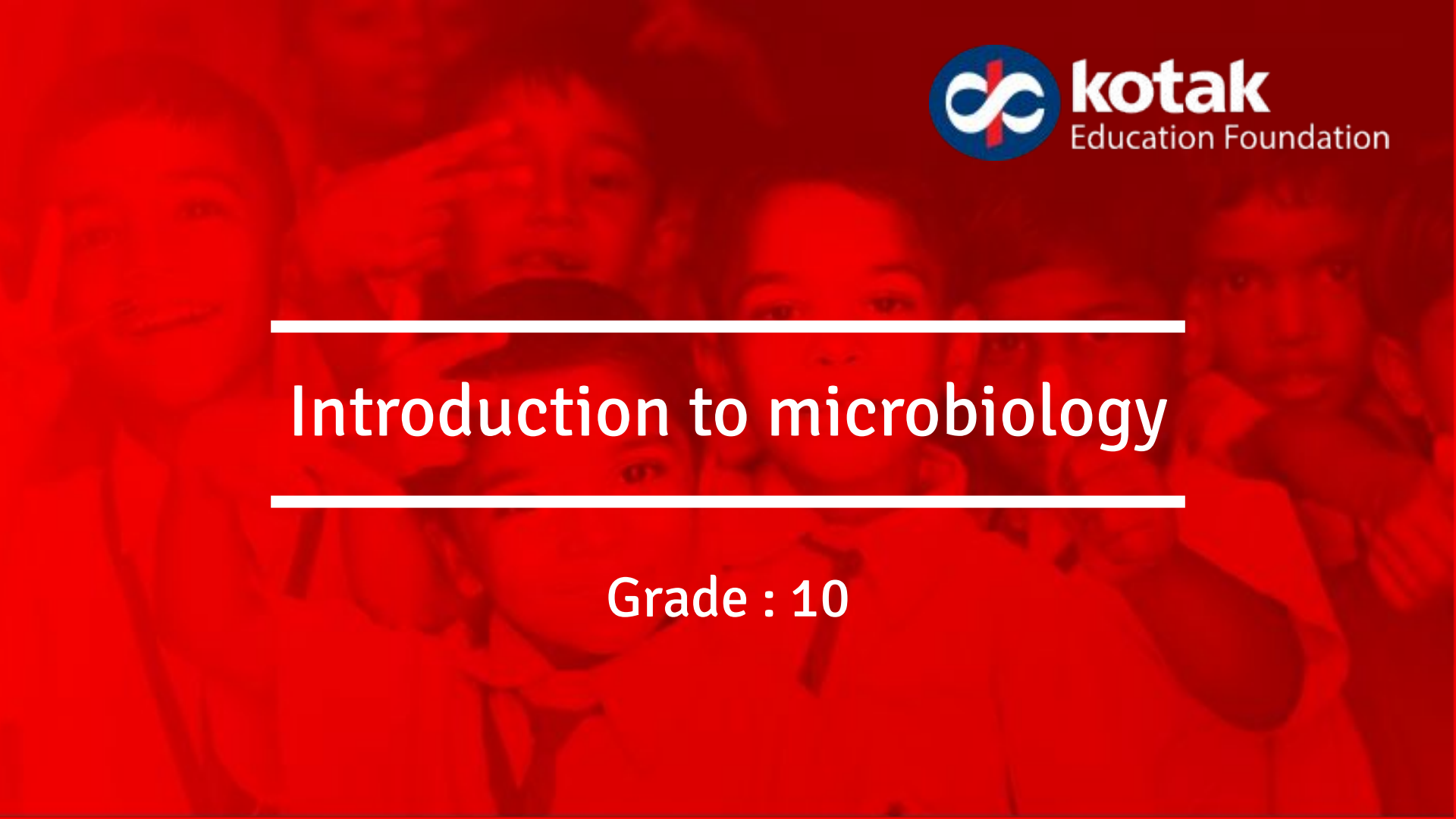
