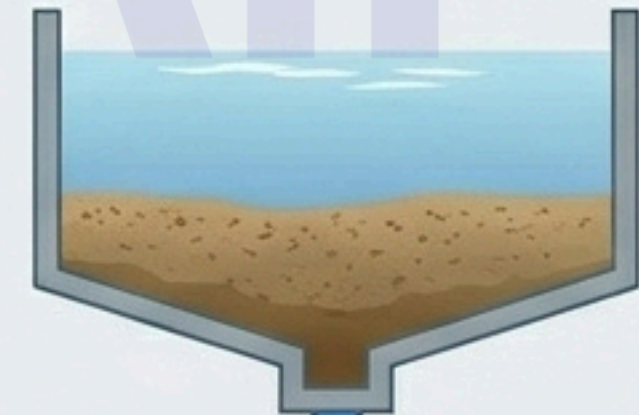
Step 1: Microbes eat organic matter → BOD goes **DOWN**.



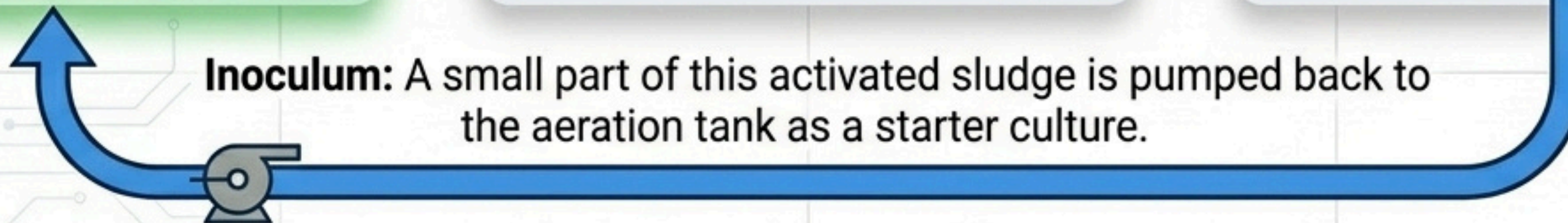
Step 2: Once BOD is significantly reduced, the water is moved to a **settling tank**.



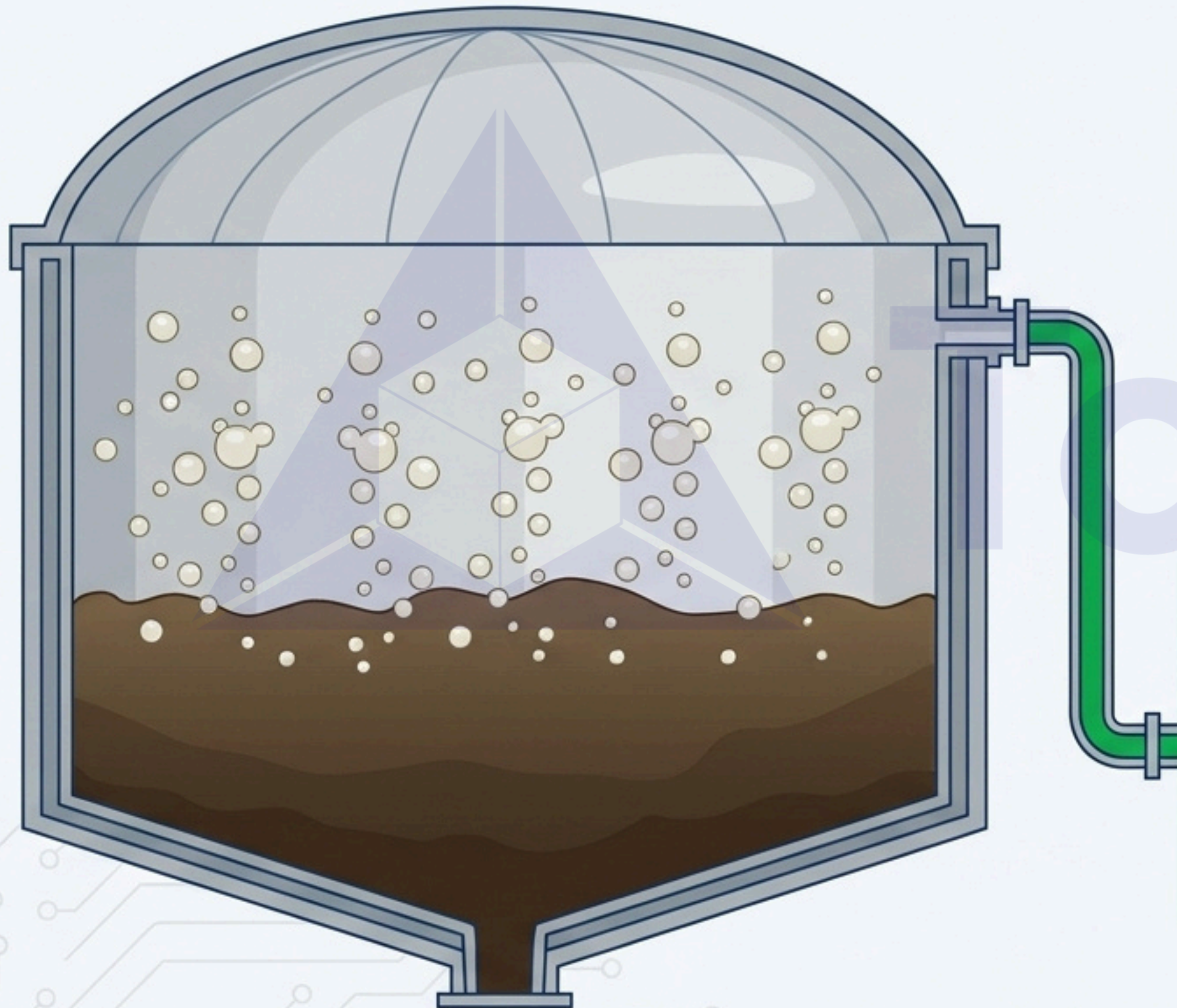
Step 3: The bacterial flocs sediment at the bottom. This sediment is now called **Activated Sludge**.



Inoculum: A small part of this activated sludge is pumped back to the aeration tank as a starter culture.



Phase 3: Anaerobic Sludge Digesters



The Final Breakdown

The remaining major part of the Activated Sludge is pumped into these large, sealed tanks. Here, a different set of anaerobic bacteria take over, digesting the aerobic bacteria and fungi.

Biogas Production

During digestion, a highly inflammable mixture of gases is produced and harvested as a renewable source of energy.

Methane (CH_4)

Hydrogen Sulphide (H_2S)

Carbon Dioxide (CO_2)

The Final Output



The purified effluent is finally released safely into natural water bodies. For over a century, no man-made technology has rivaled this microbial treatment.

The greater the BOD of waste water, more is its polluting potential.

1. Primary: Physical removal of solids.

2. Secondary: Biological (Aerobic flocs & BOD reduction).

3. Tertiary: Anaerobic digestion (Biogas).



You've Learned the Theory.

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