PRACHAND NEET

ONE SHOT

Botany

Microbes in Human Welfare

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PRACHAND SERIES

TELEGRAM CHANNEL

Microbes

- Bacteria
- Fungi
- Viruses

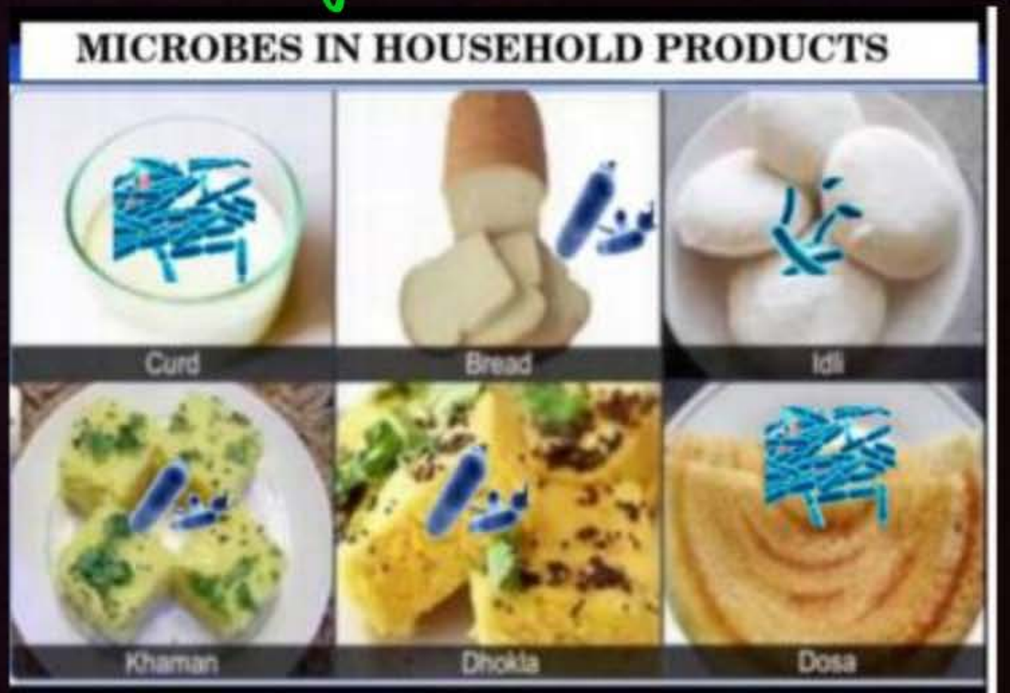
Microbes in Household Products

1. Curd → Lactobacillus → Coagulates casein protein present in milk
   (Lactobacillus → Lactic acid Fermentation)

2. Cheese → Swiss Cheese → Propionibacterium → Bacteria
   Roquefort Cheese → Penicillium roqueforti → Fungi
   Camembert Cheese → Penicillium camembert → Fungi

3. Dosa and Idli → Bacteria
   - Leuconostoc
   - Streptococcus

4. Yoghurt → Lactobacillus, Streptococcus



Microbes in Household Products

Yeast → Unicellular Fungi

Bread → Baker's yeast → Saccharomyces cerevisiae

CO_2 gas gives the puffiness

Yeast → Alcoholic fermentation → CO_2 & Ethanol

* Toddy drink → By fermenting sap of palm.

