

Use of Microbes

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USE OF MICROBES IN INDUSTRY

S.no.	Micro-organism	Enzyme/ product	Uses
1	<i>Bacillus licheniformis, Bacillus amyloliquefaciens</i>	Amylase	Food, fermentation and textile industry
2	<i>Pseudomonas species, Staphylococcus species</i>	Lipase	In preparation of cheese, detergents, leather etc
3	<i>Aspergillus niger, Bacillus subtilis</i>	Peroxydase	Waste treatment, in ELISA test
4	<i>E.coli, Nocardia species</i>	Catalase	In treatment of milk, to remove traces of H ₂ O ₂ from clothes
5	<i>Aspergillus niger, Bacillus subtilis</i>	Protease	Photographic industry
6	<i>Penicillium notatum</i>	Penicillin	Antibiotic

USE OF MICROBES IN INDUSTRY

- Bacteria, Fungi, Yeast, etc. are used commonly in the production of various fermented products like wine, yogurt, etc.
- Production of food and dairy products. Cheese, yogurt, alcoholic beverages, coffee, tea, vitamins, etc are some of the examples.
- Production of vaccines is another important application of industrial microbiology.
- Antibiotics are another important product produced by using microorganisms.
- Production of antibodies and enzymes from important industrial micro-organisms including fungus and bacteria.
- Production of biofuels from algae and related organisms
- The production of biodiesel from biomass using micro-algae.
- The production of bioethanol from starch fermentation of yeast species.

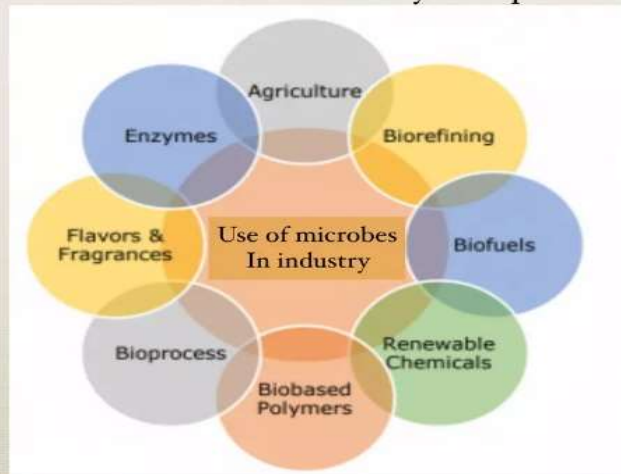


Fig 1.3 Use of microbes In industry

PRODUCTION OF ENZYMES AND GENERAL CONSIDERATIONS

AMYLASE

- Amylase catalyses the the Hydrolysis of starch into sugars.
- Following are the types of Amylase enzyme.

α -AMYLASE

- Also called as 1,4- α -D-glucan glucanohydrolase.
- Breaks Amylose to Maltose & Amylopectin to Dextrin and Glucose.
- Source: Human saliva, Pancreas, Plants, Fungi like *Ascomycetes*, *Aspergillus niger*, Bacteria like *Bacillus Licheniformis*, *Bacterium subtilis* etc.
- He enzyme is active at pH 6.7-7.0

β -AMYLASE

- Also called as 1,4- α -D-glucan Maltohydrolase.
- During ripening of fruit it breaks starch into Maltose, which provide sweet flavour to fruit.
- Source: Plants, Bacteria and fungi.
- The enzyme is active at optimum pH 4-5.
- α and β amylase are mostly use in brewing industry for the preparation of beer.

