FREE NOTES · NCERT + NEET LEVEL

Microbes in Human Welfare

Microbes in household products, industrial products (fermented beverages, antibiotics, chemicals, enzymes, bioactive molecules), sewage treatment, biogas production, biocontrol agents and biofertilisers.

01 Microbes in household products
02 Industrial products
03 Sewage treatment
04 Biogas
05 Biocontrol agents
06 Biofertilisers
07 Extra + tricks
08 Important Q&A
09 Common mistakes
10 Practice (NEET style)
11 Quick revision

01 Microbes in household products

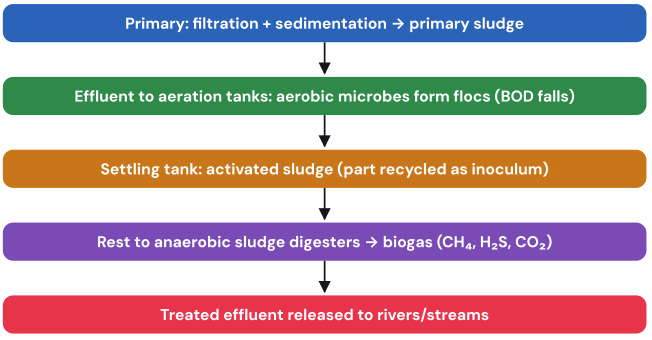
- **Lactobacillus** / lactic acid bacteria (LAB): milk → curd; increase vitamin B_{12}; check disease-causing microbes in stomach.
- Dough for **dosa, idli**: bacterial fermentation (puffed by CO_2). **Bread**: baker's yeast *Saccharomyces cerevisiae*.
- **Toddy**: fermented sap of palms (South India).
- **Swiss cheese**: large holes from CO_2 by *Propionibacterium sharmanii*. **Roquefort cheese**: ripened by specific fungi.

02 Industrial products

Product	Microbe
Wine, beer, whisky, brandy, rum (fermented beverages; brewer's yeast)	*Saccharomyces cerevisiae*; wine and beer without distillation, whisky, brandy, rum by distillation
Penicillin (first antibiotic; Alexander Fleming, from *Staphylococcus* culture; Chain and Florey established use)	*Penicillium notatum*
Citric acid	*Aspergillus niger* (fungus)
Acetic acid	*Acetobacter aceti* (bacterium)
Butyric acid	*Clostridium butylicum* (bacterium)
Lactic acid	*Lactobacillus*
Ethanol	*Saccharomyces cerevisiae*
Lipases (detergents, oily stains)	Microbial
Pectinases, proteases (clear fruit juices)	Microbial
Streptokinase (clot buster)	*Streptococcus*; modified by genetic engineering
Cyclosporin A (immunosuppressant in organ transplant)	*Trichoderma polysporum* (fungus)
Statins (lower cholesterol; inhibit enzyme of cholesterol synthesis)	*Monascus purpureus* (yeast)

03 Sewage treatment

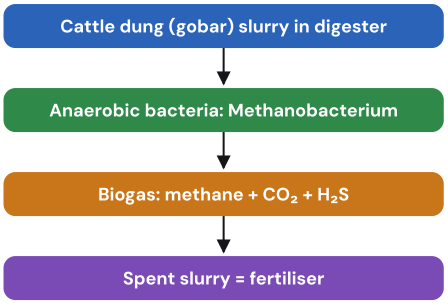
- Sewage = municipal waste-water with organic matter and microbes; treated in **STPs** (sewage treatment plants).
- **BOD** (biochemical oxygen demand): amount of O_2 consumed if all organic matter in 1 litre water were oxidised by bacteria; higher BOD = more polluting.
- Ministry of Environment and Forests: **Ganga Action Plan** and **Yamuna Action Plan** to save rivers.



