

MICROBES IN SEWAGE TREATMENT

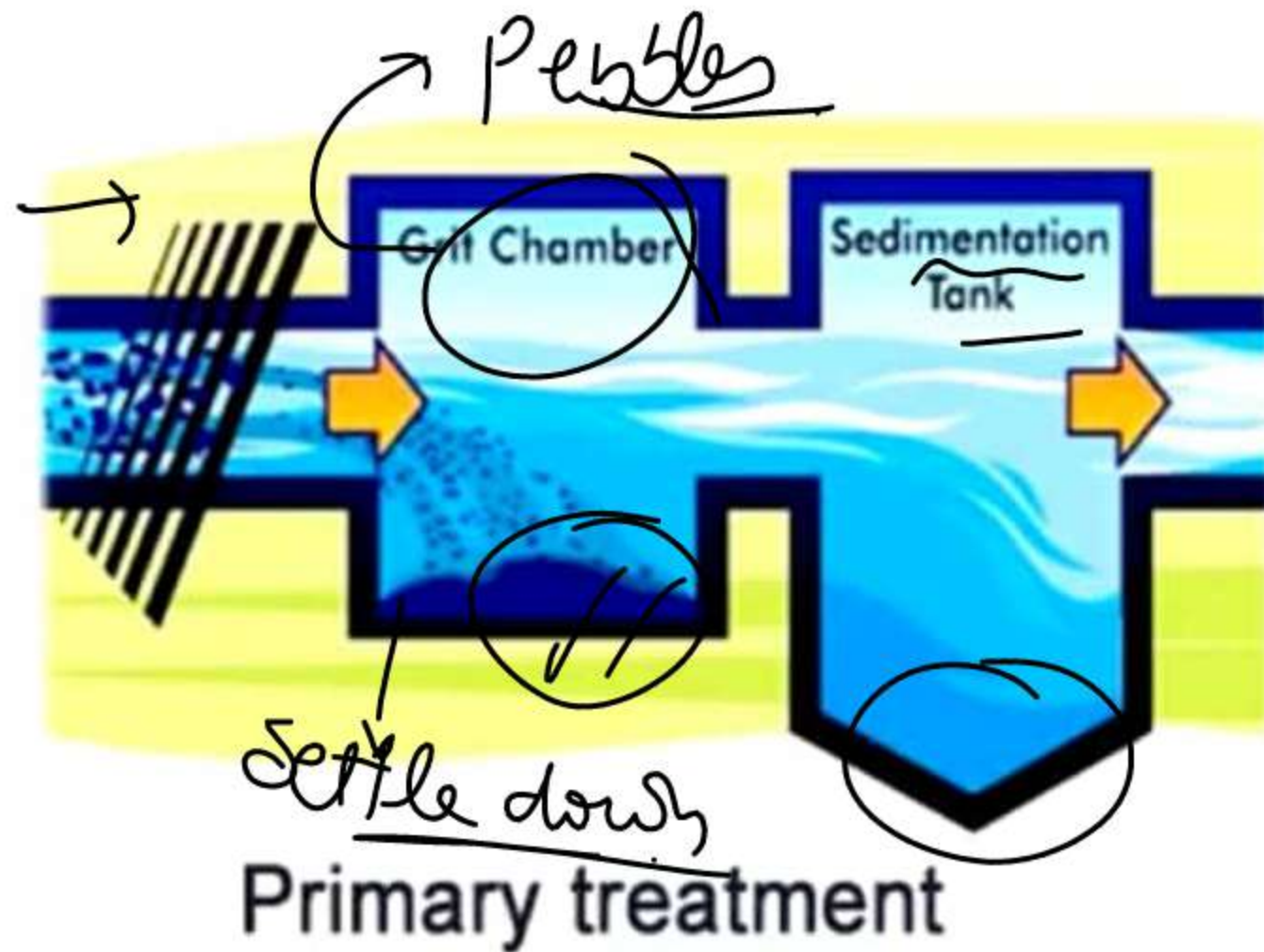


- Sewage (municipal waste-water) contains large amount of organic matter & microbes.
- Sewage is treated in Sewage Treatment Plants (STPs) to make it less polluting.
- It includes 2 stages:



