



Microbes

→ Bacteria

→ Fungi

→ Viruses



Microbes in Household Products

lactic acid Fermentation

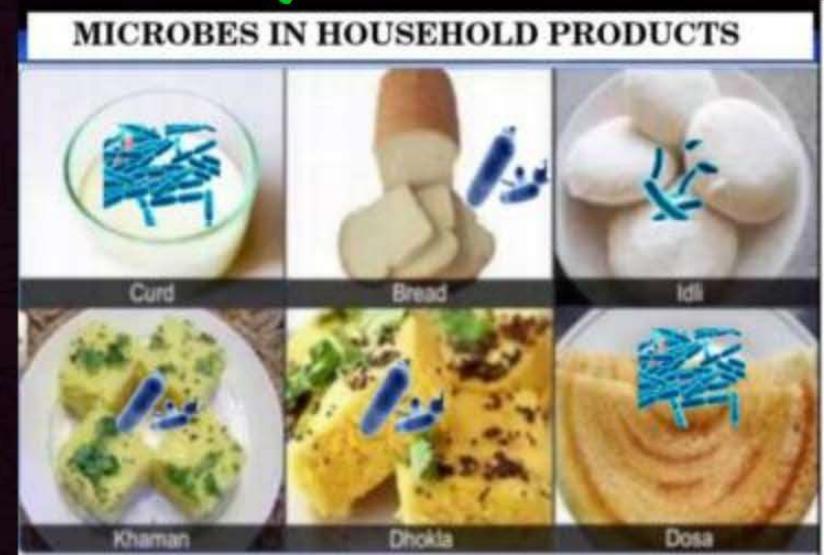
1. Curd → Lactobacillus → Coagulates casein protein present in milk

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

Bread → Baker's yeast → *Saccharomyces cerevisiae*
CO₂ gas gives the puffiness

Yeast → Unicellular Fungi



* Toddy drink → By fermenting sap of palm.

Yeast → Alcoholic fermentation → CO₂ & Ethanol



Microbes in Household Products

From fermentation of Soyabean

Tempeh

Tofu

Sufu



Pulping



Soybean milk

Pressing
into tofu
Coagulation



Tofu

*Actinomucor, Mucor,
Rhizopus or bacteria*

Cumin, allspice, cinnamon,
dried chillies etc.



Sufu

3 to 6 months



Salting

Adding salt



Pehtzes

3-4 days



Microbes in Industrial Products

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

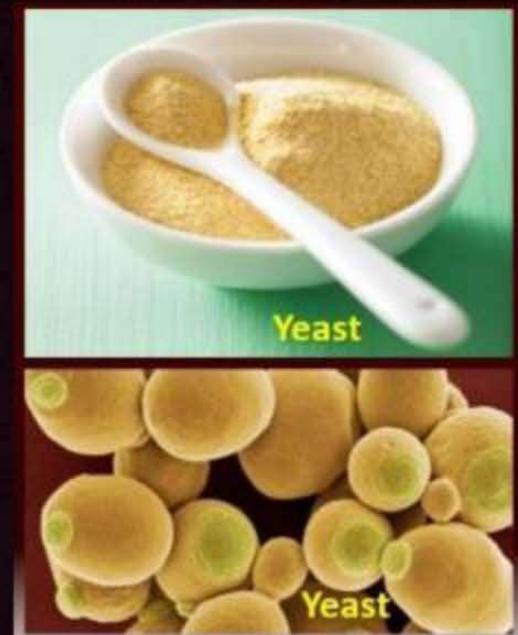
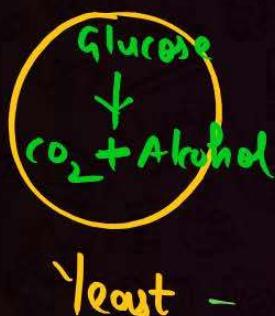
Alcoholic fermentation by yeast

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)





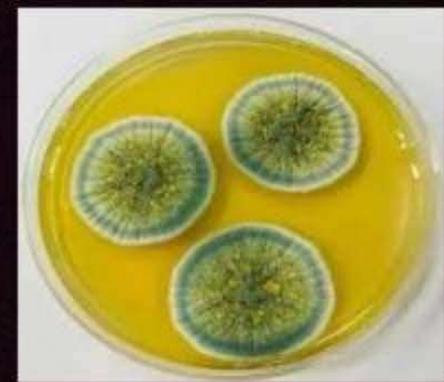
Microbes in Industrial Products

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

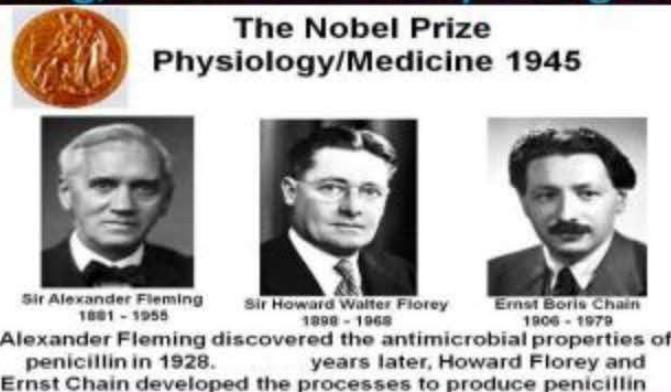
→ was explored by **Chain & Florey**





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

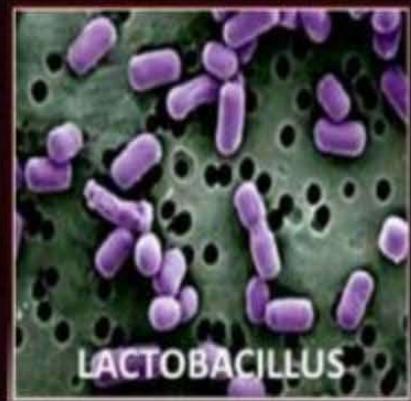
examples

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 stains

Obtained from fungi

Candida

Geotrichum



(2)

Proteases & Pectinases

Used to clarify fruit juices

Fungi



Proteases

Pectinases

✓ Aspergillus
✓ Bacillus

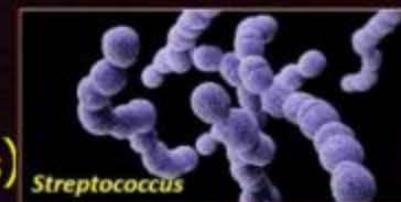
✓ Aspergillus

(3)

STREPTOKINASE

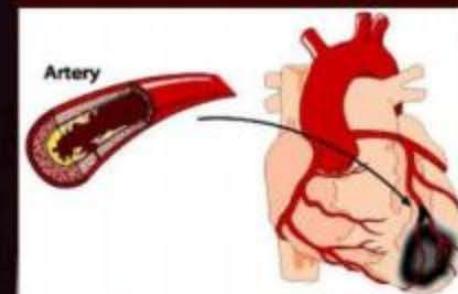
CLOT BUSTER

(Removes blood clots)