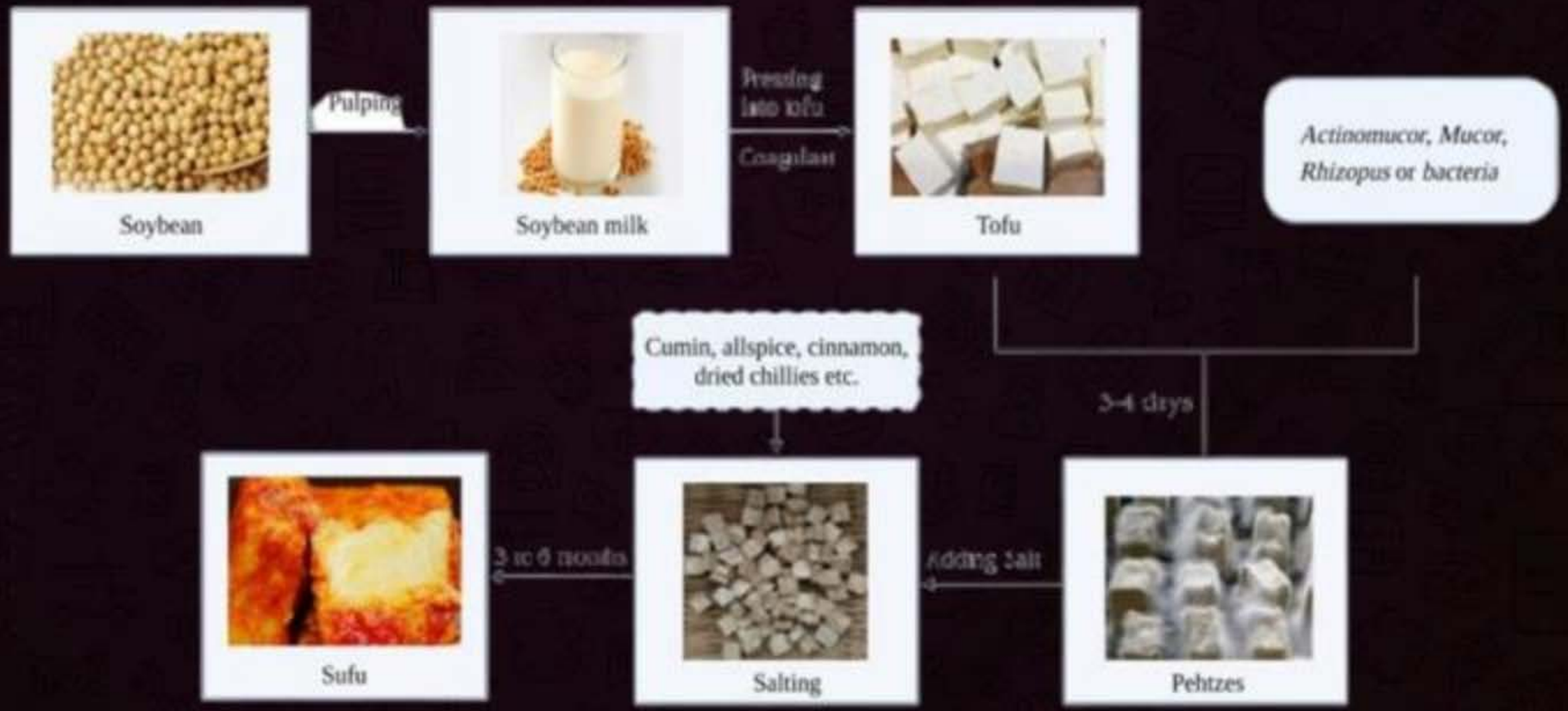
Microbes in Household Products

From fermentation of Soyabean

Tempeh

Tofu

Sufu



Microbes in Industrial Products

1. Alcohol → Brewer's yeast → Saccharomyces → Yeast (Fungi)

   → Alcoholic fermentation by yeast

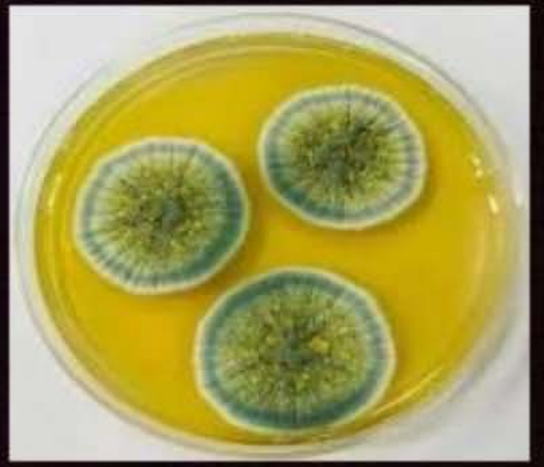
Glucose → CO_2 + Alcohol

Yeast –

- **Distilled**
  - Whisky
  - Brandy
  - Rum
  - Vodka
  - Scotch
- **Non-distilled**
  Wine (9-12%) & Beer (3-6%)
  (Max. can be 13% after which yeast poisons themselves to death)

Microbes in Industrial Products

2. Antibiotics → "Against life" of bacteria.
Alexander Fleming → was working on Bacteria Staphylococcus



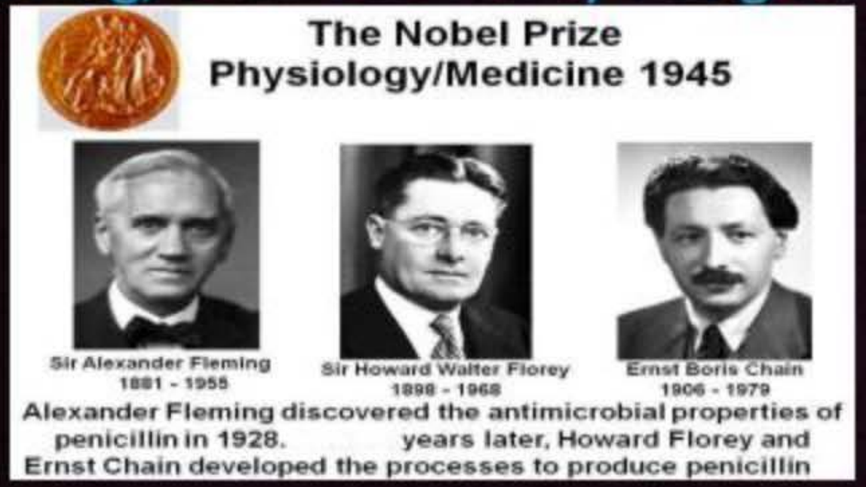
[On one of the unwanted plate the Bacteria could not grow.]

Due to chemical produced by _Penicillium_ (Fungi) & named it __Penicillin__

Potential of _Penicillin_ as Antibiotic → was explored by Chain & Florey

Microbes in Industrial Products

2. Fleming, Chain and Florey was given Noble Prize in 1945.



Streptomyces (Actinomyces)
Largest genes of Bacteria
from which most antibiotics
are obtained

examples
Erythromycin, streptomycin
chloramphenicol,

Chemicals (Organic Acids)

(1) Aspergillus niger (Fungi) → Citric acid, Gluconic acid → Fungi

(2) Acetobacter aceti (Bacteria) → Acetic acid → Bacteria

(3) Clostridium butylicum → Butyric acid → Bacteria

(4) Lactobacillus - Lactic acid → Bacteria

Enzymes

(1) **LIPASES** – used in detergents to remove oily strains

Obtained from **fungi**

- Candida
- Geoterichum

(2) **Proteases** & **Pectinases** → Fungi

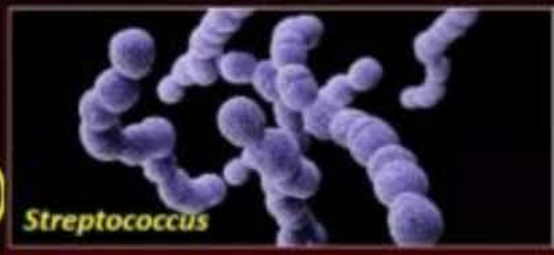
Used to clarify fruit juices

- Proteases
  - ✓ Aspergillus
  - ✓ Bacillus
- Pectinases
  - Aspergillus ✓

(3) **STREPTOKINASE**

CLOT BUSTER

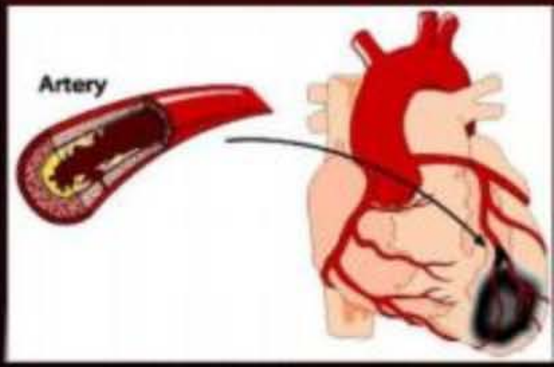
(Removes blood clots)