MICROBES IN SEWAGE TREATMENT

1. PRIMARY TREATMENT



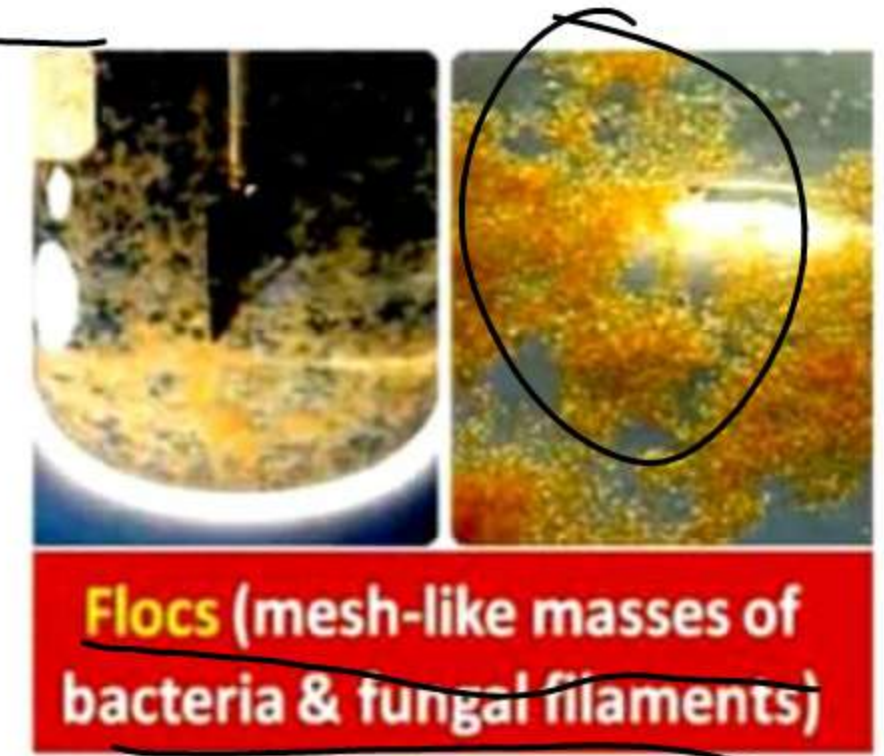
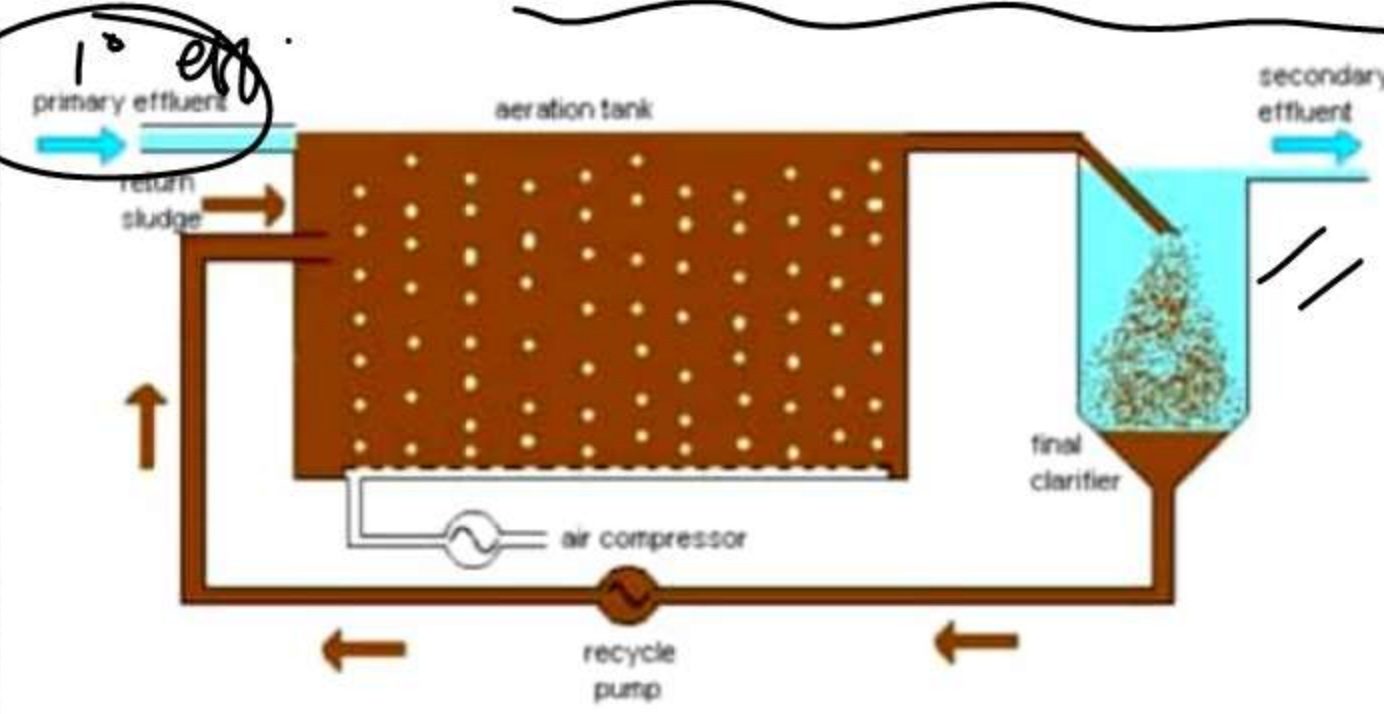
- (Physical treatment)
- It is the physical removal of particles.
 - It includes
 - ✓ Removal of floating debris by sequential filtration.
 - ✓ Removal of the grit (soil & small pebbles) by sedimentation.

The settled solids form **primary sludge** and the supernatant forms the **primary effluent**.

MICROBES IN SEWAGE TREATMENT

2. SECONDARY (BIOLOGICAL) TREATMENT

→ Agitator.