γ -AMYLASE

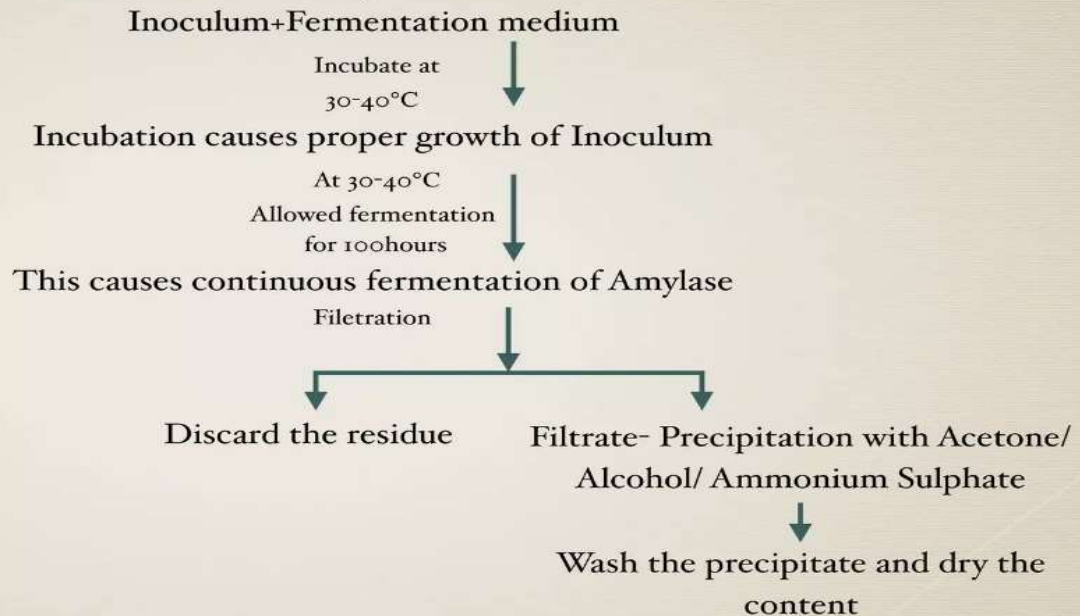
- Also called as 1,4- α glucosidase
- It breaks the amylose to Amylopectin.
- He enzyme is active at optimum pH 3.

PRODUCTION OF ENZYMES AND GENERAL CONSIDERATIONS

AMYLASE

Production process of Amylase enzyme is as follows:

- MEDIUM: Starch+ Corn steep liquor + Buffering agent
- INOCULUM: *Bacillus licheniformis*



The application of Amylase are:

- Used in liquefaction of Starch.
- Use in Brewing industry.
- Production of bread.
- Production of candy of desired softness etc.

PRODUCTION OF ENZYMES AND GENERAL CONSIDERATIONS

CATALASE

- It protects the cell from oxidative damage.
- One molecule of Catalase can convert 40,000 molecules of H₂O₂(Hydrogen Peroxide) to water and oxygen.
- Following are the types of Catalase enzyme.

Heme Catalase

- The enzyme along with iron.

Manganese Catalase

- The enzyme along with manganese.

Peroxidase Catalase

- The enzyme found in peroxisomes of cell , neutralises the toxicity of H₂O₂ .