Obtained form

Streptococcus

(Bacterium)



Imp

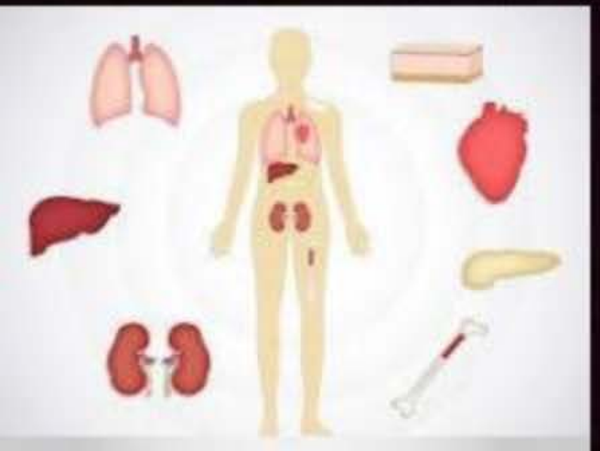
CYCLOSPORIN A

↓

Immunosuppressive agent in organ transplants

↓ from

Trichoderma (Fungi)



Imp

STATINS

↓

"Lowers blood cholesterol levels"

* Functions by competitively inhibiting the enzymes responsible for cholesterol synthesis.

* Obtained from

Monascus purpureus

Type (Yeast → Unicellular Fungi)

Monascus purpureus growing on white rice

Microbes in Sewage Treatment

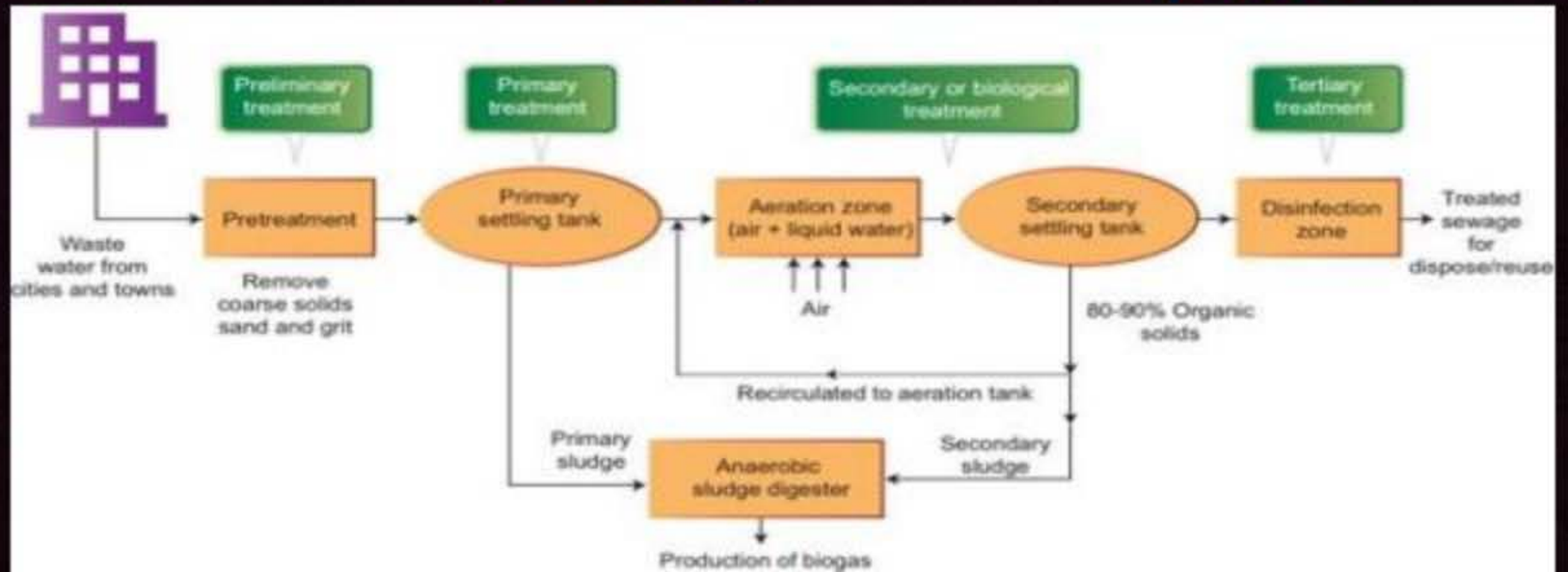
Sewage
Dirty water
Physical impurities
Organic impurities

Sewage treatment plant

Primary treatment → Physical process

Secondary treatment → Biological treatment (Microbes)

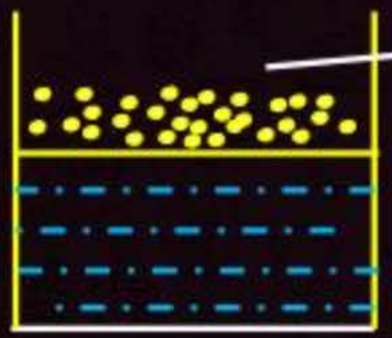
Tertiary treatment → Physical Chemical process