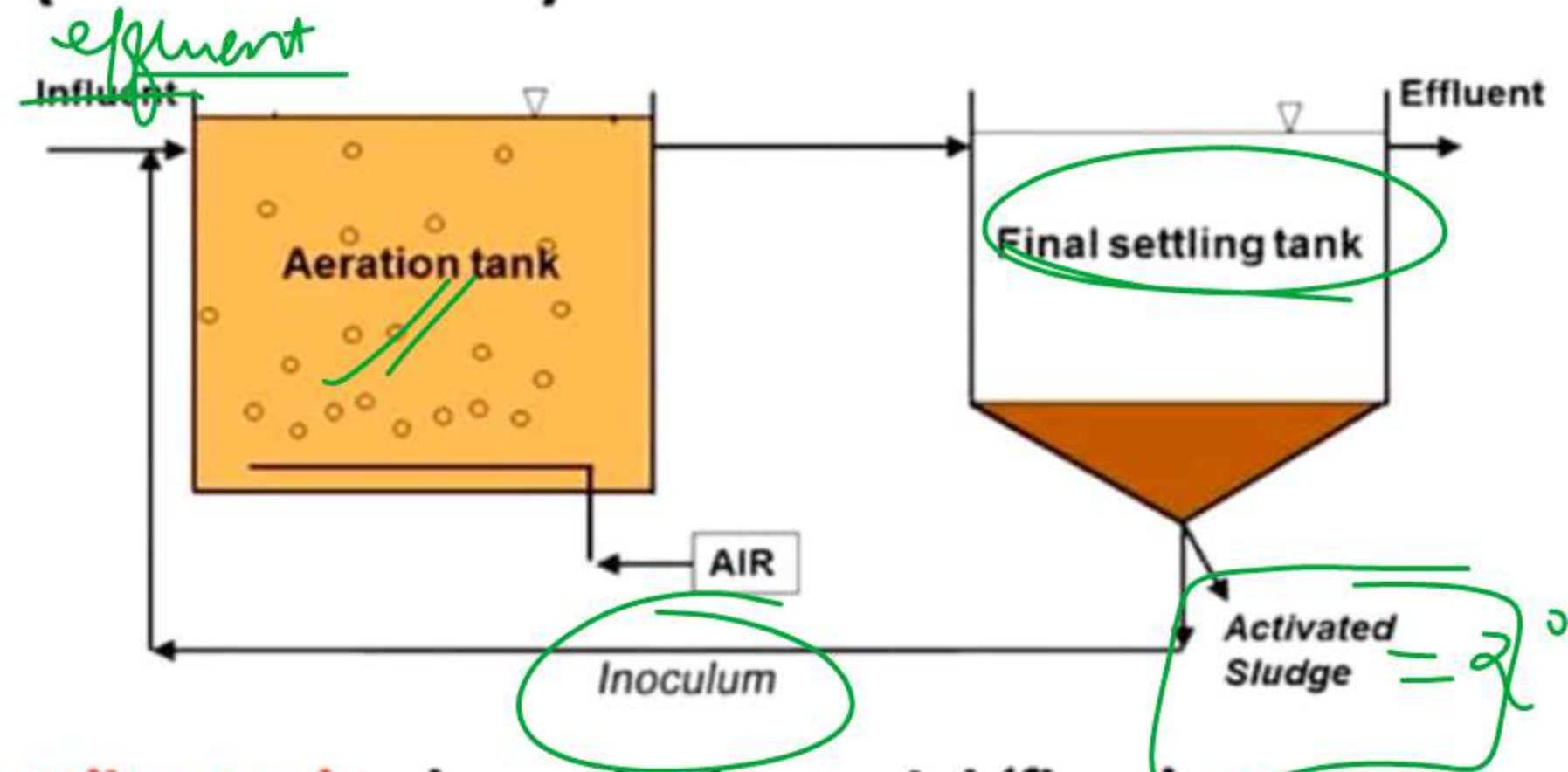


- **Primary effluent** is passed into large **aeration tanks** and constantly agitated.
- This allows vigorous growth of **useful aerobic microbes** into **flocs** (bacteria associated with fungal filaments to form mesh-like structures).
- These microbes consume the organic matter in the effluent. This reduces the **BOD (Biochemical Oxygen Demand)** of the effluent.



MICROBES IN SEWAGE TREATMENT

2. SECONDARY (BIOLOGICAL) TREATMENT

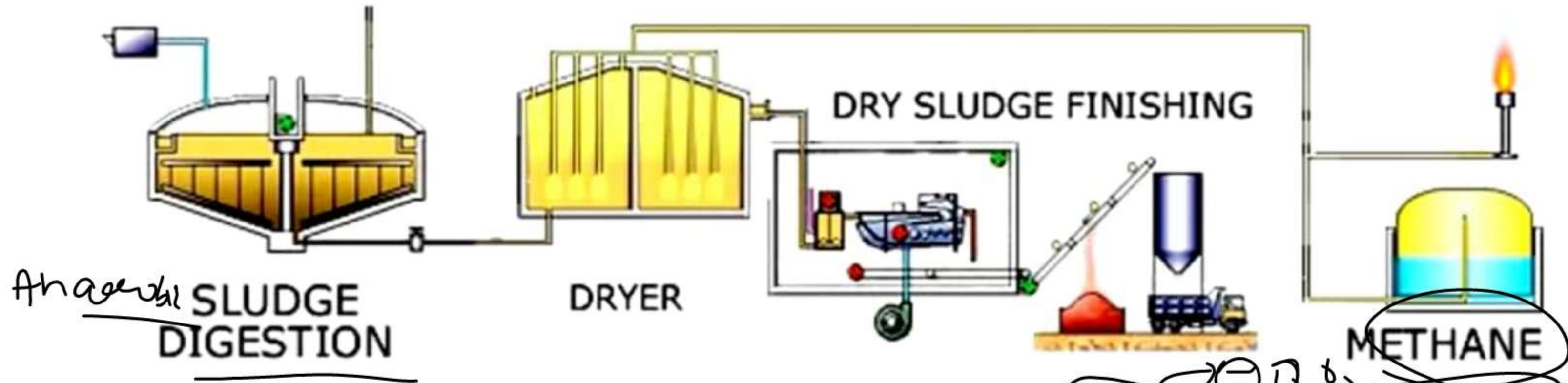


- The effluent is then passed into a **settling tank** where the bacterial 'flocs' are sediment. This sediment is called **'activated sludge'**. (*aerobic bacteria + nt*)
- A small part of the activated sludge is pumped back into the aeration tank to serve as the **inoculum**.