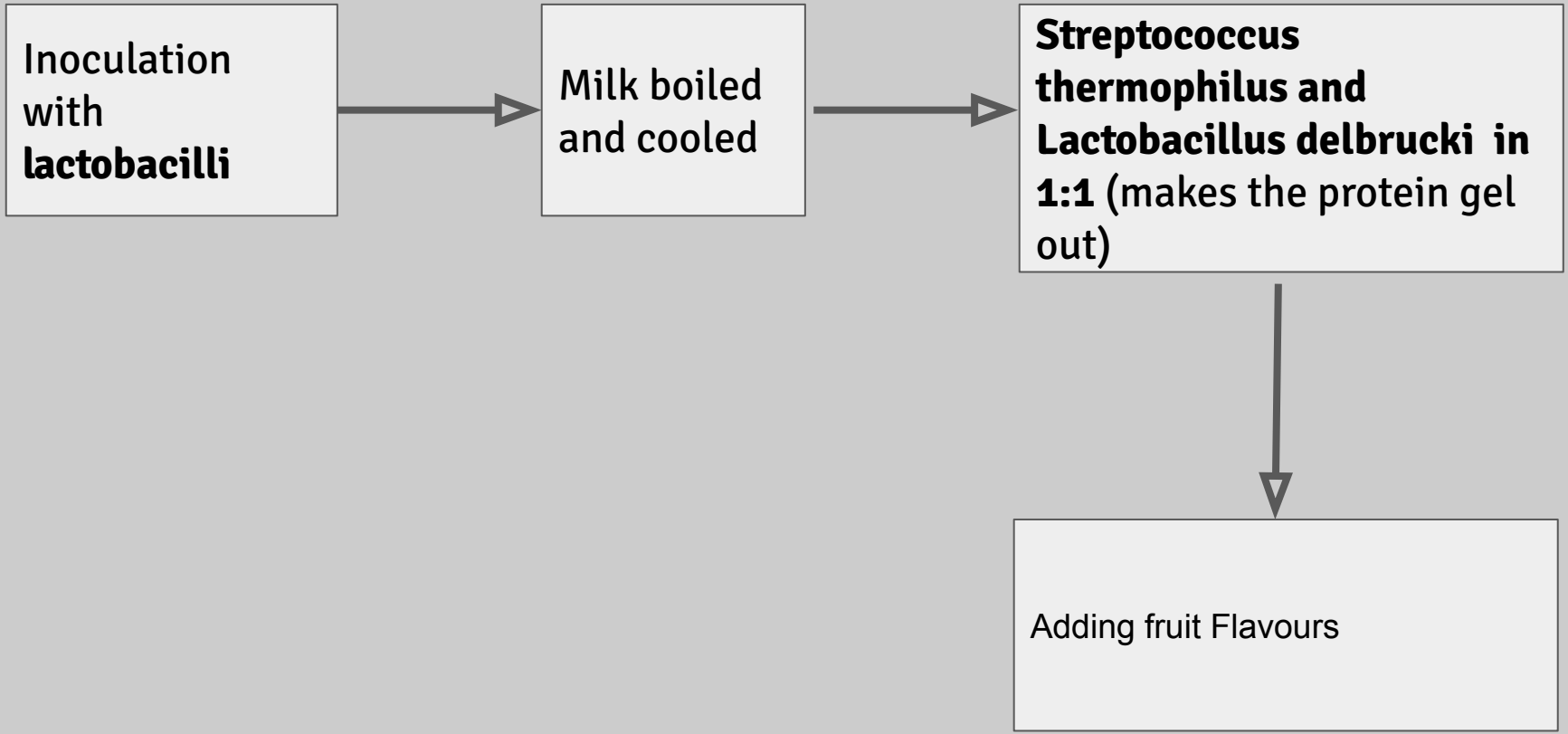