Microbes in Sewage Treatment

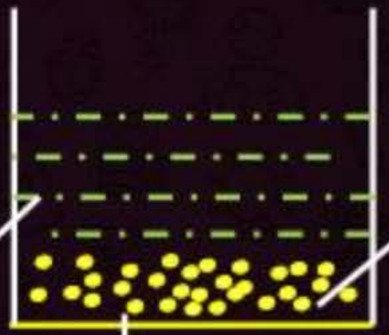
Primary Treatment

Sequential Filtration



Floating debris is removed

Sedimentation



Small pebbles removed by sedimentation

All solids that settles down called as "Primary sludge" ✓

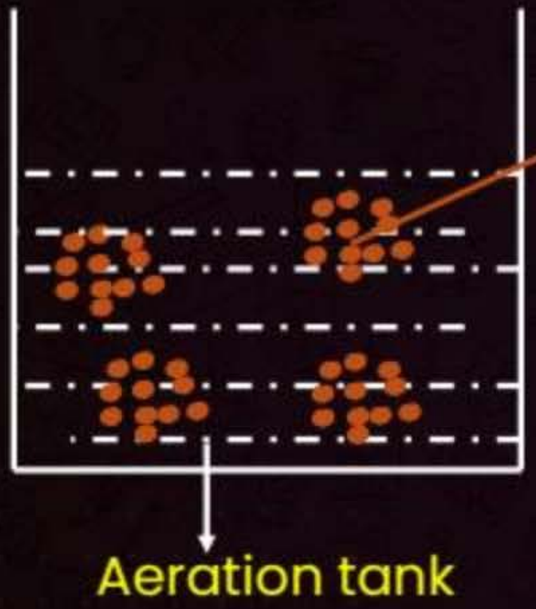
[Primary effluent]

Taken for secondary treatment

water obtained after primary treatment

Secondary / Biological Treatment

Primary effluent is passed to large "Aeration Tanks"



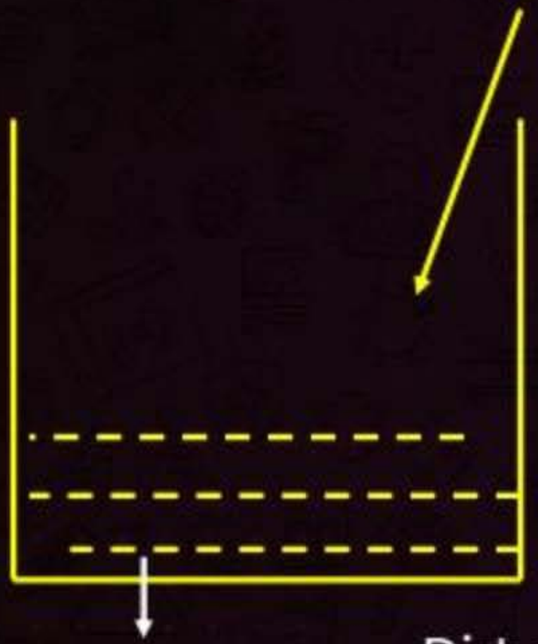
"FLOCS" Large mass of Aerobic Bacteria (heterotrophic) → Decomposers
+
Fungal filaments

Which consumes organic impurities & reduces the BOD of H_2O

Secondary / Biological Treatment

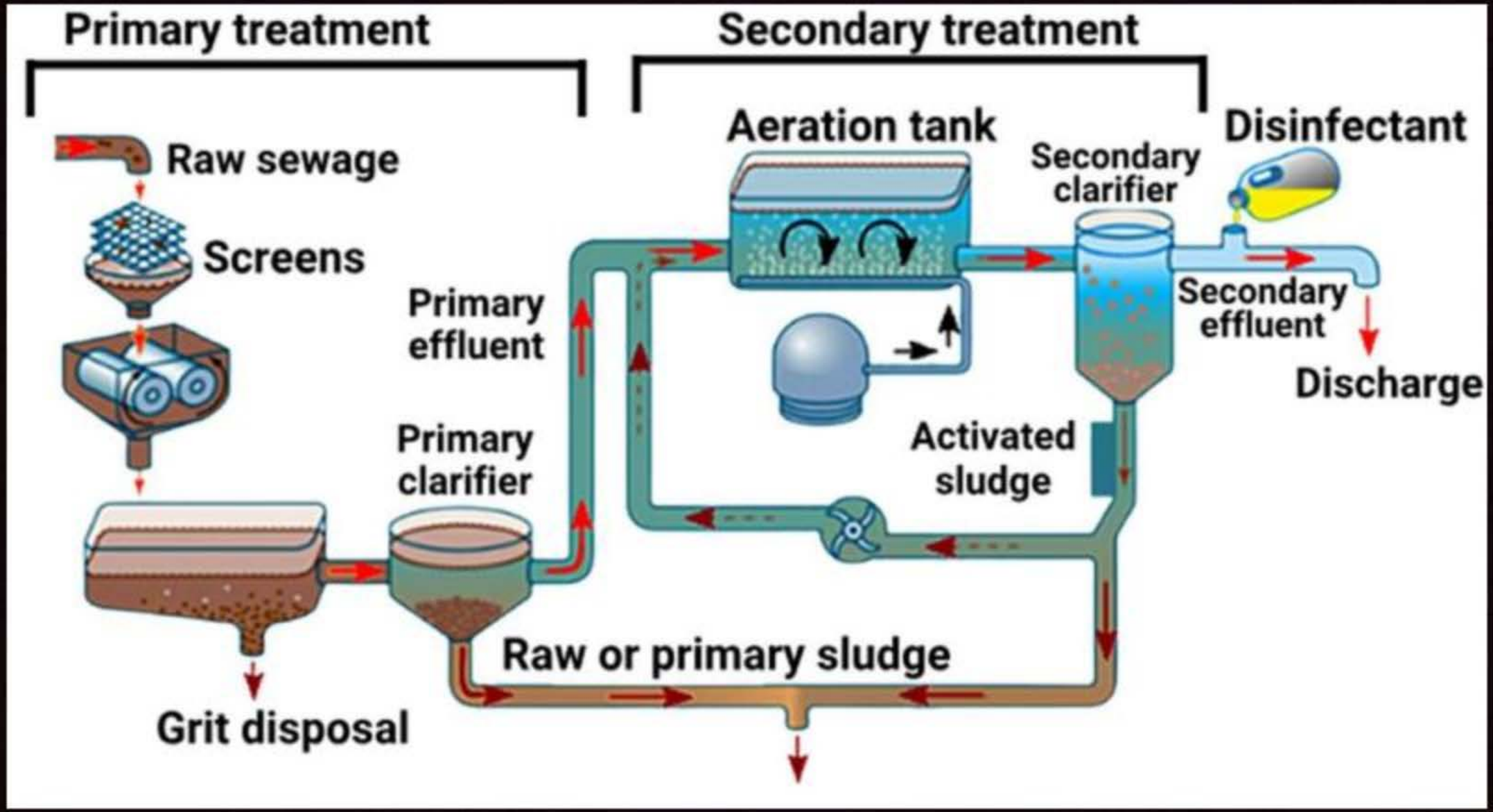
BOD Biological oxygen demand / Biochemical oxygen demand