starts

MICROBES IN SEWAGE TREATMENT

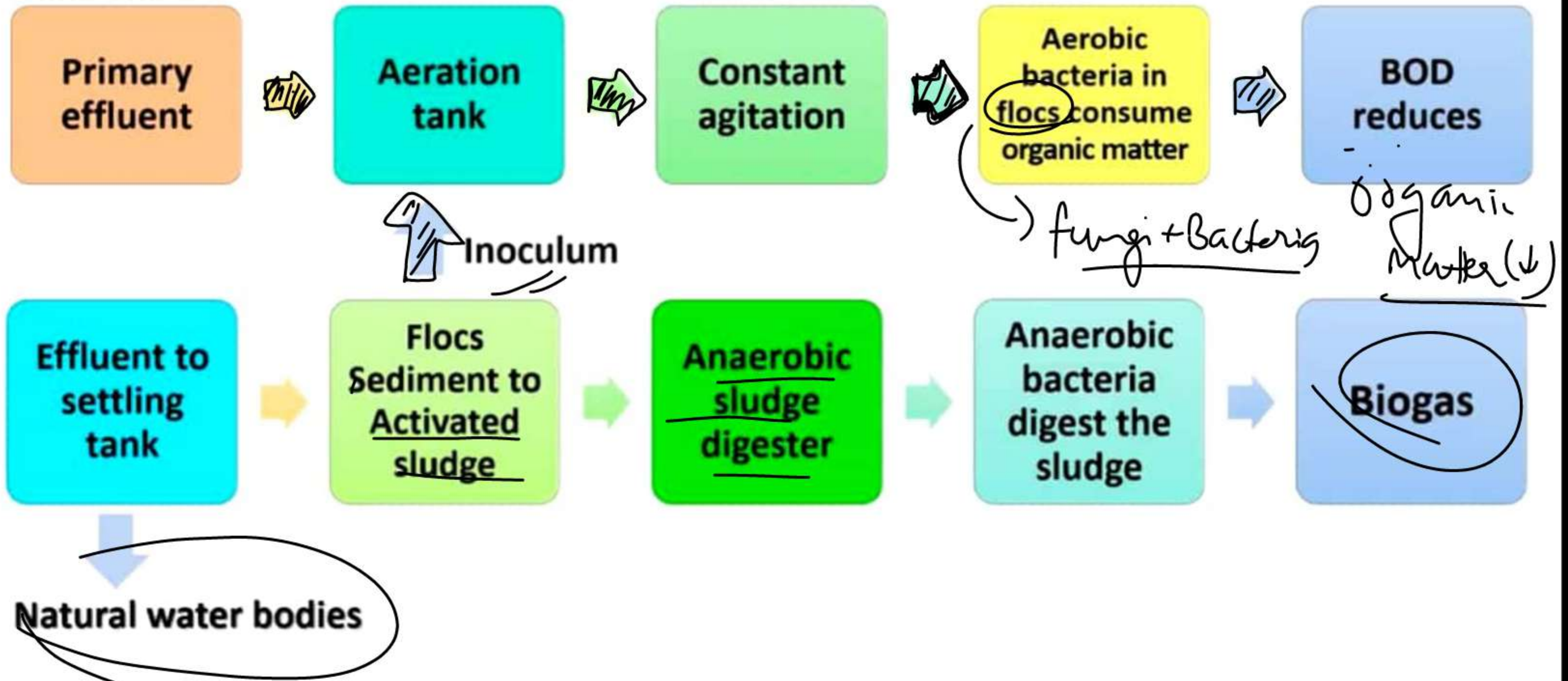
2. SECONDARY (BIOLOGICAL) TREATMENT



- The remaining sludge is pumped into large tanks called **anaerobic sludge digesters**. Here, some **anaerobic bacteria** digest the bacteria and fungi in the sludge by producing gases like CH_4 , H_2S and CO_2 . These gases form the **biogas**.
- The effluent is released into natural water bodies like rivers and streams.

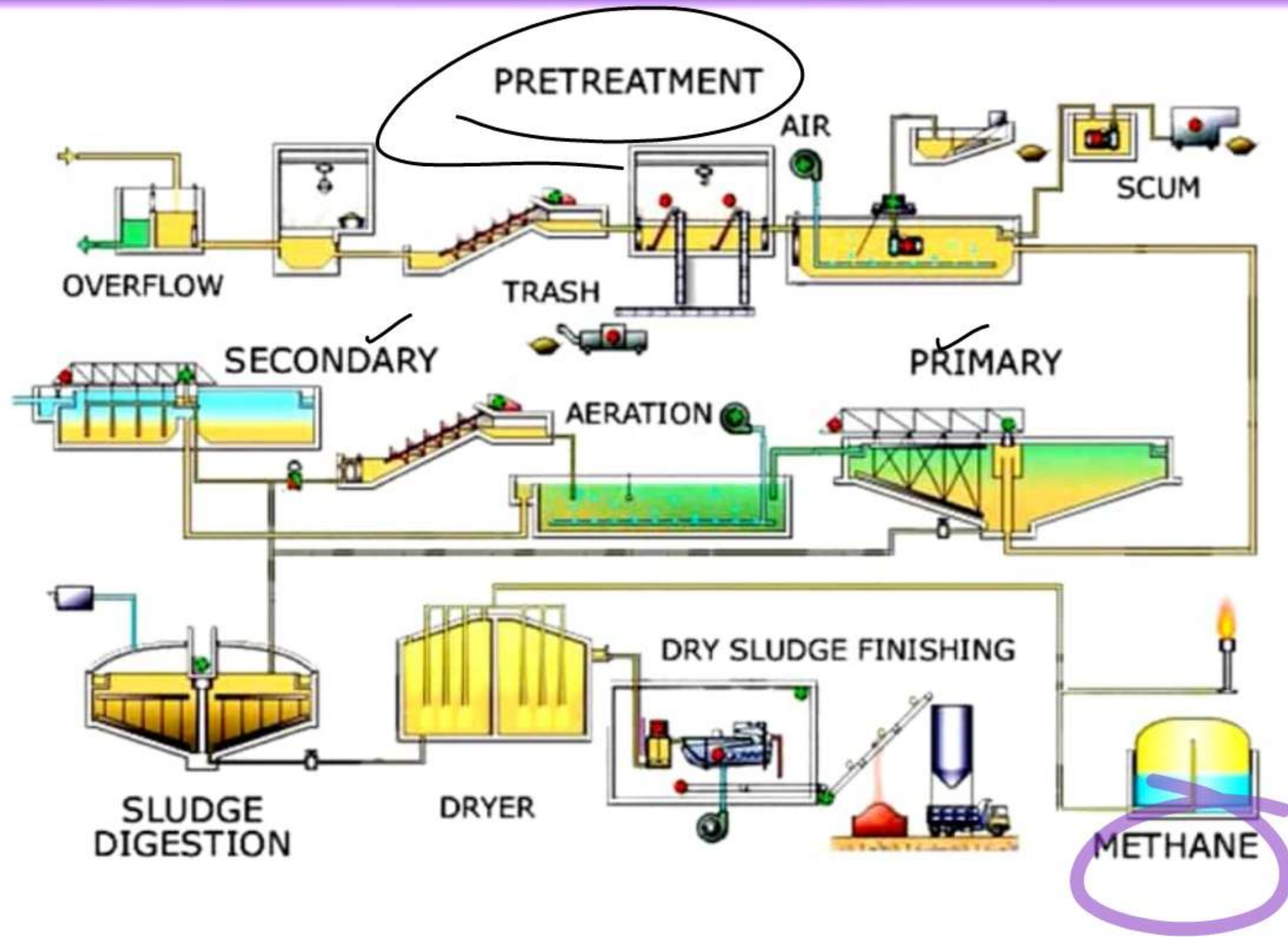
MICROBES IN SEWAGE TREATMENT

SECONDARY (BIOLOGICAL) TREATMENT - OVER ALL STEPS



MICROBES IN SEWAGE TREATMENT

SEWAGE TREATMENT: AT A GLANCE



MICROBES IN SEWAGE TREATMENT



(MEF)
The Ministry of Environment & Forests has initiated Ganga ¹⁹⁸⁶
Action Plan &
Yamuna Action ¹⁹⁹³
Plan to save from water pollution.