Stages of sewage treatment

04 Biogas

- Biogas mainly **methane**, produced by **methanogens** (e.g. *Methanobacterium*) under anaerobic conditions, also in rumen of cattle (cellulose breakdown) and in anaerobic sludge.
- Biogas plant: concrete tank (10–15 feet deep), floating cover rises with gas; outlet pipe supplies gas for cooking and lighting.
- Technology developed in India by IARI (Indian Agricultural Research Institute) and KVIC (Khadi and Village Industries Commission).



Biogas production

05 Biocontrol agents

- Biological methods to control plant diseases and pests; organic farming avoids chemicals that harm humans, animals and pollute.
- **Ladybird** beetles (red and black) control aphids; **dragonflies** control mosquitoes.
- ***Bacillus thuringiensis* (Bt)**: spores sprayed; caterpillars eat them; toxin released in gut kills larvae (butterfly caterpillars) without harming other insects.
- ***Trichoderma***: free-living fungus in root ecosystems; controls plant pathogens.
- **Baculoviruses** (genus *Nucleopolyhedrovirus*): species-specific, narrow-spectrum insecticides; no negative impact on non-target organisms; ideal for **IPM** (integrated pest management).

06 Biofertilisers

Biofertiliser	How it helps
Rhizobium (symbiotic)	Root nodules of legumes; fixes atmospheric N_2
Azotobacter, *Azospirillum* (free-living)	Fix N_2 in soil
Mycorrhiza (fungi, e.g. *Glomus*)	Absorb phosphorus for plant; resistance to root pathogens, salinity, drought; overall growth
Cyanobacteria (*Anabaena*, *Nostoc*, *Oscillatoria*)	Fix N_2 in paddy fields; add organic matter

07 Extra + tricks

Antibiotic / product	Source
Penicillin	*Penicillium notatum*
Streptomycin	*Streptomyces griseus*
Tetracycline	*Streptomyces aureofaciens*
Erythromycin	*Streptomyces erythreus*
Vitamin B_{12}	*Pseudomonas*, *Propionibacterium*

- Trick for acids: **"CAB-L"** → Citric (*Aspergillus*), Acetic (*Acetobacter*), Butyric (*Clostridium*), Lactic (*Lactobacillus*).
- Primary treatment is physical (filtration, sedimentation); secondary is biological (aerobic flocs).
- Biogas ≈ 50–70% methane; gobar gas plants also give manure.

08 Important Q&A

Q1. What is BOD? What does high BOD indicate?

Oxygen required by microbes to oxidise organic matter in 1 L water; high BOD means highly polluted water.

Q2. Why are baculoviruses good for IPM?

They are species-specific, narrow-spectrum and do not harm non-target insects or beneficial organisms.

Q3. Name the microbe and use of statins.

Monascus purpureus; lowers blood cholesterol by inhibiting the enzyme for cholesterol synthesis.

09 Common mistakes

- Saying citric acid comes from Acetobacter (it is Aspergillus niger).
- Calling Methanobacterium aerobic (it is anaerobic).
- Mixing Trichoderma (cyclosporin A) and Monascus (statins).
- Thinking all beverages need distillation (wine, beer do not).

10 Practice (NEET style)

1. Microbe for holes in Swiss cheese?
2. Clot buster?
3. Free-living N_2 fixer?
4. Bacterium making butyric acid?
5. Biocontrol fungus?

ANSWERS

1) *Propionibacterium sharmanii* · 2) Streptokinase · 3) *Azotobacter* · 4) *Clostridium butylicum* · 5) *Trichoderma*

11 Quick revision: 5 minutes before the exam

HOUSEHOLD

- LAB: curd, B_{12}
- Yeast: bread
- Propionibacterium: Swiss cheese

INDUSTRY

- Penicillin: Fleming
- Aspergillus citric, Acetobacter acetic
- Cyclosporin, statins

SEWAGE/BIOGAS

- BOD high = polluted
- Flocs, activated sludge
- Methanogens: CH_4

AGRICULTURE

- Bt, ladybird, Trichoderma
- Baculovirus IPM
- Rhizobium, Glomus, Anabaena

Have a doubt? Ask the AI Doubt Solver at padhaiadda.netlify.app, or take the mock test on this chapter.