Amount of O_2 required to degrade / remove organic impurities from 1 ltr. water by aerobic bacteria



$$BOD \propto \frac{1}{\text{Purity of } H_2O}$$

Dirty water has more BOD
Clean water has less BOD


Primary treatment
Secondary treatment
Raw sewage
Screens
Primary clarifier
Primary effluent
Aeration tank
Secondary clarifier
Disinfectant
Secondary effluent
Discharge
Activated sludge
Raw or primary sludge
Grit disposal

Aeration Tank

"Settling Tank"

Secondary Effluent
(water obtained after 2° treatment)

Is released into "Rivers"

If has to use for Humans
↓
Then sent for Tertiary treatment

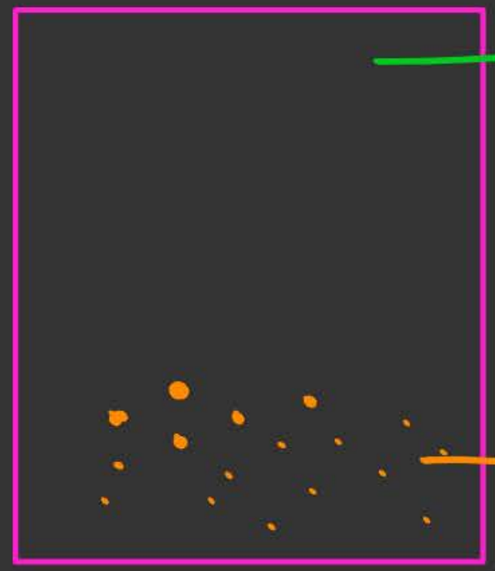
Physical process
→ Reverse Osmosis (R.O)
→ U.V rays

Chemicals
→ Chlorine
→ Ozone (O_3)

A part of Activated sludge is transported again to Aeration Tank to be used as "Inoculum"

Activated Sludge
(Aerobic Bacteria + Fungi)

Rest of the Activated sludge is transported to another tank → Anaerobic Sludge Digester



Anaerobic Bacteria → Methanogen (Archaebacteria)

"Digests" Aerobic Bacteria + Fungi

Produces

CH4 gas (Methane gas)

Used for Biogas production

Activated sludge

Anaerobic Sludge Digester


Plans
Ganga Action Plan
Yamuna Action Plan

MICROBES IN PRODUCTION OF BIOGAS

Biogas / Gobar gas

Mixture of gases

- CH_4 (Methane) → (60-70%)
- CO_2 → 30-40%
- Traces < H_2, H_2S, etc.

Bacteria

"Methanogen"

(Methanobacterium, Methanococcus)

* "Obligate Anaerobe"
* Found in Gut (Rumen) of cattles in Symbiotic association
* Helps in Cellulose digestion.

Biogas was popularised by

- IARI (Indian Agricultural Research Institute)
- KVIC (Khadi Village Industries Commission)

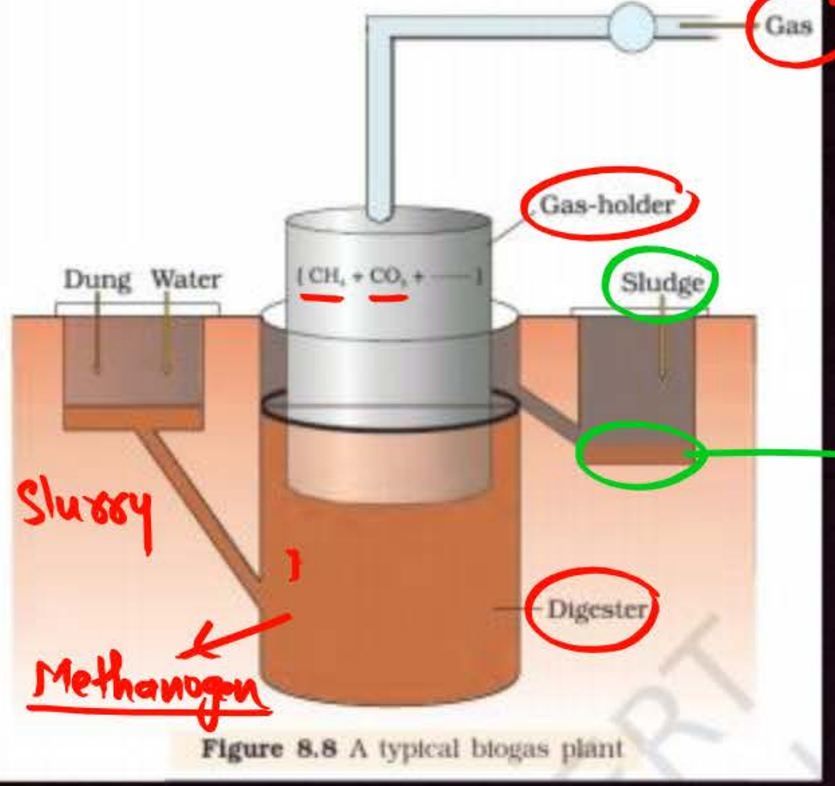


Figure 8.8 A typical biogas plant

→ Biogas

Used as Manures

MICROBES AS BIOCONTROL AGENTS

"IPM"
(Integrated Pest Management)

In Organic Farming

* ~~Insecticides~~, Pesticides (No use)
* Use of Biocontrol Agents in "Sustainable manner"

"Bioinsecticides" → when Natural predators (living organisms) are used to control the population of "PESTS" (Harmful insects).