Obtained from

Streptococcus
(Bacterium)



Imb

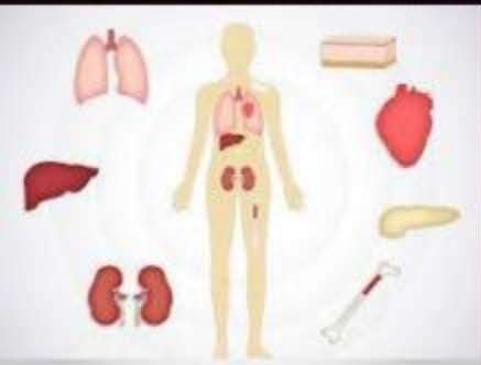
CYCLOSPORIN A



↓
Immunosuppressive agent
in organ transplants

↓ from

Trichoderma (Fungi)



Imb

STATINS



↓
“Lowers blood cholesterol levels”

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

* Obtained from
Monascus purpureus
(Yeast → Unicellular Fungi)



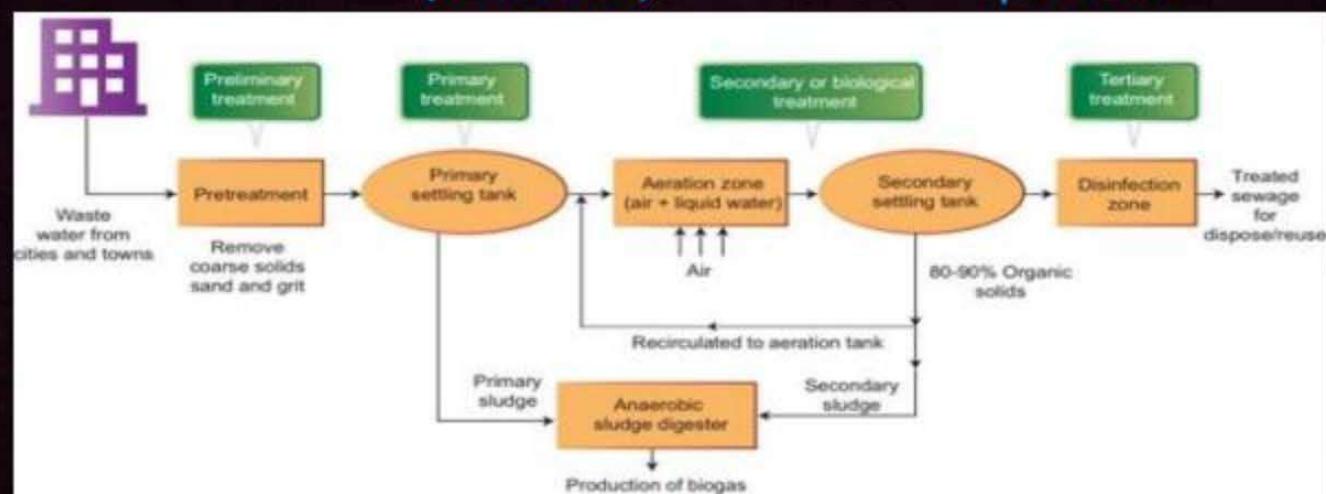
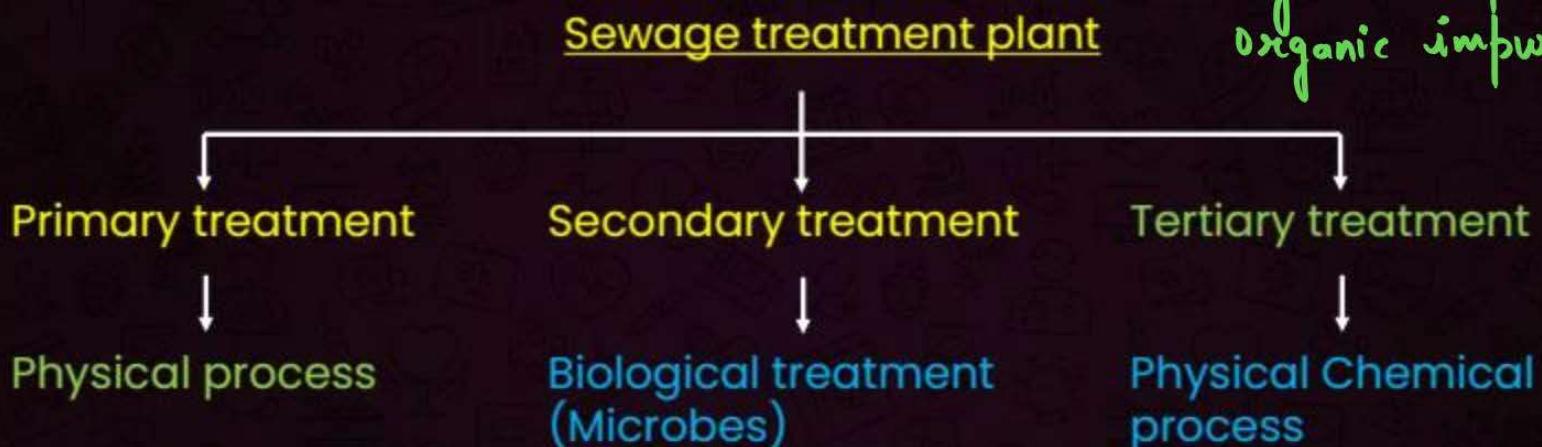
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Microbes in Sewage Treatment