MICROBES IN BIOGAS PRODUCTION



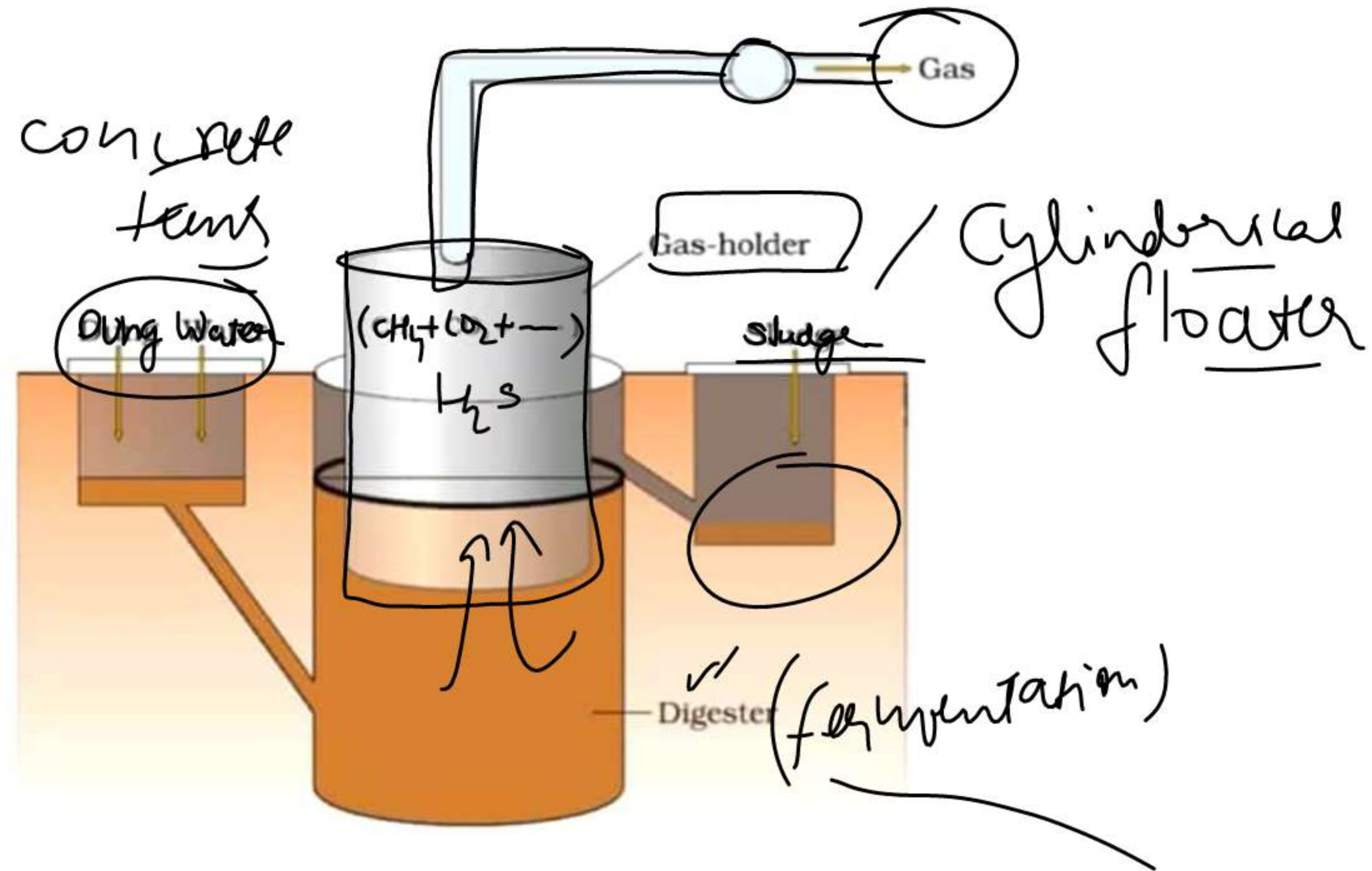
→ Methanogens (Archaea)

- Biogas is a mixture of gases (mainly CH_4)^{*} produced by the microbes such as **Methanogens**.
- Methanogens grow anaerobically on cellulosic material and produce CH_4 along with CO_2 & H_2 .
E.g. **Methanobacterium**.
Homopolysac
- **Methanobacterium** is found in the anaerobic sludge and rumen of cattle (for cellulose digestion).
Part of Rumen (dominants)
- Biogas is used for **cooking and lighting**.
- Cattle dung (gobar) contains these bacteria. So dung is used to produce biogas (**Gobar gas**).

MICROBES IN BIOGAS PRODUCTION

PARTS OF A BIOGAS PLANT

1. A concrete tank (10-15 feet deep) to collect bio-wastes and slurry of dung. A floating cover is placed over the slurry, which keeps on rising as the biogas is produced.



MICROBES IN BIOGAS PRODUCTION



- **Indian Agricultural Research Institute (IARI) and Khadi & Village Industries Commission (KVIC)** developed technology of biogas production in India.

