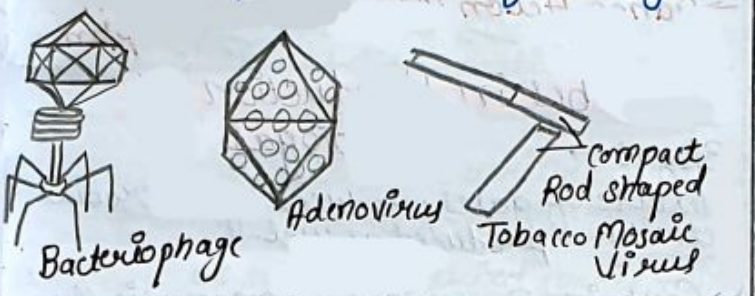
MICROBES IN HUMAN WELFARE

Microbes → Diverse - protozoa, bacteria, fungi and microscopic animal and plant viruses, viroids and also prions that are proteinacious infectious agent.



Microbes in Household Products

(1) Milk → Curd. : Micro-organisms (Lactobacillus, Lactic acid bacteria) grow in milk and convert to curd.
↳ LAB → acids → coagulate and partially digest milk proteins.
↳ Inoculum / Starter → contain millions of LAB, which multiply (25°-30°c). ✱
↳ Improves nutritional quality (↑↑ B_{12} Vitamin) ✱

(2) Dough : Dosa, Idli.. (fermented by Bacteria)
↓
making Bread → fermented using Baker's Yeast (Saccharomyces cerevisiae)
CO_2 ↑ → pores → fluffy.

(3) Toddy → Traditional drink of Southern India.
↳ Fermenting Sap from palms.
Microbes - ferment fish, soyabean, bamboo shoots.

(4) Cheese : Oldest food Items (Microbes used)
↳ Swiss Cheese → Large Holes → ↑↑↑ CO_2
↓
By Bacterium - Propionibacterium sharmami
↳ Roquefort Cheese → ripened by growing fungus on them → particular flavour
↓
penecillium roqueforti.

Microbes in Industrial Products

Industrial Scale Production
↓
growing microbes in Fermentors (large Vessels)

(1) Fermented Beverages

↳ Microbes - Yeast - production of beverages, (wine, beer, whiskey, brandy or rum)
↳ Saccharomyces cerevisiae → Brewer's Yeast
used for fermenting malted cereals and fruit juices to produce ethanol.
↳ fermentation - Beer, Wine. (13%-14% ethyl alcohol)
↳ Distillation - Whiskey, Rum, Vodka, Gin, Brandy (40-60% ethyl alcohol)

(2) Antibiotics →

Chemical substances, produced by some microbes and can kill, or retard growth of other disease causing microbe.
1st antibiotic → Penicillin - (Chance discovery)
Alexander Flemming → Staphylococci bacteria.
Penicillium Notatum. ✱
● Full potntial → Ernest Chain and Howard Florey
American Soldiers (World War II).
Fleming, Chain and Florey → Noble prize 1945.
↳ Antibiotics - plague, whooping cough (Kali Khasi), diptheria (Galgotu), leprosy (Kusht rog)...

Chemicals, Enzymes and other Bio-active Molecules

Chemicals : →
Aspergillus Niger (fungus) - Citric Acid.
Acetobacter Aceti (bacterium) - Acetic Acid
Clostridium butylicum (bacterium) - Butyric acid.
Lactobacillus (bacterium) - Lactic acid.
Saccharomyces cerevisiae - Ethanol.

Enzymes : →
Lipase - Used in laundary detergents
Pectinase and protease - Used in bottled juices
Streptokinase (Streptococcus bacterium) - Used as clot buster (to remove clots)

Bioactive Molecules →

- Cyclosporin A (Trichoderma polysporum fungi) – Used as immunosuppresive agent (for organ transplantation)
- Statins (Monascus purpureus Yeast) – Used as blood cholesterol lowering agent

Microbes in Sewage Treatment

Treatment of waste water – Heterotrophic microbes naturally present in sewage.

① Primary / Physical Treatment
physical removal of particles.
→ Sequential filtration – to remove floating debris.
→ Sedimentation – to remove grit (soil and small pebbles)

Settled down solid from primary sludge + Supernatant → effluent → Secondary Treatment

② Secondary / Biological Treatment.
→ primary effluent → large aeration tank this allows vigrous growth of aerobic microbes into flocks, which consume major part of organic matter in effluent.
↳ ↓↓ Biological Oxygen Demand of effluent.
↳ BOD – amount of O_2 that would be consumed if all organic matter in 1 litre of water were oxydised by bacteria.
(Measure of organic matter present in water)
→ ↑↑ BOD of waste water, ↑↑ polluting potential.