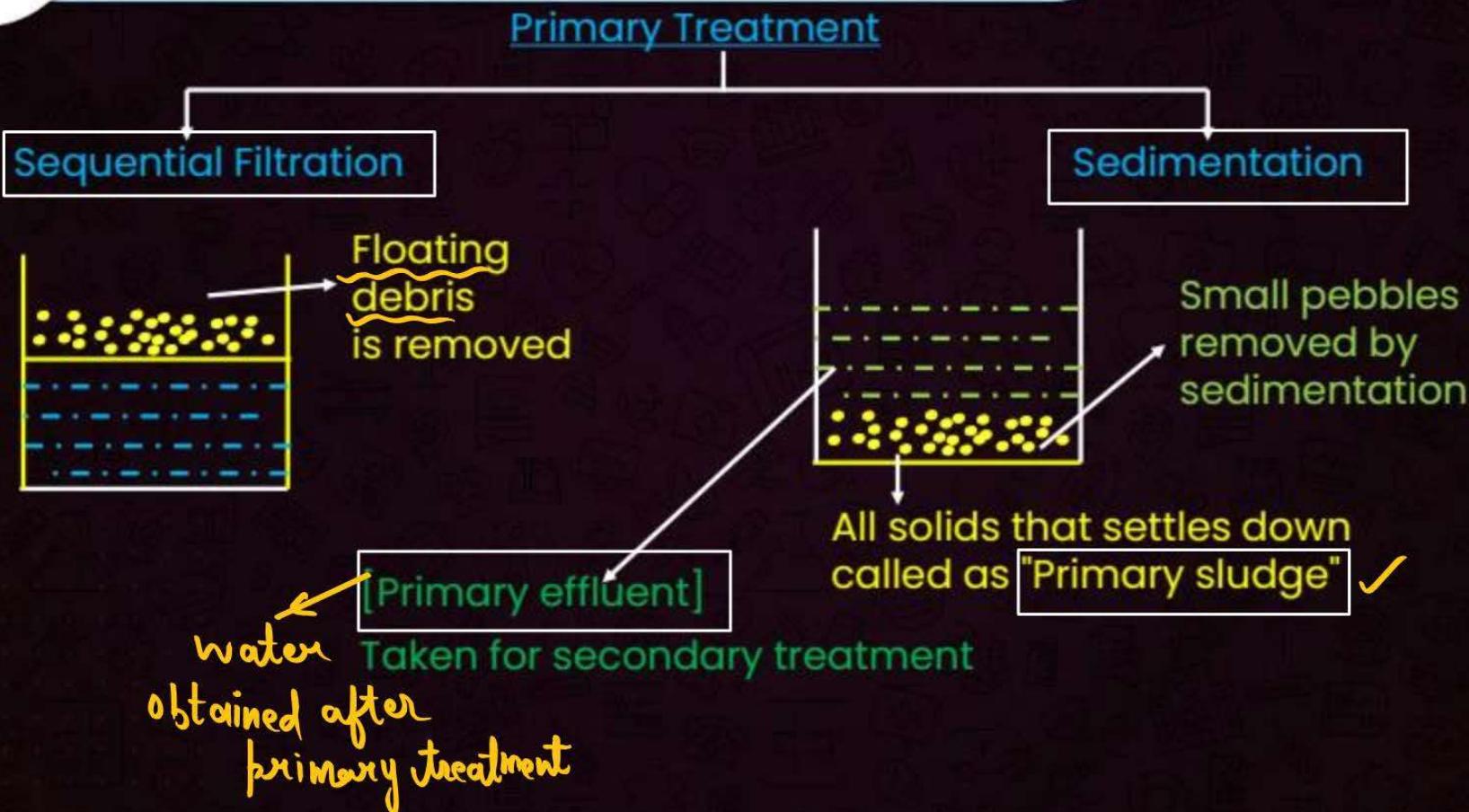


Sewage
Dirty water
Physical impurities
Organic impurities





Microbes in Sewage Treatment

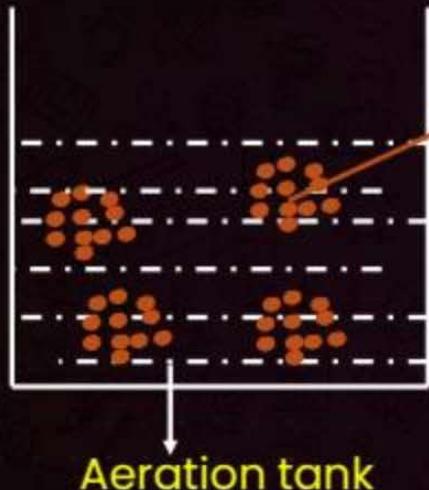




Secondary / Biological Treatment



Primary effluent is passed to large "Aeration Tanks"



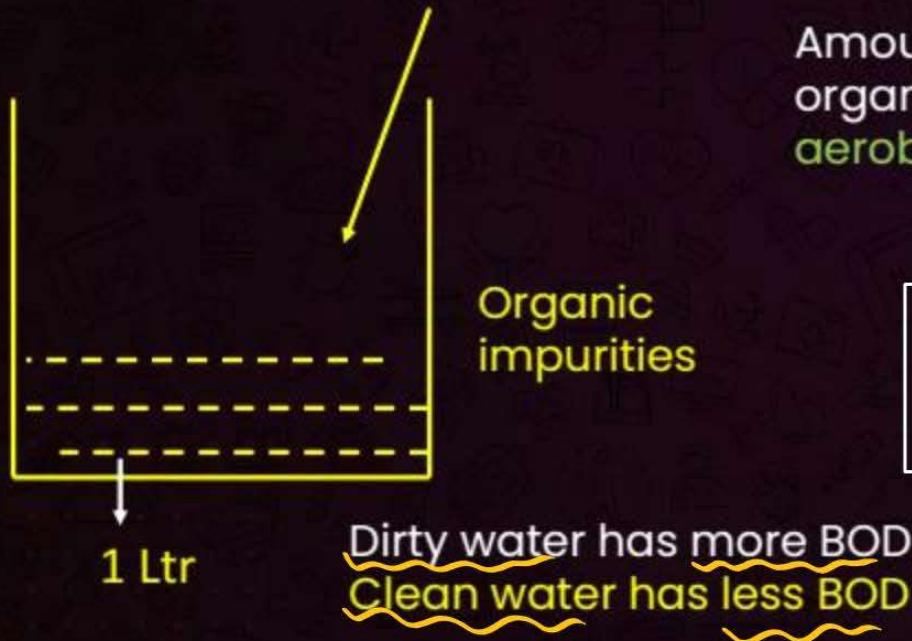
"FLOCS" Large mass of Aerobic
Bacteria (heterotrophic) +
Fungal filaments → *Detomphobes*