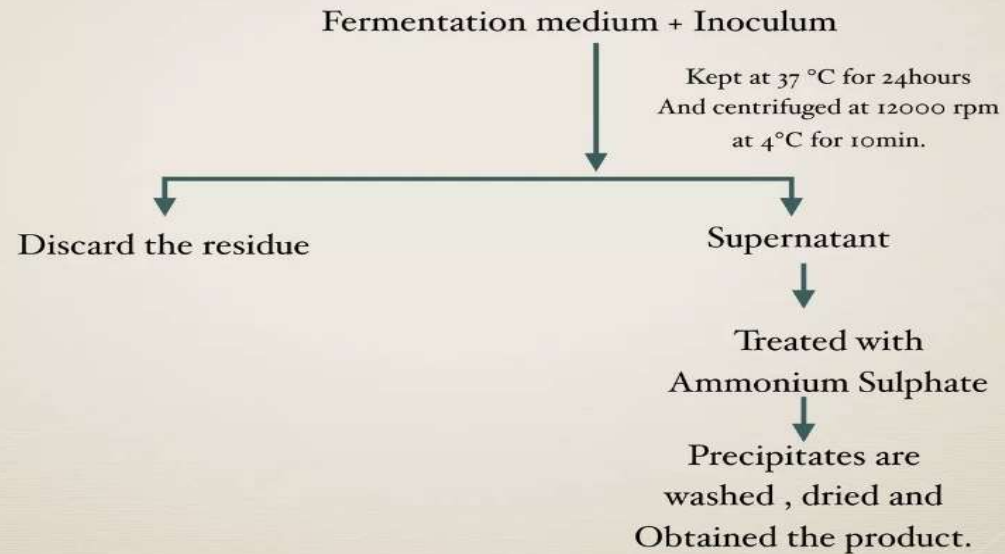
- Catalase is Tetrameric enzyme and is present in the cells of all aerobic organisms.
- **Source:**Catalase is produced mainly by extraction from bovine liver and, in recent years , from *Aspergillus Niger* , *Micrococcus luteus* , *E.coli*, *Nocardia species* etc.
- Sweet potato is a Good source of Catalase.
- **The Applications Catalase enzyme are:**
 - H₂O₂ is used in textile industry fro Bleaching of clothes , Catalase enzyme is used to remove traces of H₂O₂ from clothes.
 - Catalase is used for treatment of milk to remove H₂O₂ before cheese production.
 - Used to degrade from industrial effluent.

PRODUCTION OF ENZYMES AND GENERAL CONSIDERATIONS

CATALASE

Production process of Catalase enzyme is as follows:

- MEDIUM: Sucrose/Lactose/Fructose + Peptone/Beef extract + Ferrous sulphate/ Ammonium sulphate.
- STOCK SOLUTION: Nutrient broth+E.coli kept for 24hours at 30°C.
- INOCULUM: E.coli.



PRODUCTION OF ENZYMES AND GENERAL CONSIDERATIONS

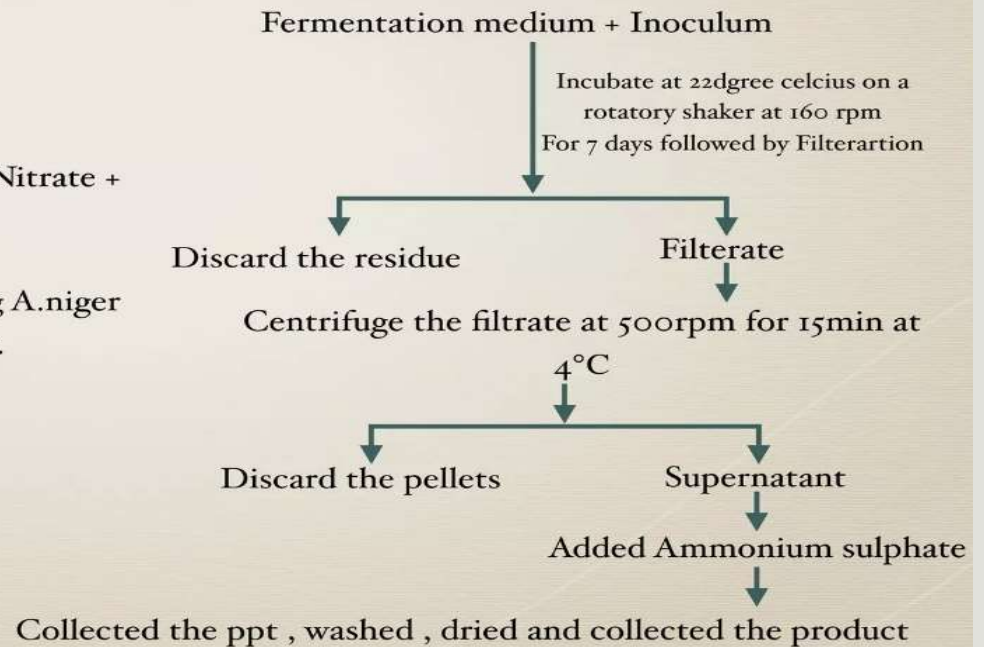
PEROXIDASE

- Peroxidase are the group of enzymes that catalyses Oxidation-Reduction reactions.
- It is also called as Oxidoreductase.
- Peroxidase use H_2O_2 as electron acceptor for catalysing different oxidative reaction.
- **Source:** Fungi- *Aspergillus niger* , Bacteria- *Bacillus subtilis*.