A major component of gobar gas is: [AIPMT-2004]

- ~~(A) Methane~~
- (B) Ethane
- (C) Butane
- (D) Ammonia

~~Measuring~~ ~~Biochemical~~ ~~oxygen~~ ~~demand~~ (BOD) is a **[AIPMT-2012]** method used for

~~(A)~~ Estimating the amount of organic matter in sewage water

⇒ Organic matter ⇒ Polluting Potential

(B) Working out the efficiency of oil driven automobile engines

(C) Measuring the activity of *Saccharomyces cerevisiae* in producing curd on a commercial scale

(D) Working out the efficiency of RBCs about their capacity to carry oxygen

Select the correct statement from the following: [AIPMT-2010]

(A) Biogas is produced by the activity of aerobic bacteria on animal waste.

(B) Methanobacterium is an aerobic bacterium found in rumen of cattle

(C) Biogas, commonly called gobar gas, is pure methane \rightarrow Major comp. \rightarrow CO_2 , H_2S

(D) Activated sludge-sediment in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria

The domestic sewage in large cities:

[AIPMT-2012]

- (A) A processed by aerobic and then anaerobic bacteria in the secondary treatment in sewage treatment Plant (STPs)
- (B) When treated in STPs, does not really require the aeration step as the sewage contains adequate oxygen
- (C) Has very high amounts of suspended solids and dissolved salts
- (D) Has a high BOD as it contains both aerobic and anaerobic bacteria

During sewage treatment, biogases are produced which include:

[AIPMT-2013]

- (A) methane, oxygen, hydrogen sulphide
- (B) Hydrogen sulphide, methane, sulphur dioxide
- (C) Hydrogen sulphide, nitrogen, methane
- (D) Methane, hydrogen sulphide, carbon dioxide

M.C

What gases are produced in anaerobic
sludge digesters?

[AIPMT-2014]

O_2 absent

(A) Methane and CO_2

(B) Methane, Hydrogen Sulphide and O_2

(C) Methane, Hydrogen Sulphide and CO

(D) Hydrogen Sulphide and CO_2

CO_2

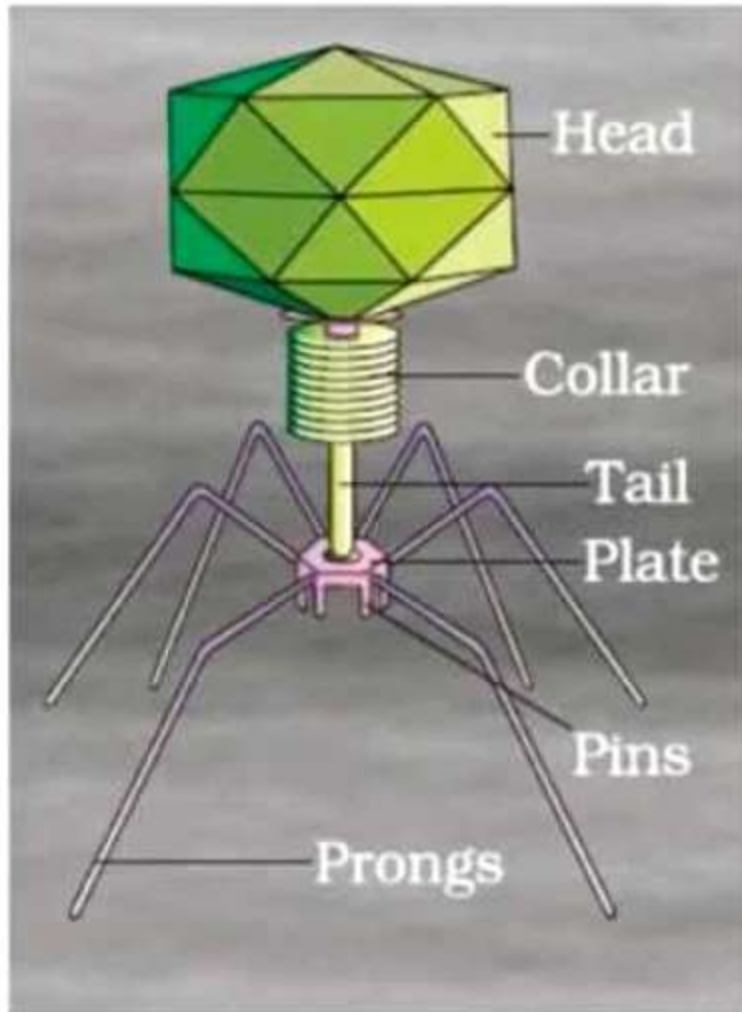
Which of the following in sewage treatment removes suspended solids?

[NEET-2017]

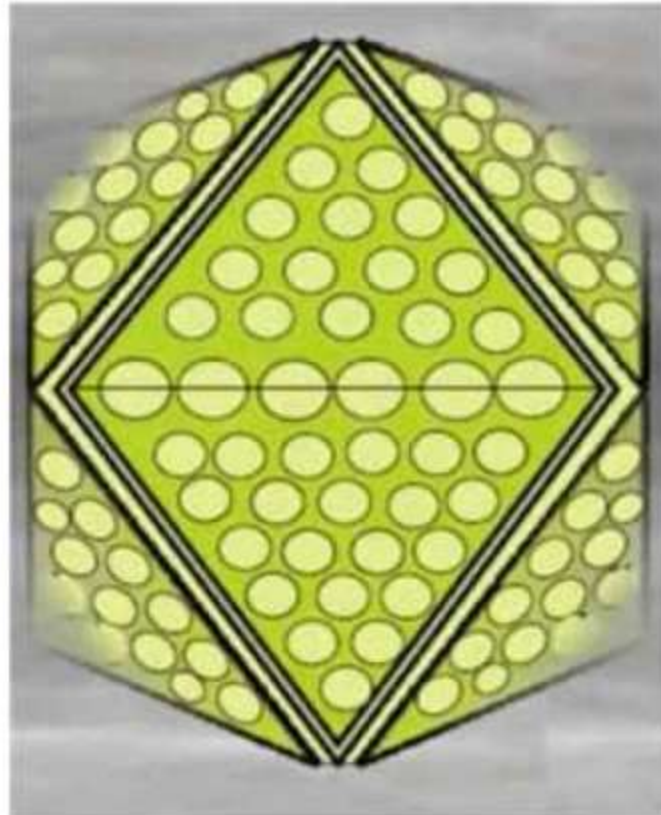
Physical treat

- (A) Secondary treatment
- ~~(B) Primary treatment~~
- (C) Sludge treatment
- (D) Tertiary treatment