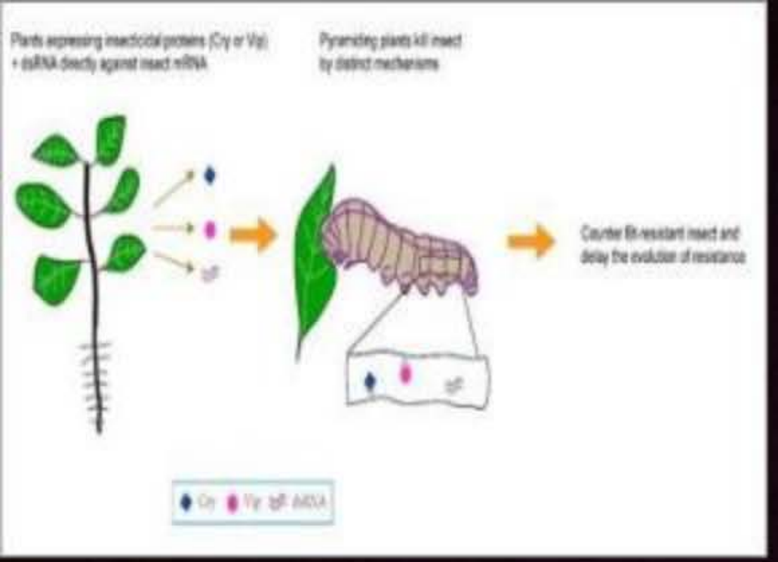
Biocontrol Agent

Pest (Insects) / Pathogen → Bacteria, Virus, Fungi

1. Lady Bird (Beetle) (Insect) (Bioinsecticide) — APHIDS (Pest)
2. Dragonflies (Insect) — Mosquitoes
3. Bacillus thuringiensis (Bioinsecticide) (Bacteria)
   * Butterfly (moths)
   * Bollworms
4. Baculovirus (Bioinsecticide) — Targeted insects (Pests)
5. Trichoderma (Fungi) — Controls "plant pathogens"

↳ "ladybird" (Beetle)

Dragonfly



Bacillus thuringiensis → 'CRY' gene

↓

Spores are available in packets

↓

Cry protein (Toxic)

↓

Kills Butterfly
Bollworms

↓

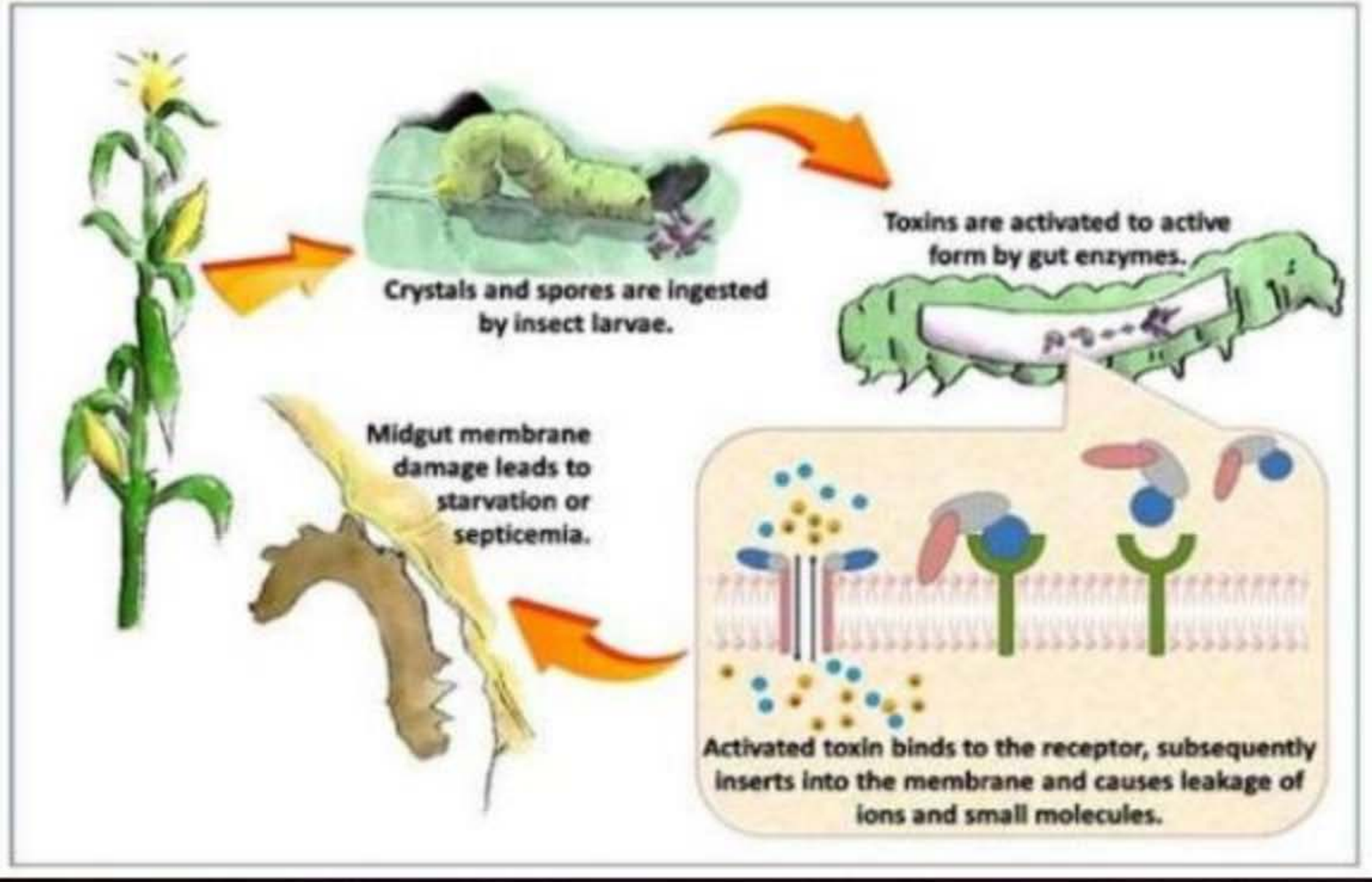
Spores (water solution)