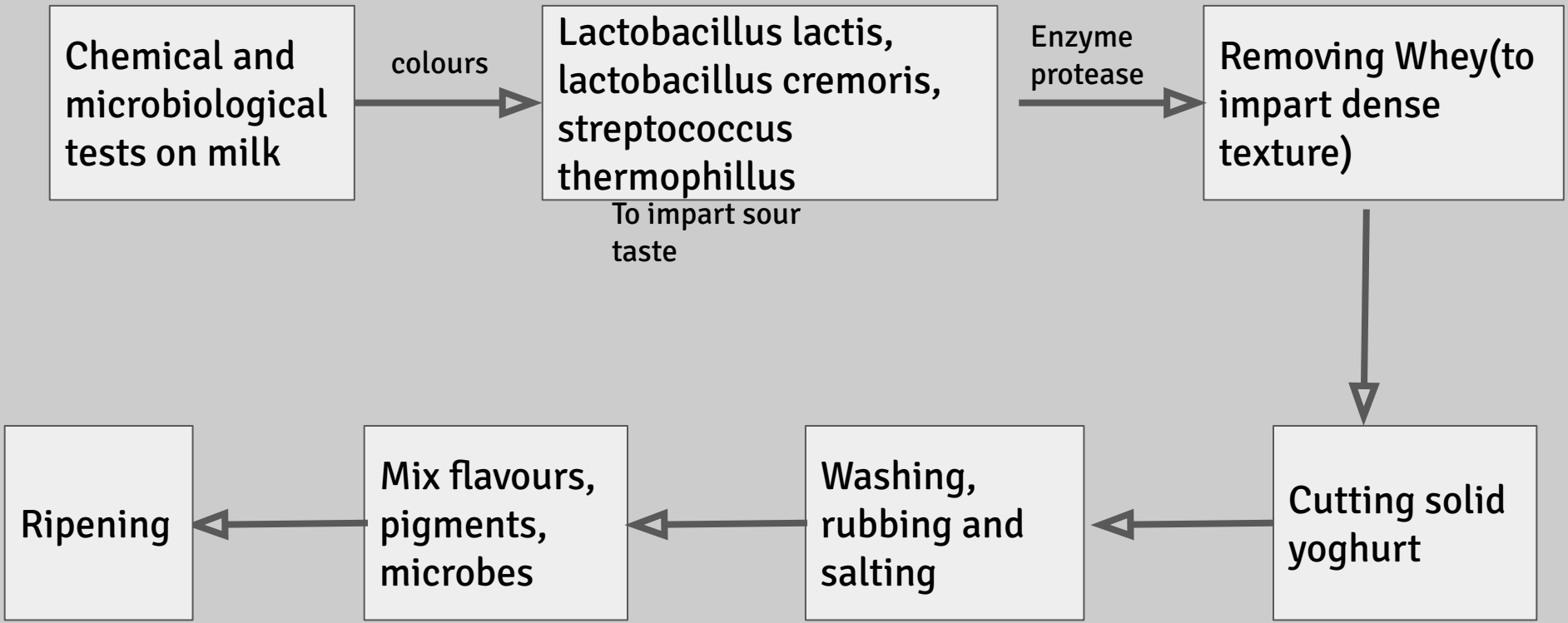
Introduction to microbiology

Grade : 10

Yoghurt production-important steps



Cheese production-important steps



Cheese and its types

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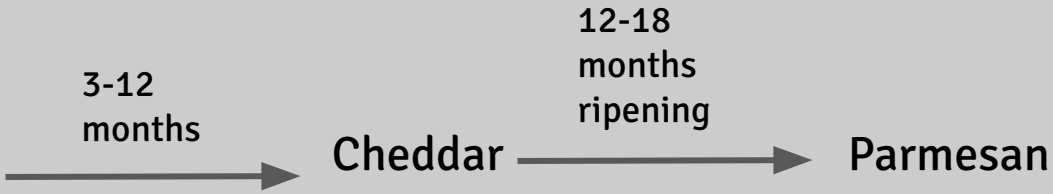
Soft Cheese	Semi- hard Cheese	Hard Cheese
Cottage Cheese (paneer), Cream cheese, Mozarella cheese	Cheddar	Parmesan



Probiotics

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https://youtu.be/h4o-mkSwrxI