Which consumes organic impurities &
reduces the BOD of H₂O



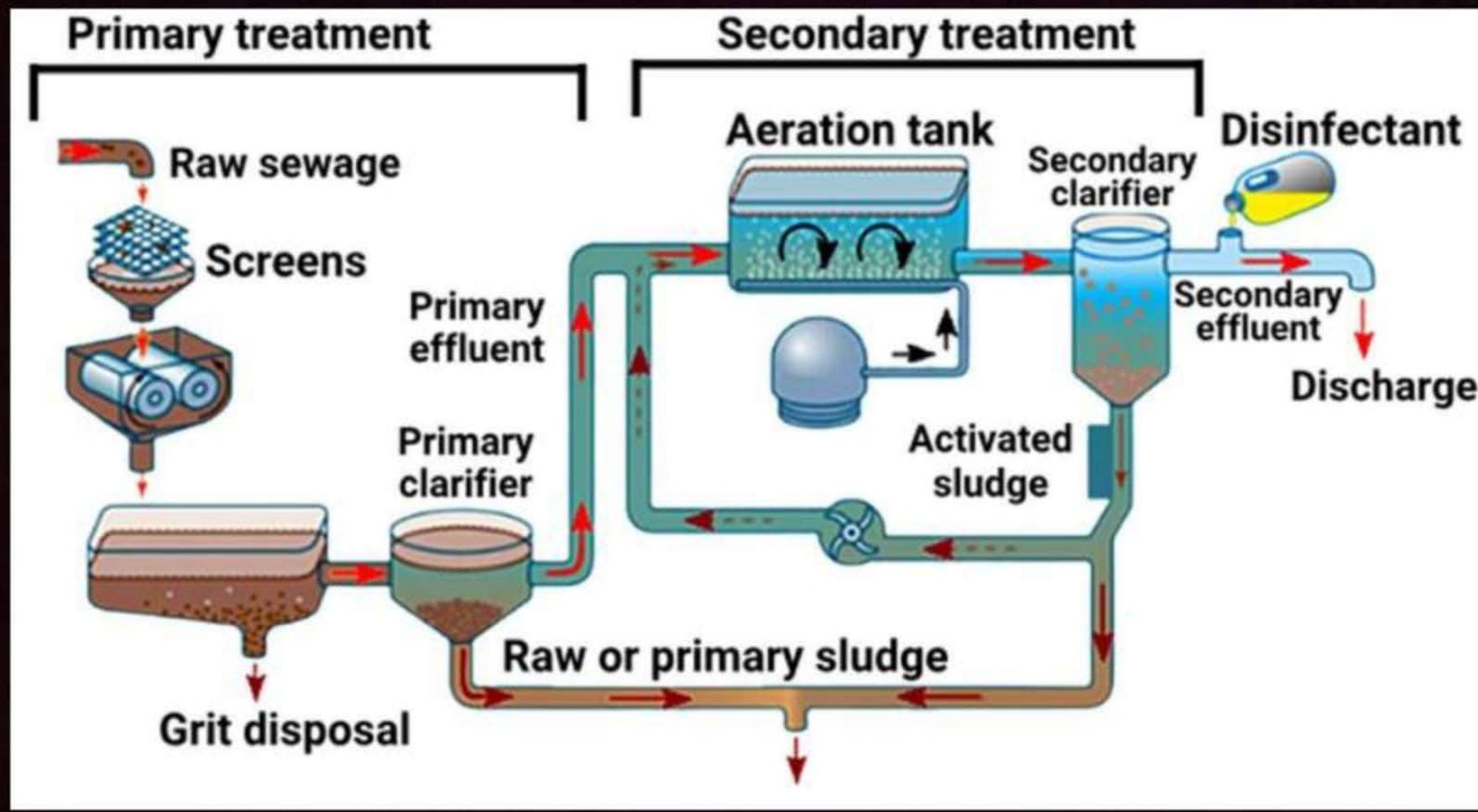
Secondary / Biological Treatment

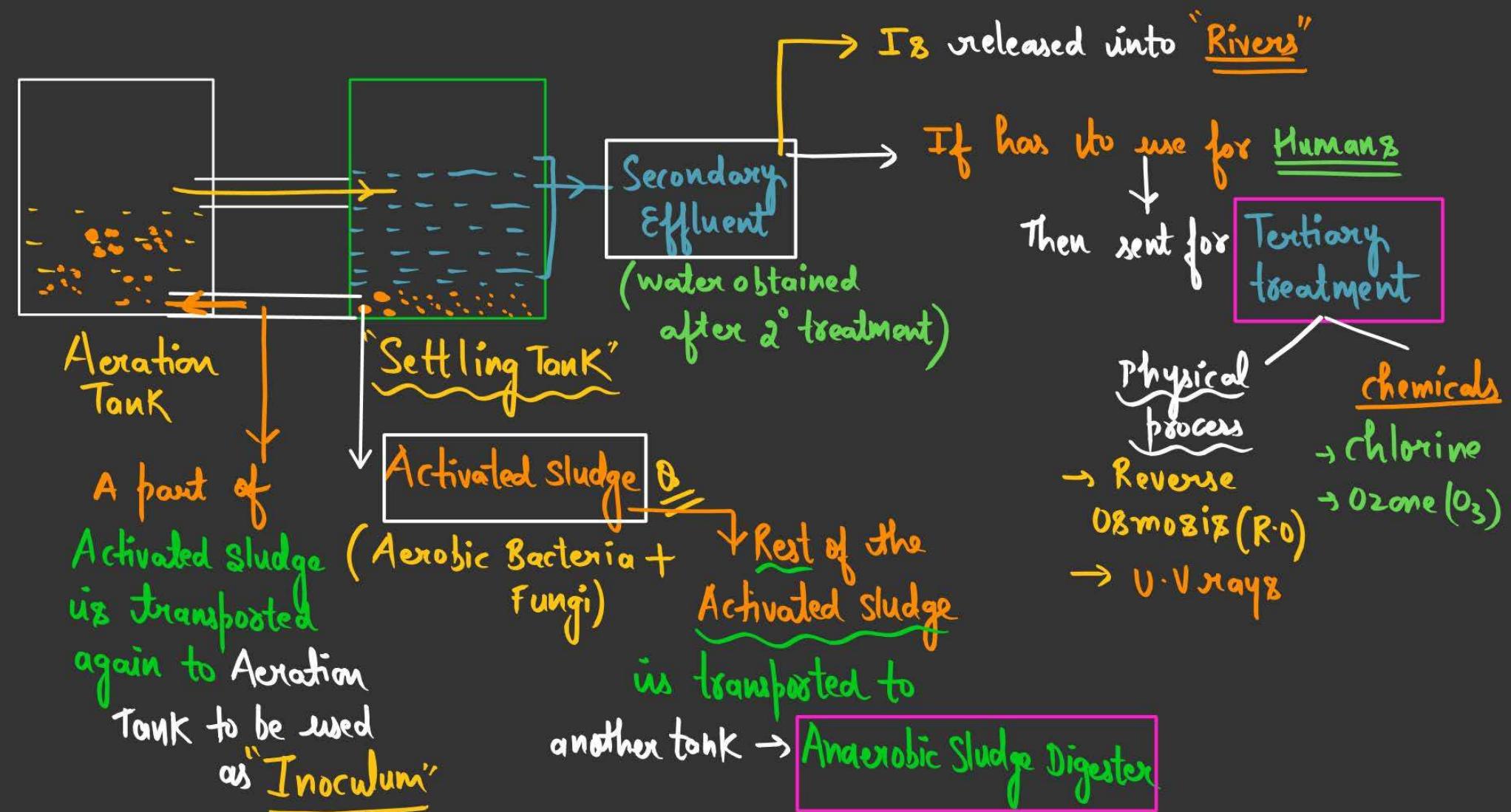
BOD Biological oxygen demand / Biochemical oxygen demand