→ Once BOD ↓↓ → effluent → Settling tank where bacterial flocks are allowed to sediment.
→ This Sediment → Activated Sludge
→ Small part of Sludge – pumped back to aeration tank → Inoculum.
→ Remaining part of Sludge – pumped into large tanks → Anaerobic Sludge Digesters.
→ During this digestion
↓
Bacteria produce mixture of gases (Methane, Hydrogen Sulphide, CO_2) → BIOGAS

→ Biogas – Inflammable source of energy
→ effluent from 2° treatment plant
↓
Released into rivers and Streams.

Note – flocks → Masses of Bacteria + fungi filaments → mesh like structure

→ Ganga Action Plan, Yamuna Action Plan

Microbes in Production of Biogas

Biogas →
Mixture of gases produced by microbial activity → used as fuel.
↳ Certain Bacteria grow anaerobically on cellulose material
↓ produce
↑↑ methane + CO_2 and H_2
↳ Bacteria → Methanogens (Methano-bacterium)
↓
commonly found in —
• anaerobic sludge during sewage treatment
• Rumen (part of stomach) of cattle.
→ Alot of cellulosic material present in food of cattle is also present in rumen.
→ In rumen → Bacteria help in breakdown of cellulose and play imp. role in nutrition of cattle
∴ Gobar → Rich in bacteria.
↳ generation of Gobar Gas.

Biogas Plant

→ Concrete Tank (10-15 ft deep) in which bio-wastes are collected and slurry of dung is fed.
→ floating cover is placed over slurry which keeps on rising as gas is produced in tank due to microbial activity.
→ Biogas plant – Outlet → Connected to pipe to supply biogas to nearby houses
→ Spent Slurry → Removed by another outlet & used as fertilizer.
→ Biogas → Cooking and lighting

→ Biogas → India → IARI (Indian Agricultural Research Institute)
KVIC → (Khadi and Village Industries Commision).

Microbes as BioControl Agents.

→ Biological Control of pests and diseases

① Beetle with red and Black marking (LadyBird) and Dragonflies
↳ to control aphids and mosquitoes.

② Bacteria Bacillus thuringiensis (Bt)
↳ To control butterfly caterpillars.
↓
available as sachets as dried spores, mixed with water and sprayed onto vulnerable plants such as brassicas and fruit trees
→ Bt Cotton - Resistant to attack by insect pests.

③ Trichoderma (fungi) - protects root system and control plant pathogens.

④ BaculoViruses (NucleopolyhedroVirus)
↳ pathogens that attack insects and other arthopods. NPHV
→ Excellent Candidate for species-specific, narrow spectrum insecticidal applications.
→ Integrated pests management (IPM)

Microbes as Biofertilizers.

↳ Organisms that enrich the nutrient quality of soil.
→ Main Sources → Bacteria, fungi and Cyanobacteria.

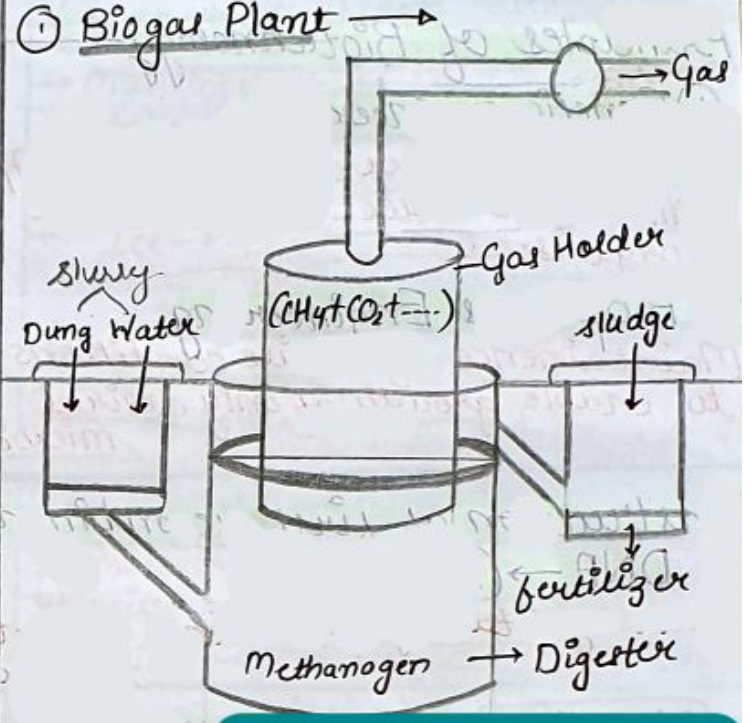
① Bacteria →
Symbiosis (Symbiotic association)
↓
Rhizobium with root nodules of leguminous plants.
Free living (in the soil)
↓
Azobacter and Azospirillum.
} fix atmospheric Nitrogen

② Fungi →
Symbiosis → Mycorrhiza with root system of genus Glomus and absorb phosphorus and water from soil for plant growth.

③ Cyanobacteria → autotrophic microbes.
Symbiosis — Anabena in Azolla
Free living — Nostoc, Oscillatoria and Blue green algae.
→ Paddy fields → Cyanobacteria (biofertilizer)

Important / Left Points: →

① Biogas Plant →



NEET SLAYER