Bread

Saccharomyces cerevisiae
Water and Salt+Flour

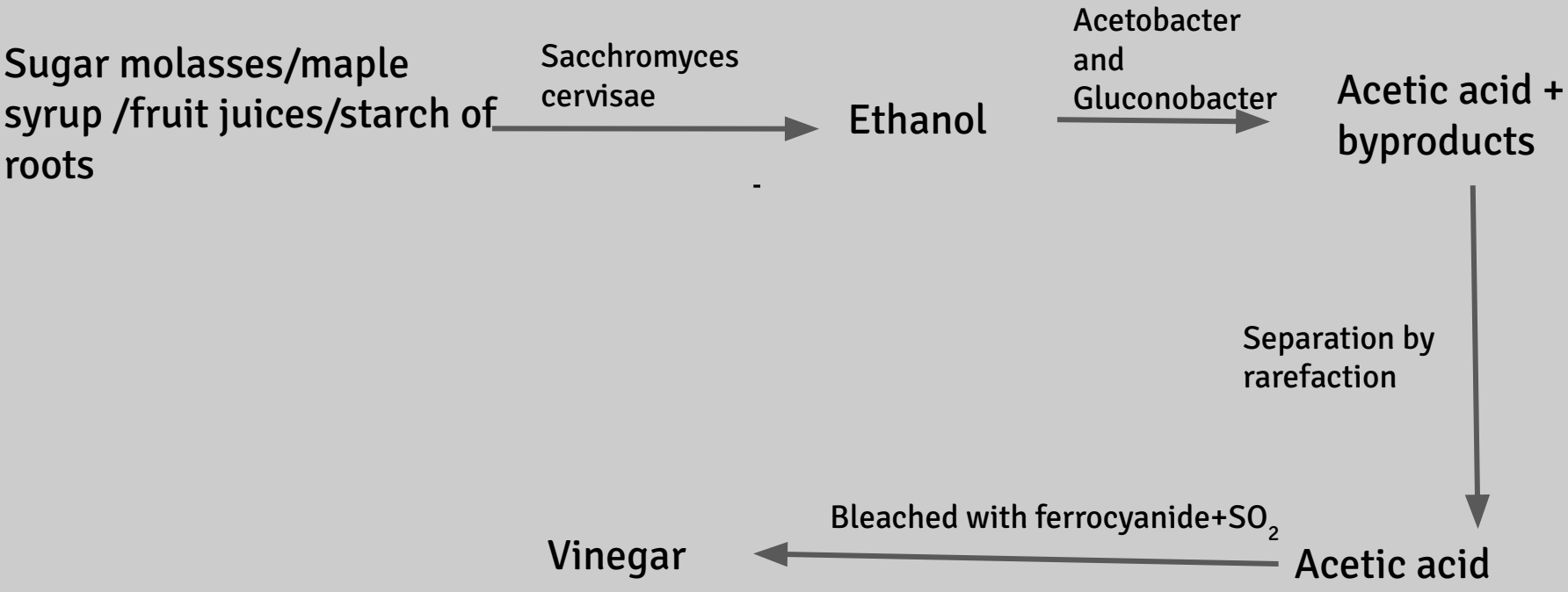
Breaks the carbohydrates in the flour

Sugar CO_2 Ethanol

Makes the dough rise which makes the bread soft and fluffy

Vinegar production(very very important)

Chemically, vinegar is 4% acetic acid **(CH_3COOH)**



Very important table: Some beverages and their production

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Soya sauce is produced by fermentation of the mixture of flour of wheat or rice and soyabean with the help of the fungus Aspergillus oryzae.

Production of beverages

Sr. No.	Fruit	Microbe used	Role of microbe	Name of beverage
1	Caffea arabica	Lactobacillus brevis	Separating seeds from fruit	Coffee
2	Theobroma cacao	Candida, Hansenula, Pichia,Saccharomyces.	Separating seeds from fruit	Cocoa
3	Grapes	Saccharomyces cerevisiae	Fermentation of juice	Wine
4.	Apple	Saccharomyces cerevisiae	Fermentation of juice	Cider

Why microbial enzymes over catalyst?