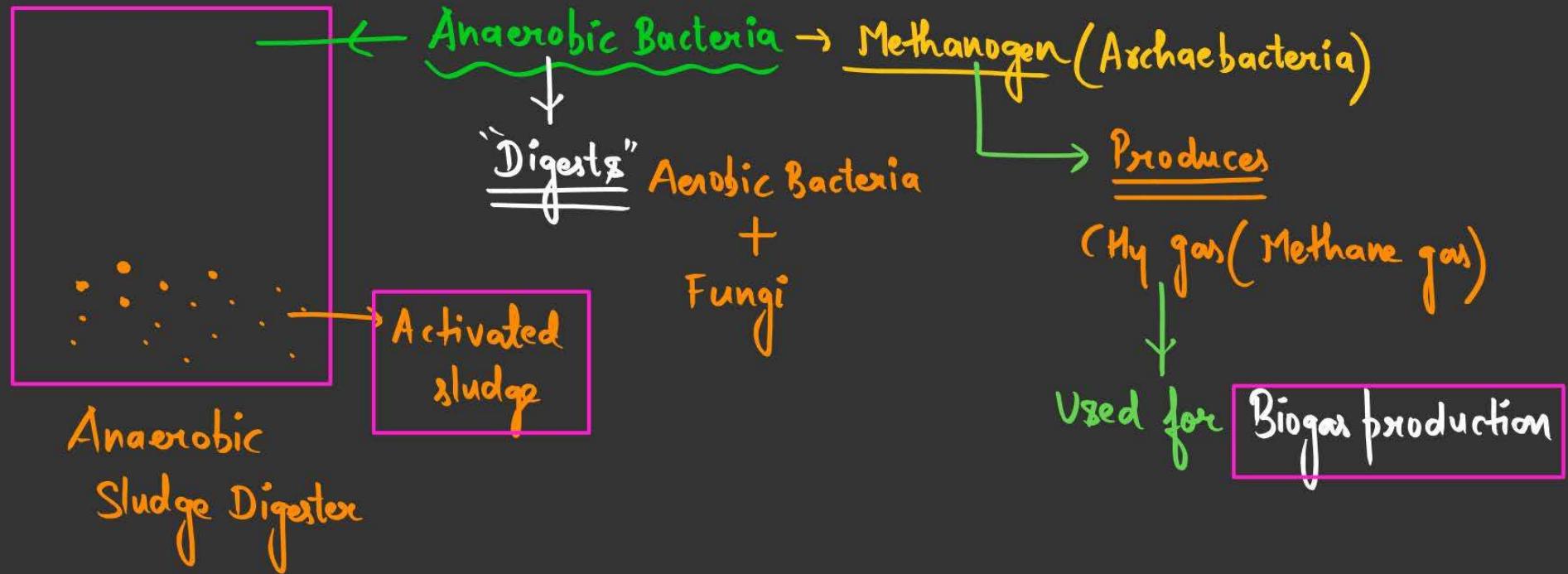


Amount of O₂ required to degrade / remove organic impurities from 1 ltr. water by aerobic bacteria

$$\text{BOD} \propto \perp \text{Purity of H}_2\text{O}$$







Plans

Ganga Action Plan

Yamuna Action Plan



MICROBES IN PRODUCTION OF BIOGAS



Biogas / Gobar gas
Mixture of gases

CH_4 (Methane) \rightarrow (60-70 %.)

CO_2 \rightarrow 30-40 %.

Traces < H_2
 H_2S
etc.

Bacteria
"Methanogen"
(*Methanobacterium*,
Methanococcus)
* "Obligate Anaerobe"
* Found in Gut (Rumen)
of cattle in
Symbiotic association
* Helps in cellulose digestion.

Biogas was
popularized by

↓
IARI
(Indian
Agricultural
Research
Institute)

↓
KVIC
(Khadi Village
Industries
Commission)

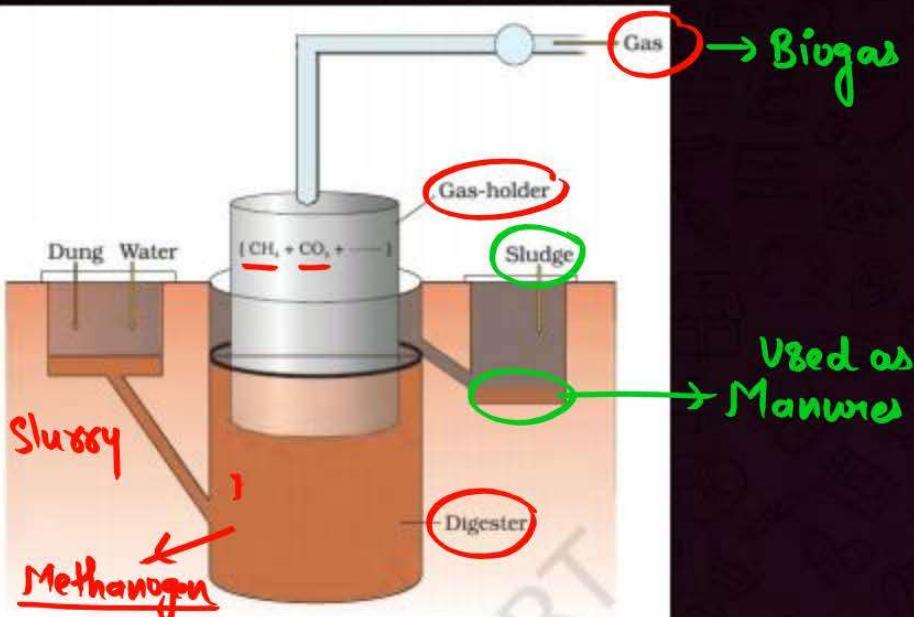


Figure 8.8 A typical biogas plant



MICROBES AS BIOCONTROL AGENTS



"IPM"
(Integrated Pest Management)

In Organic Farming

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

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

Biocontrol Agent

1. Lady Bird (Insect)
(Beetle)
(Bioinsecticide)
2. Dragonflies (Insect)
3. Barillus thuringiensis
(Bioinsecticide) (Bacteria)
4. Barulovirus (Bioinsecticide)
5. Trichoderma (Fungi)

Pest / Pathogen
(Insects)

APHIDS (Pest)

Bacteria
Virus
Fungi



Mosquitoes

* Butterfly (moths)
* Bollworms

Tangled insects (Pests)

Controls "plant pathogens".