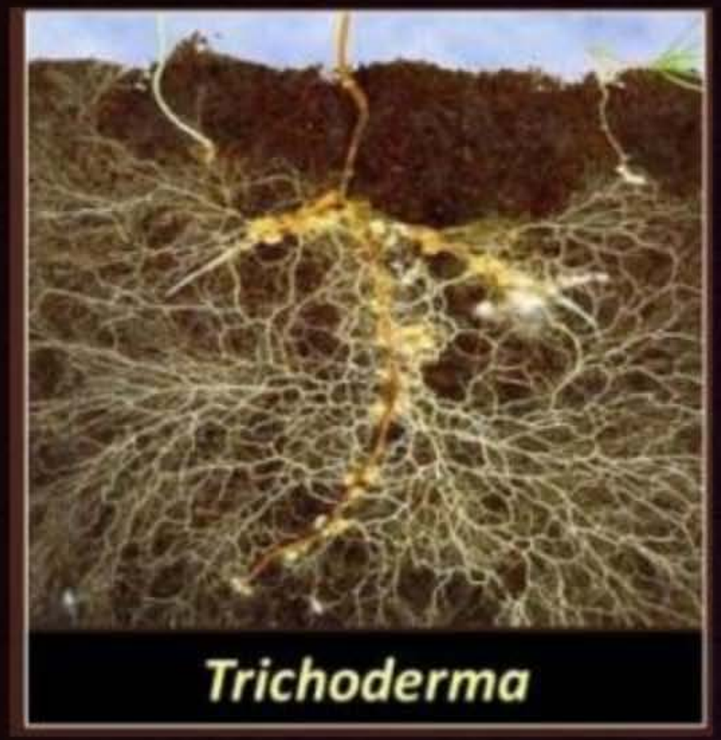
↓

Sprayed on plant

* R. DNA → Bt. crops

"Bt. cotton"


Crystals and spores are ingested by insect larvae.
Toxins are activated to active form by gut enzymes.
Midgut membrane damage leads to starvation or septicemia.
Activated toxin binds to the receptor, subsequently inserts into the membrane and causes leakage of ions and small molecules.


Trichoderma

Trichoderma (Fungi)

↓

Angel for plants

→ Found in Free-living conditions in "Root Ecosystem"

→ Controls several plant-pathogens

(Nucleoproteinaceous particles) Baculoviruses → Nucleopolyhedrovirus (NPV)
(Genus)

Bioinsecticide

* "Species - specific" → Cause harm only to Targeted insects

* Narrow-spectrum

* Do not cause harm to → Non-targeted Insects
  → Plants
  → Animals
  → Birds
  → Fishes

MICROBES AS BIOFERTILISERS

→ Natural organisms which increases soil fertility

- Bacteria
- BGA | cyanobacteria
- Fungi

Bacteria

Nitrogen-fixers → N_2 → NH_3 (Nitrogenase)

Free-living N_2-fixers

- → Azospirullum
- → Azotobacter
- → Clostridium
- → BeijerincKia

Symbiotic N_2-fixers

Can fix N_2 only in symbiotic associat^{n}

Rhizobium

Found with Roots of leguminous plants

(Inside Root Nodules) →
- → Pea
- → Soyabean

FranKia

with Roots of Plants

Alnus, Casuarina

Nitrifying Bacteria

$NH_3 \longrightarrow NO_2^- \longrightarrow NO_3^-$

(Nitrite) (Nitrate)

- → Nitrococcus
- → Nitrosomonas
- → Nitrobacter
- → Nitrocystis

Root Nodules

legumirous plant

Cyanobacteria / Blue Green Algae

- Nostoc
- Anabena
- Oscillatoria
- Aulosira

N_2 - fixers ($N_2 \rightarrow NH_3$)

Nostoc & Anabena

Both are "Free-living" as well as Symbiotic N_2-fixers

"Aulosira" ??

→ "Free-living" N_2-fixer

→ Mostly found in Rice / Paddy fields

Anabena (In symbiotic association)

- Azolla (Pteridophyte) (Aquatic fern) → Used as Biofertilizer
- Cycas (Gymnosperm)

Fungi → Mycorrhiza (symbiotic associatn)

(Fungi + Roots of Higher plants)