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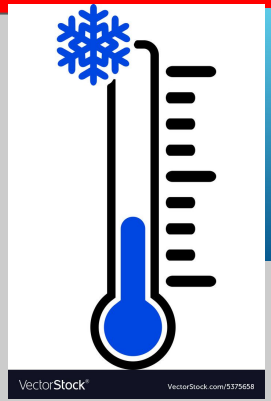
- These enzymes are **active at low temperature, pH and pressure;**
- As a result **energy is saved and erosion-proof instruments** are also **not necessary.**
- Enzymes carry out specific processes; hence **unnecessary by- products are not formed** due to which expenses on purification are minimised.
- In case of microbial enzymatic reactions, **elimination and decomposition of waste material** is avoided and enzymes can be reused. Hence, such enzymes are eco-friendly.



Examples of microbial enzymes are:

- Transferases
- Hydrolases
- Ligases
- Isomerases
- Oxido-reductases
- Lyases

Xanthum gum

Xanthan gum that **imparts thickness** to ice creams, puddings, chocolates, milk shakes, chocolate drinks, instant soups, etc.is **obtained by fermentation of starch and molasses with the help of Xanthomonas species.**

It is variously **useful due to properties like solubility in hot and cold water, high density,** etc.

It is **used for production of pigments, fertilizers, weedicides, textile pigments, tooth pastes, high quality paper**, etc.

Important table

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Organic acids used in various commercial products and microbes useful for the same

Source	Microbe	Acid	Use
Sugar and beet molasses, ammonia salt	Brevibacterium, Corynobacterium	L-glutamic acid	Production of monosodium glutamate (Ajinomoto)
Sugar molasses, salt	Aspergillus niger	Citric acid	Drinks, toffees, chocolate production
Glucose, corn steep liquor	Aspergillus niger	Gluconic acid	Production of minerals used as supplement for calcium and iron
Molasses, corn steep liquor	Lactobacillus delbrueckii	Lactic acid	Source of nitrogen, production of vitamins.
Molasses, corn steep liquor	Aspergillus itaconius	Itaconic acid	Paper, textile, plastic industry, gum production

Important table

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Substances obtained by microbial processing	Roles
Citirc, Malic and Lactic acid	To impart acidity
Glutamic acid, Lysine, Tryptophan	Protein binding
Nycin and natamycin	Microbial restrictor
Ascorbic acid (Vit. C), B_{12}, B_2	Antioxidants, vitamins.
Beta carotene, lycopenes, xanthenes, lutein	Edible colours
Polysaccharides, glycolipids	Emulsifiers
Vanillin, Ethyl butyrate (fruit flavour), peppermint flavour, essence of various fruits and flowers	Essence
Xylitol, aspartame	Artificial sweetener (low calorie)

Summary of what we have seen till now

https://youtu.be/UCuOK8DomWs

Very important: Modern landfills and bioremediation

https://youtu.be/3ZeFIVhHwvk (modern landfills)

https://youtu.be/1FGfrl3i2xA (bioremediation)

***Bacteria like **Pseudomonas spp. and Alcanovorax borkumensis** have the ability to destroy the pyridines and other chemicals. Hence, these bacteria are used to clear the oil spills. These are called as **hydrocarbonoclastic bacteria (HCB)**.

HCB decompose the hydrocarbons and bring about the reaction of carbon with oxygen. CO_2 and water is formed in this process.

Remember these

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Vibrio, Ideonella sakaiensis can decompose the PET.

Similarly, species of bacteria like **Actinomycetes, Streptomyces, Nocardia, Actinoplanes** have ability of decomposing rubber from garbage.

Sulphuric acid is source of energy for some species of bacteria like **Acidophillium spp. and Acidobacillus ferrooxidans.** Hence, these bacteria can control the soil pollution occurring due to acid rain.

Solution containing **Azotobacter and artificial nitrogenase** is used in organic farming.

Spinosad, a by-product of fermentation is a **biopesticide.**