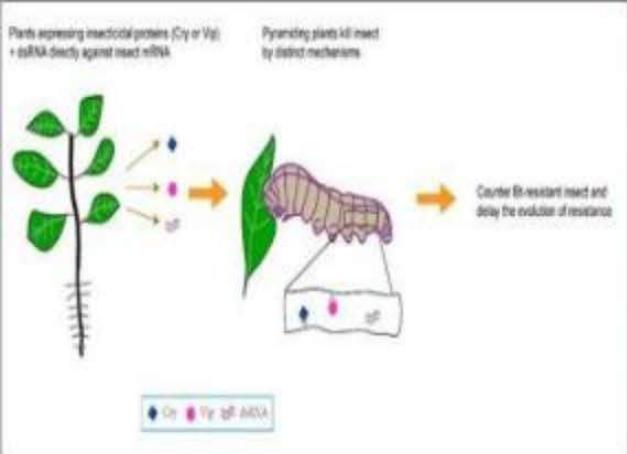


↳ "ladybird" (Beetle)



Dragonfly



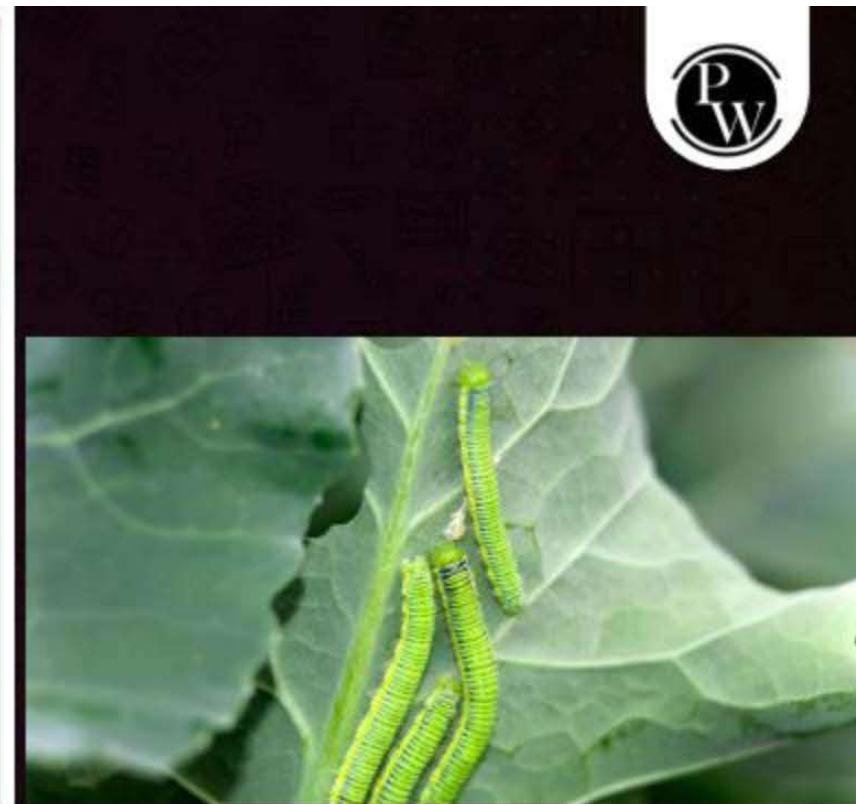
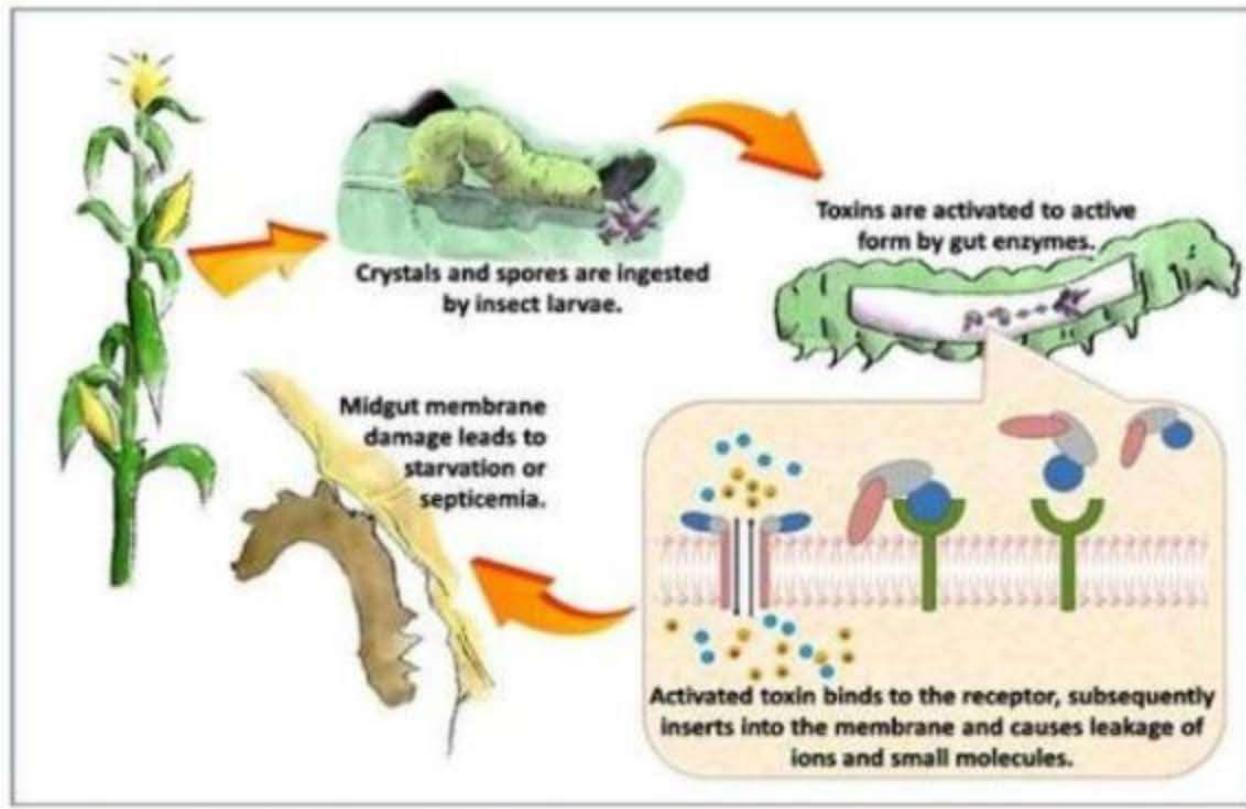


Bacillus thuringiensis → CRY gene
Spores ↓ ↓
Spores are available in packets
(water solution) ↓
Sprayed on plant

Kills Butterfly
Bollworms

* R. DNA → Bt. crops
Bt. cotton







Trichoderma

Trichoderma (Fungi)

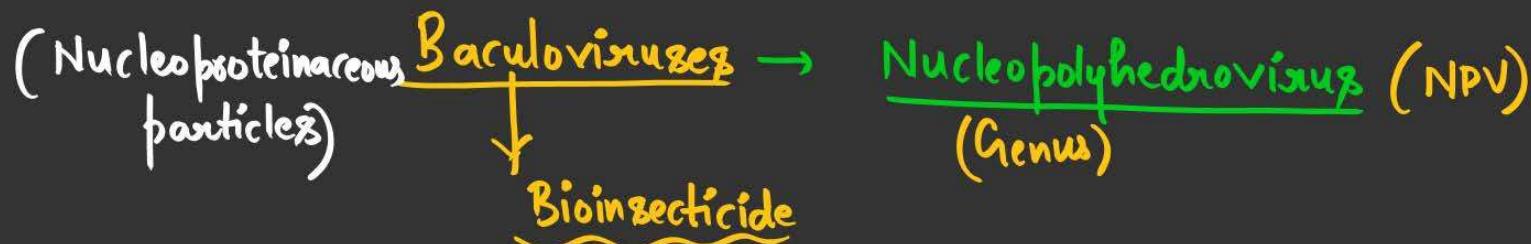
Angel foot plantz

→ Found in Free-living conditions

in "Root Ecosystem"