Increases surface area

→ Efficient absorption of H_2O, P, K, N

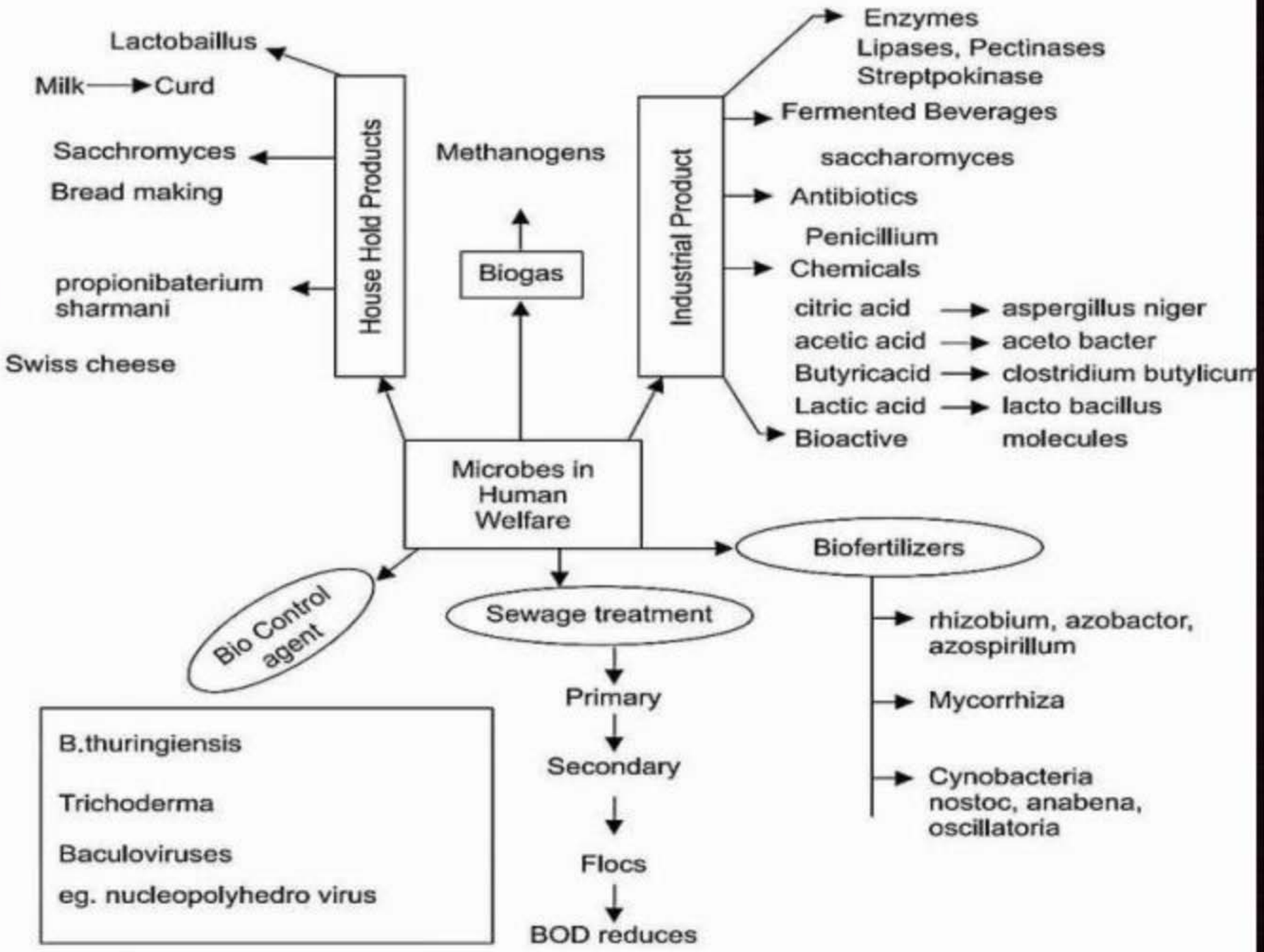
∴ GLOMUS

(Fungi)

Forms most of the mycorrhizal associations.

Ex → Orchids (Angio)

→ Pinus (Gymno)


Lactobaillus
Milk → Curd
Sacchromyces
Bread making
propionibaterium sharmani
Swiss cheese
House Hold Products
Methanogens
Biogas
Industrial Product
Enzymes
Lipases, Pectinases
Streptpokinase
Fermented Beverages
saccharomyces
Antibiotics
Penicillium
Chemicals
citric acid → aspergillus niger
acetic acid → aceto bacter
Butyricacid → clostridium butylicum
Lactic acid → lacto bacillus
Bioactive molecules
Microbes in Human Welfare
Biofertilizers
rhizobium, azobactor, azospirillum
Mycorrhiza
Cynobacteria nostoc, anabena, oscillatoria
Bio Control agent
B.thuringiensis
Trichoderma
Baculoviruses
eg. nucleopolyhedro virus
Sewage treatment
Primary
Secondary
Flocs
BOD reduces

QUESTION

Technology of biogas production was developed in India mainly due to the efforts of

1. IARI
2. KVIC
3. Both (1) & (2)
4. ICAR

QUESTION

Mark the odd one (w.r.t. NPV)

1. Narrow spectrum herbicide ✗ bioinsecticide
2. Species specific ✓
3. Bioinsecticide ✓
4. Nucleoprotein particles ✓

QUESTION

Ladybird beetle is useful in the control of

1. Bollworms
2. Aphids
3. Mosquitoes
4. Nematodes

QUESTION

Which of the following microbe is most active nitrogen fixer in rice field in India?

1. *Rhizobium*
2. *Rhodospirillum*
3. *Frankia*
4. *Aulosira*

QUESTION

Which of the following microbe is used for ripening of Swiss cheese?

1. *Penicillium roquefortii*
2. *P. camembertii*
3. *Propionibacterium sharmanii*
4. *Streptomyces griseus*

QUESTION

Match the following (column-I with column-II)

Column-I		Column-II	
a.	*Aspergillus niger*	(i)	Butyric acid
b.	*Clostridium butylicum*	(ii)	Citric acid
c.	*Acetobacter aceti*	(iii)	Lactic acid
d.	*Lactobacillus*	(iv)	Acetic acid

1. a-(i), b-(ii), c-(iii), d-(iv)
2. a-(ii), b-(i), c-(iv), d-(iii)
3. a-(ii), b-(iv), c-(iii), d-(i)
4. a-(iii), b-(i), c-(iv), d-(ii)

QUESTION

_____are used in detergent formulations and are helpful in removing oily stains from laundry.

1. Ligases
2. Proteases
3. Lipases
4. Pectinases

QUESTION

Select the microbe which is the source of 'clot buster' enzyme.

→ StreptoKinase

1. *Bacterium; Lactobacillus*
2. *Fungi; Aspergillus niger*
3. *Fungi; Penicillium notatum*
4. *Bacterium; Streptococcus*

QUESTION

An immunosuppressive agent used in organ- transplant patients is

1. Streptokinase
2. Statins
3. Cyclosporin-A
4. Lipases

QUESTION

The product of *Monascus purpureus* has been commercialised as

Statins

1. Immunosuppressive agent
2. Blood-cholesterol lowering agent
3. Clot buster
4. Bottled juices clarifying agents

QUESTION

Assertion: Baculovirus are species specific.
Reason: It is very common in root ecosystem and effective against several plant pathogens.

Trichoderma

(C)

1. Both Assertion & Reason are true and the Reason is a correct explanation of the Assertion.
2. Both Assertion & Reason are true but Reason is not a correct explanation of the Assertion.
3. Assertion is true but Reason is false.
4. Assertion is false but the Reason is true.


THANK YOU