Microbes in Human Welfare Class 12 Key Points

CBSE Class 12 Biology · NCERT · for boards, NEET and JEE revision

ChapterNotes

Microbes Are Mostly Helpful

Fermentation = microbes eating sugar with little/no O_2 → useful by-product

Same chemistry at home and in giant industrial fermentors (bioreactors).

- They serve us in food, medicine, sewage, fuel, farming
- Choose the microbe whose 'waste' product you want
- Whole chapter = humans harnessing microbial by-products

Microbes in Household Products

Curd: Lactobacillus (LAB) · lactose → lactic acid → casein coagulates

Curd = bacterium; bread = yeast. Never swap them.

- LAB raise vitamin B12 and check gut pathogens
- Dough/idli/dosa puff up due to CO_2 (not methane)
- Bread leavened by baker's yeast Saccharomyces cerevisiae

Toddy & Cheese

Swiss-cheese holes: CO_2 from Propionibacterium sharmanii

Toddy = fermented palm SAP, not barley or grapes.

- Roquefort cheese ripened/flavoured by fungus Penicillium roqueforti
- Cheese is one of the oldest microbe-made foods
- Swiss holes = bacterium; Roquefort flavour = fungus

Fermented Beverages

Saccharomyces cerevisiae → ethanol · $C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$

Wine & beer = WITHOUT distillation; whisky/brandy/rum = BY distillation.

- Distillation concentrates the alcohol
- Same yeast as bread, different end product wanted
- Grown in large fermentors (bioreactors) at scale

Antibiotics & Bioactive Molecules

Penicillin (1st antibiotic): Penicillium notatum · Alexander Fleming

Chain & Florey proved its full clinical value; saved WWII soldiers.

- Cyclosporin A (Trichoderma polysporum) = immunosuppressant for transplants
- Statins (Monascus purpureus) = lower blood cholesterol
- Streptokinase (Streptococcus) = 'clot buster' after heart attack

Organic Acids & Enzymes

Citric → Aspergillus niger · Acetic → Acetobacter aceti · Lactic → Lactobacillus

Citric = fungus; acetic = bacterium. Do not flip them.

- Butyric acid → Clostridium butylicum (bacterium)
- Lipases in detergents; pectinases & proteases clarify juices
- Enzymes are microbial products used in industry

Microbes in Sewage Treatment

Primary = physical (filtration/sedimentation) · Secondary = biological (aerobic flocs)

High BOD = dirty water (more organic matter, more polluting).

- Aeration tank: aerobic microbes form flocs, reduce BOD
- Flocs settle as activated sludge; part recycled as inoculum
- Rest digested anaerobically → biogas

Biogas & Methanogens

Biogas ≈ predominantly methane (CH_4) · Methanogen e.g. Methanobacterium

Methanogens are strictly anaerobic - never in the aerated tank.

- Live in anaerobic sludge and in rumen of cattle
- Rumen methanogens digest cellulose → dung ('gobar') rich in them
- Developed in India by IARI and KVIC; spent slurry used as fertiliser

Microbes as Biocontrol Agents

Bacillus thuringiensis (Bt): larva eats spore → toxin released → larva dies

Baculoviruses (Nucleopolyhedrovirus) = species-specific, narrow-spectrum (IPM).

- Ladybird → aphids; dragonfly → mosquitoes
- Trichoderma (fungus) controls plant pathogens
- Bt gene inserted into Bt-cotton for built-in resistance

Microbes as Biofertilisers

Symbiotic N_2-fixer: Rhizobium in legume root nodules · Free-living: Azotobacter, Azospirillum

Mycorrhiza (Glomus) supplies PHOSPHORUS, not nitrogen.

- Cyanobacteria (Anabaena, Nostoc, Oscillatoria) fix N_2 in paddy fields
- Azolla fern fixes N_2 via the Anabaena inside it
- Glomus mycorrhiza also gives drought/salinity tolerance

Quick revision

- Curd: Lactobacillus; Bread: yeast; Swiss cheese: Propionibacterium
- Penicillin: Penicillium notatum (Fleming); Cyclosporin: Trichoderma; Statins: Monascus
- Sewage: primary (physical) → secondary (biological, reduces BOD) → anaerobic digestion → biogas
- BOD: higher = more pollution
- Biogas: methanogens (Methanobacterium); cattle dung; KVIC/IARI
- Biocontrol: Bt, Trichoderma, Baculovirus, ladybird beetle
- Biofertilisers: Rhizobium (legume N_2-fixation), Mycorrhiza (phosphorus absorption)

Full chapter notes with solved examples and practice questions: https://chapternotes.in/cbse/class-12-biology/microbes-in-human-welfare-class-12-notes/