→ Controls several plant-pathogens





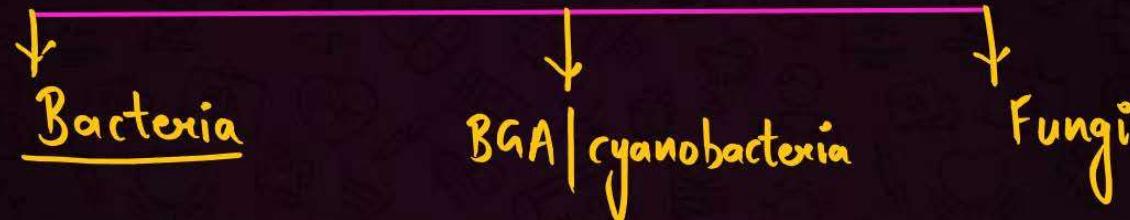
- * "Species-specific" → Cause harm only to
Targeted insects
- * Narrow-spectrum
- * Do not cause harm to → Non-targeted Insects
 - Plants
 - Animals
 - Birds
 - Fishes

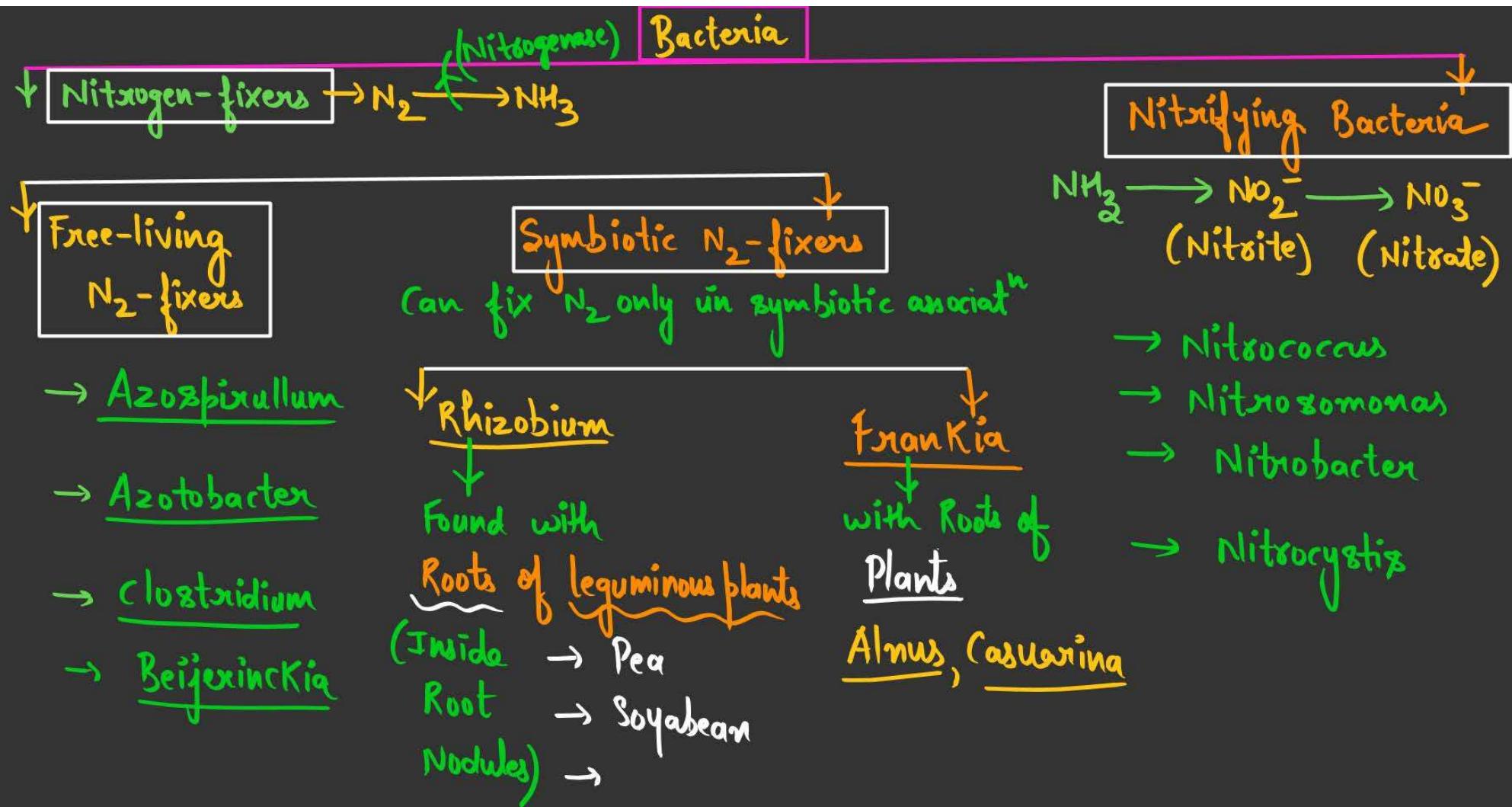


MICROBES AS BIOFERTILISERS



Natural organisms which
increases soil fertility







leguminous plant

Root
Nodules



- Nostoc
- Anabena
- Oscillatoria
- Aulosina

Cyanobacteria/ Blue Green Algae

N₂-fixers
 $(N_2 \rightarrow NH_3)$

Nostoc & Anabena

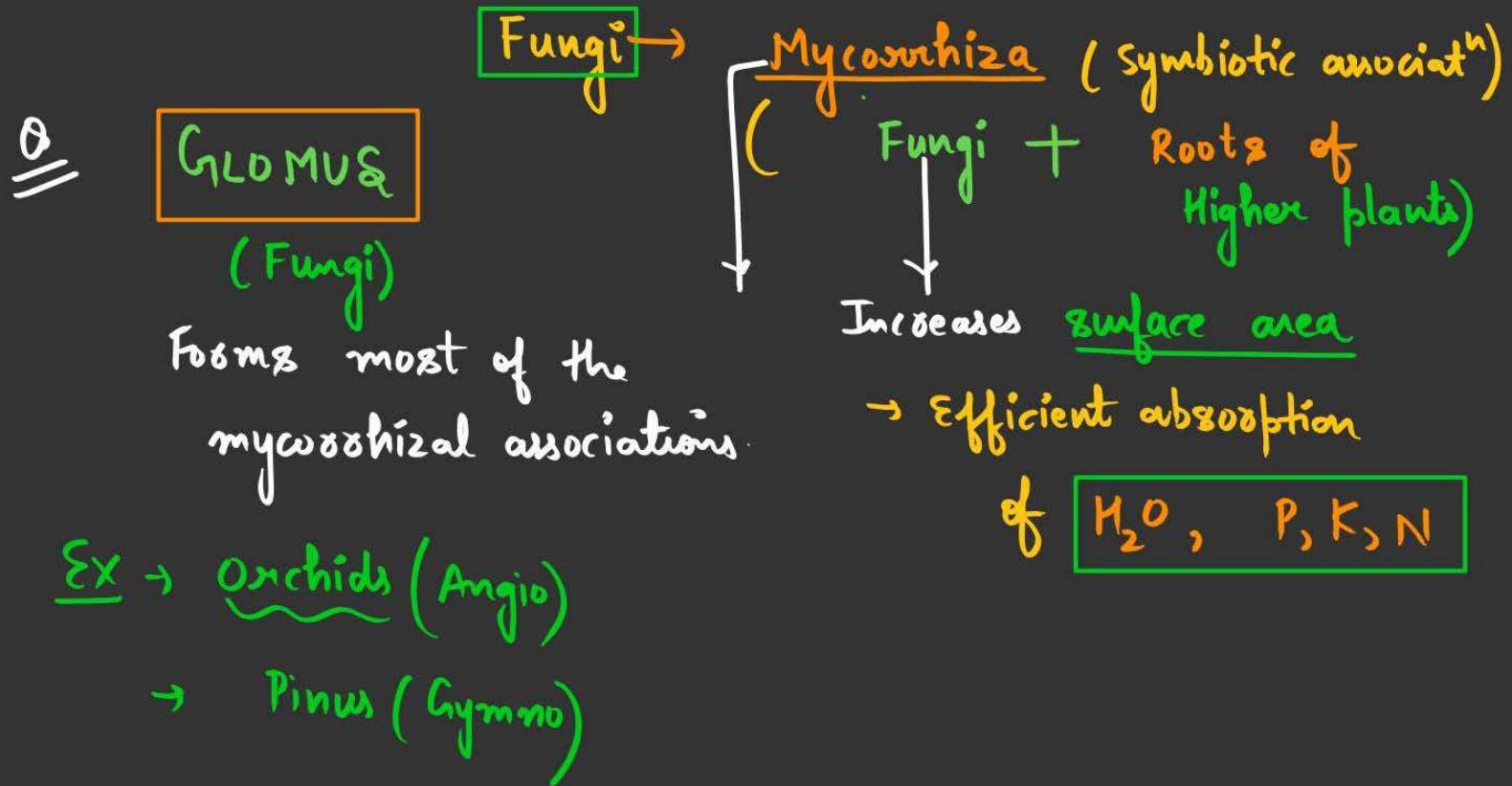