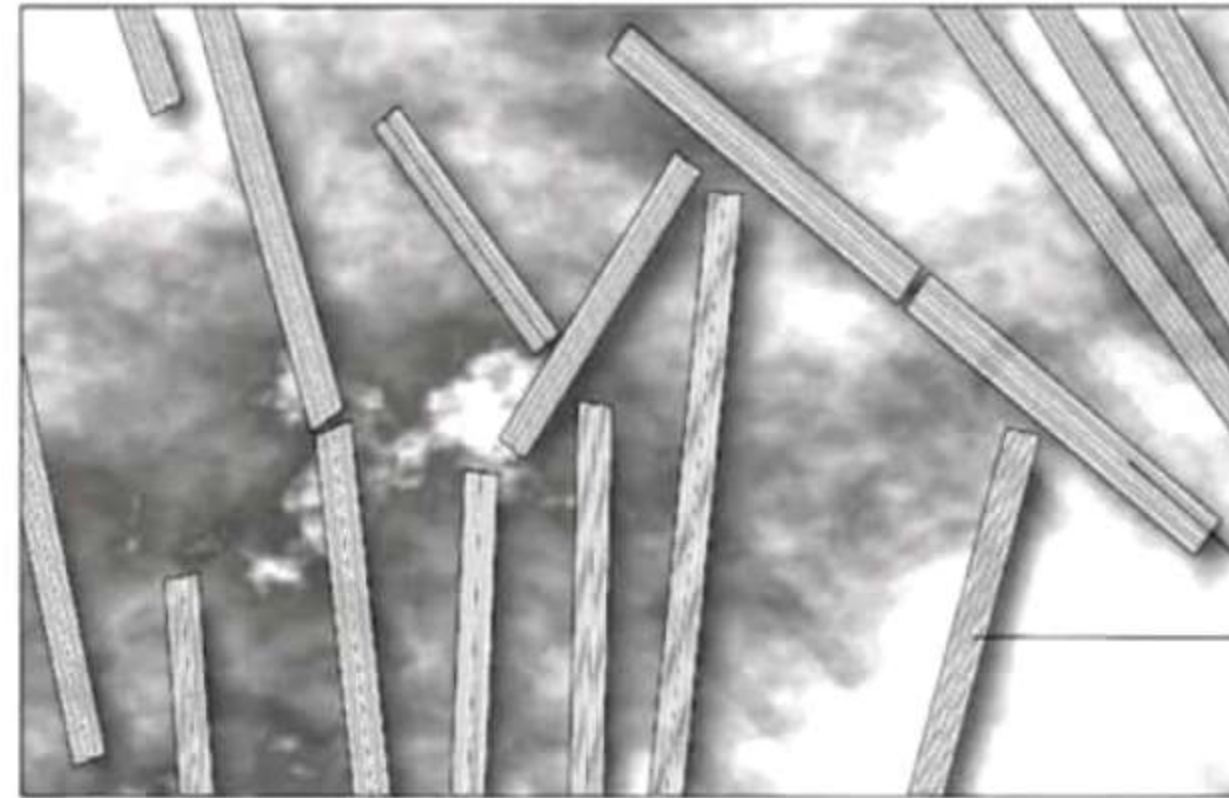
Various Microbes



A bacteriophage



Adenovirus which causes respiratory infections



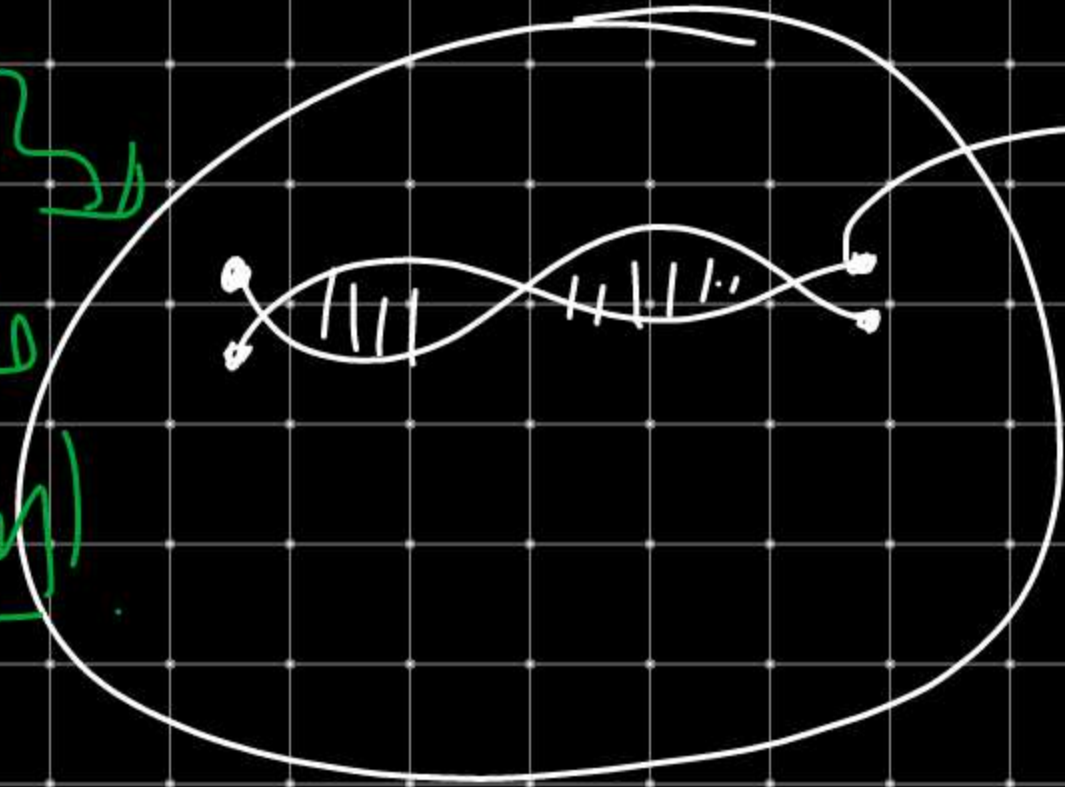
Compact Rod-shaped viruses

Rod-shaped Tobacco Mosaic Virus (TMV). Magnified about 1,00,000–1,50,000X

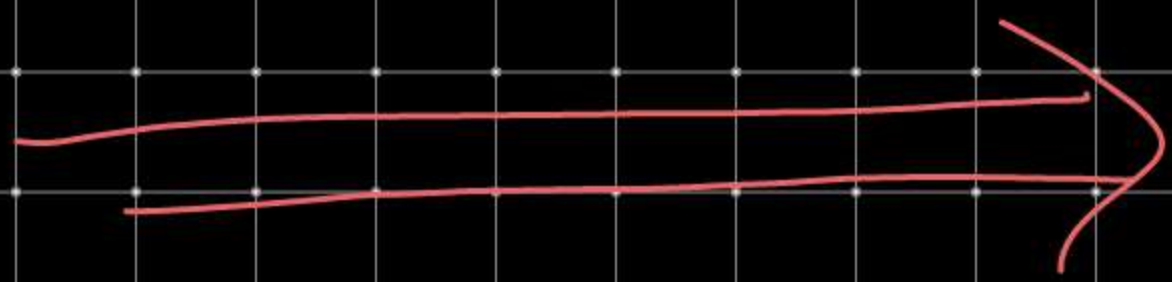
① Microbes (Bacteria, fungus) \Rightarrow Organic acids.