Production process of Catalase enzyme is as follows:

1st method

- **MEDIUM:** Glucose +yeast extract+Ammonium Nitrate + Magnesium sulphate +Dipotassium phosphate
- **INOCULUM:** *Aspergillus niger*
- **STOCK:** Stock culture is prepared by inoculating *A.niger* on potato dextrose agar slants at $4^\circ C$ for 24hours.

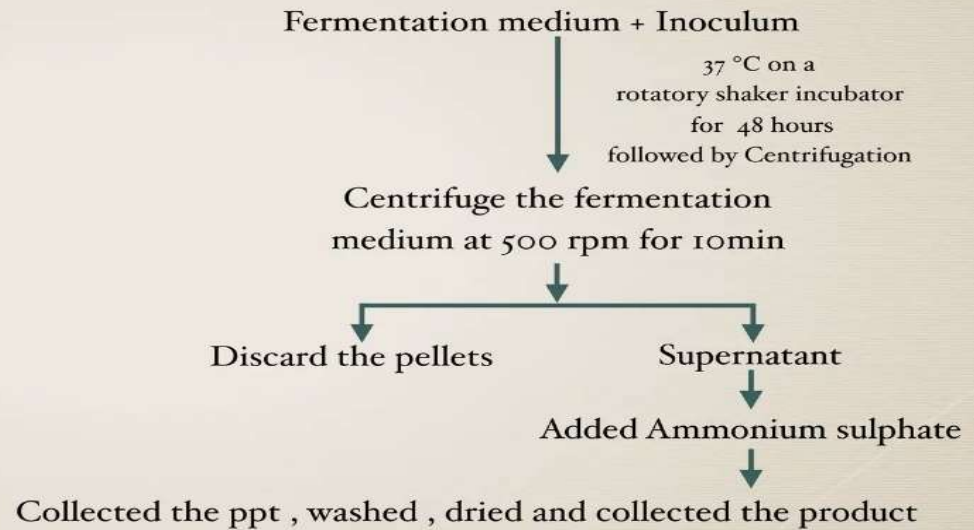


PRODUCTION OF ENZYMES AND GENERAL CONSIDERATIONS

PEROXIDASE

**Production process of Catalase enzyme is as follows:
2nd method**

- MEDIUM: Glucose +yeast extract+ Dipotassium Hydrogen phosphate
- INOCULUM: *Bacillus subtilis*



The applications of Peroxidase are:

- Mostly use for treatment of waste material
- Used in ELISA for detection of Antigen-Antibody (Ag-Ab) Reaction.

PRODUCTION OF ENZYMES AND GENERAL CONSIDERATIONS

LIPASE

Lipase is also called as Glycerol ester hydrolase.

Lipase converts fat to mono/di - glycerides and fatty acids

Source: Fungi: Aspergillus species, Penicillium species & Bacteria- Pseudomonas species, Staphylococcus species.

Production process of Lipase enzyme is as follows:

- MEDIUM: Peptone +yeast extract+ olive oil +Dipotassium Hydrogen phosphate+ Manganese chloride + Ammonium sulphate + Calcium chloride
- INOCULUM: *Pseudomonas aeruginosa*
- pH maintained at 7.2

The applications of Lipase are:

- Used in dairy preparation like cheese , butter etc.
- Used in preparation of detergents to remove greasy stain.
- Also used in leather industry to clean leather.