Both are "Free-living" as well as
Symbiotic N₂-fixers.

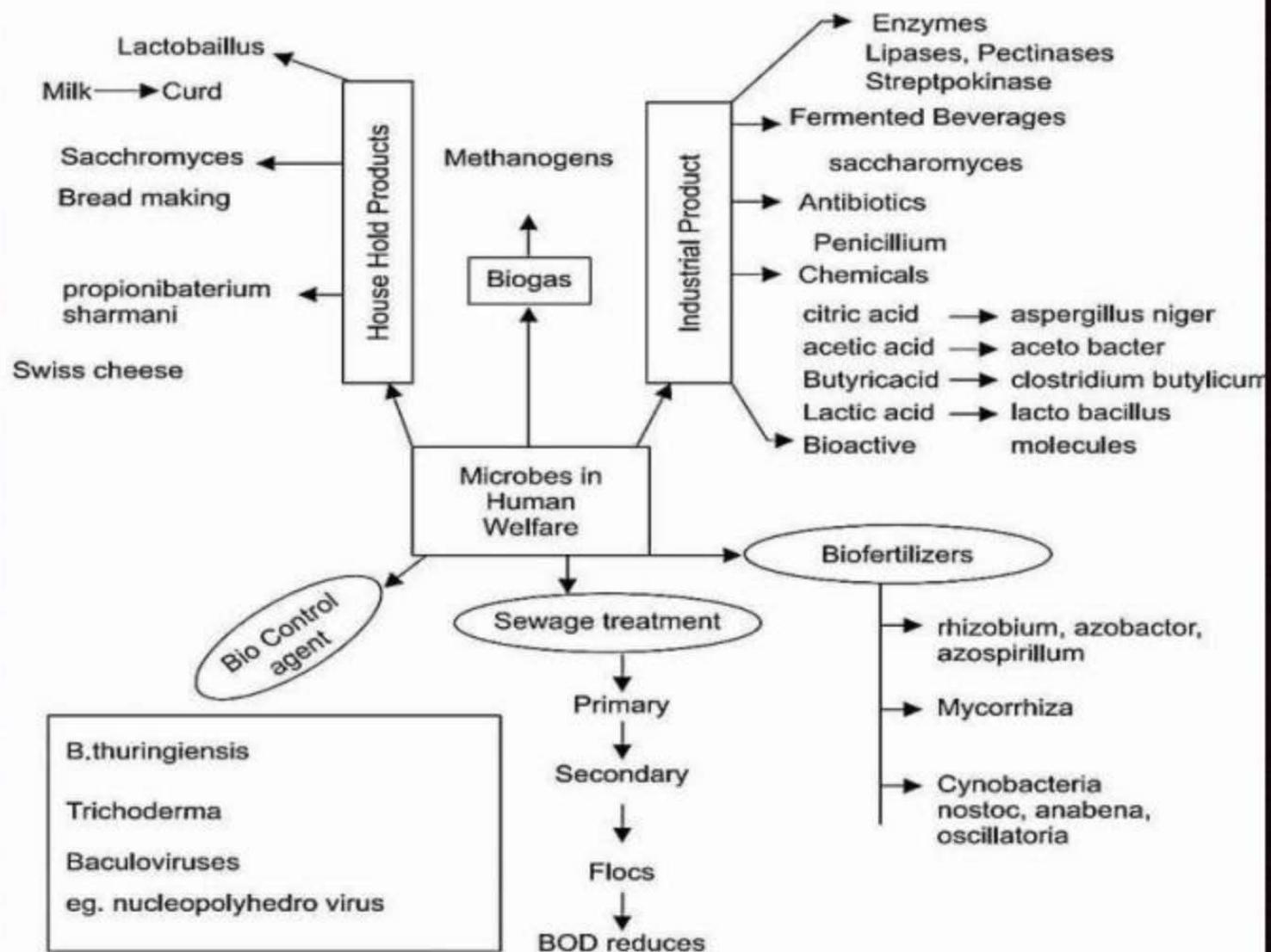
"Aulosina" PYB
 ↓
 → "Free-living" N₂-fixer
 → Mostly found in
 Rice | Paddy fields

Anabena
 (In symbiotic association)

Azolla (Pteridophyte)
 (Aquatic fern)
 Used as Biofertilizer

Cycas (Gymnosperm)





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)

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)

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

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.

(C)

Trichoderma

- 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.