(Inorganic acids) ~~X~~

(Mutation)



Telomere



Telomere
Int.

With time
cell division gets
stop

① B.O.D \propto Polluting potential of
water

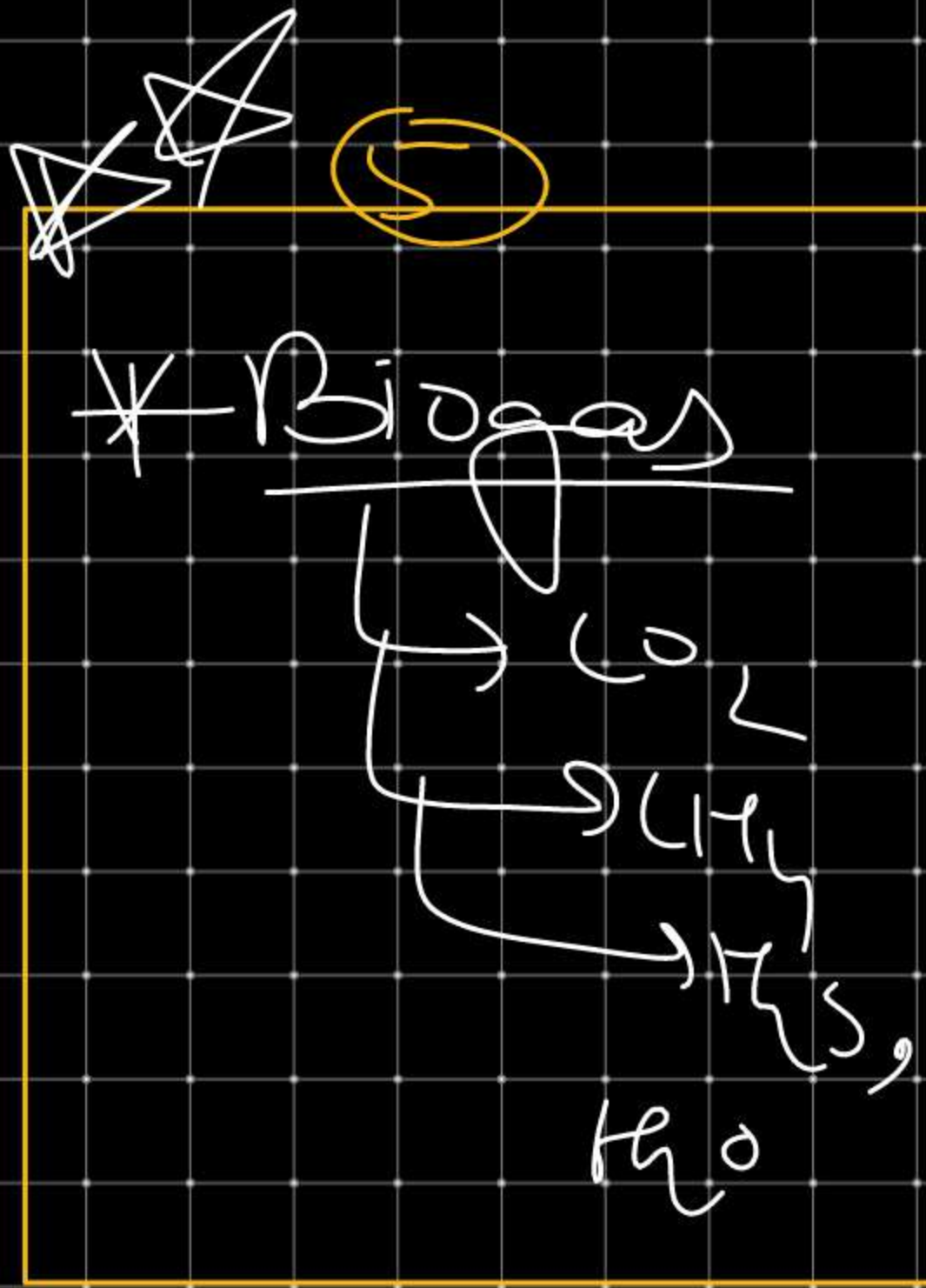
② Sludge & effluent.

③ Aerobic Bacteria = Q Treatment.

(\therefore Agitator system,
i.e. turbine)

(9)

BOD = Biochemical O_2 demand



Activated Sludge (R^-)

Inoculum

