Bioprocessing of Industrially Important Microbial Metabolites

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- Microbial metabolites are chemical compounds produced by microorganisms during growth and metabolism.
- Bioprocessing of these metabolites involves their production using fermentation and their recovery through downstream processing.

Definition of Microbial Metabolites

- Microbial metabolites are substances produced by microorganisms during metabolic activities.
- These products may be useful in medicine, food, agriculture, and industry.

Types of Microbial Metabolites



1. Primary Metabolites

- These are produced during active growth phase.
- They are essential for growth and metabolism.

Examples:

- Alcohol.
- Organic acids.
- Amino acids.
- Vitamins.

2. Secondary Metabolites

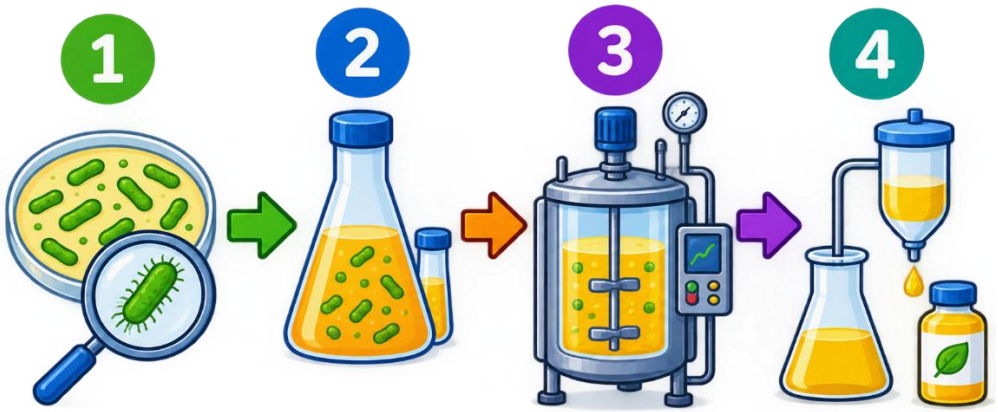
- These are produced mainly after active growth slows.
- They are not directly required for growth.

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Examples:

- Antibiotics.
- Pigments.
- Alkaloids.

Steps in Bioprocessing



1. **Selection of Microorganism**
   - Suitable productive strain is selected.
2. **Preparation of Inoculum**
   - Microorganisms are grown before fermentation.
3. **Fermentation Production**
   - Product is produced under controlled conditions.
4. **Product Recovery**
   - Product is isolated and purified.

Factors Affecting Bioprocessing

1. Microorganism used.
2. Medium composition.
3. pH.
4. Temperature.
5. Aeration.
6. Agitation.

Industrial Importance

- **Microbial metabolites are important in:**
  - Pharmaceuticals.
  - Food industry.

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- Chemical industry.
- Biotechnology.

Organic Solvents: Alcohol

- Alcohol is an important microbial metabolite produced by fermentation.
- Ethanol is the most common industrial alcohol produced by microorganisms.

Definition of Alcohol Fermentation

- Alcohol fermentation is a process in which microorganisms convert sugars into alcohol.
- It is a major industrial fermentation process.

Microorganisms Used

1. **Yeasts**
   - Most common organism:
     - Saccharomyces cerevisiae
2. **Some Bacteria**
   - Certain bacteria can also produce alcohol.

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Raw Materials Used

- **Common substrates include:**
  - Molasses.
  - Glucose.
  - Starch.
  - Sugarcane products.

Principle of Alcohol Production

- Sugars are converted into ethanol and carbon dioxide.
- Microorganisms carry out this biochemical conversion.

Steps in Bioprocessing of Alcohol

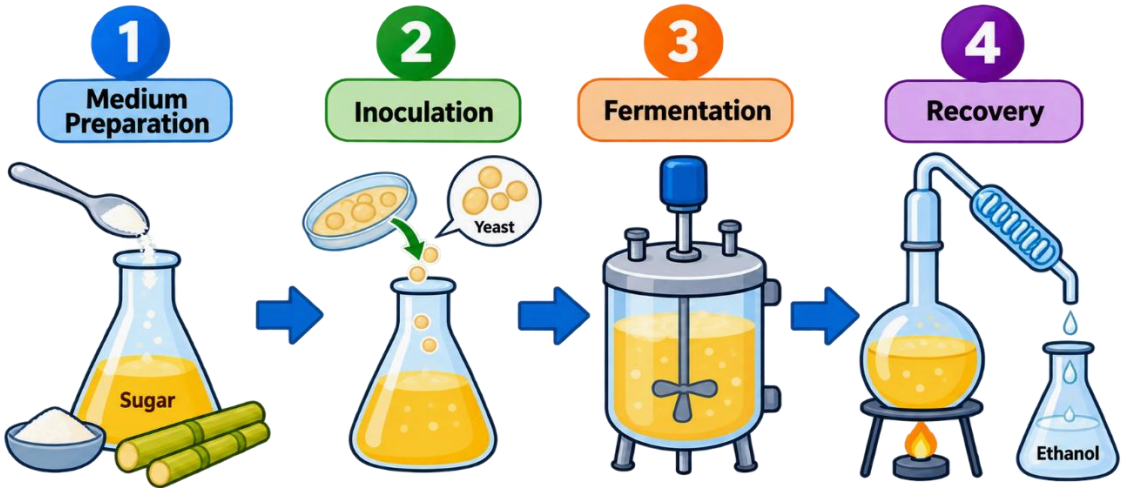
1. **Medium Preparation**
   - Nutrient medium containing sugars is prepared.
2. **Inoculation**
   - Yeast is added.
3. **Fermentation**

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- Sugar is converted into alcohol.

4. Recovery

- Ethanol is separated by distillation.



Types of Alcohol Fermentation

1. Batch Fermentation

- All nutrients added initially.

2. Continuous Fermentation

- Medium added continuously.

Factors Affecting Alcohol Production

1. Sugar concentration.
2. Temperature.
3. pH.
4. Yeast strain.
5. Oxygen conditions.

Applications of Alcohol

1. Beverage industry.
2. Fuel ethanol.
3. Chemical industries.
4. Pharmaceutical industry.

Advantages

- Renewable production method.
- Large-scale industrial use.
- Economical process.

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Organic Solvents: Glycerol

- Glycerol is an important organic solvent and microbial metabolite produced by fermentation.

Definition of Glycerol Fermentation

- Glycerol is produced by microbial conversion of carbohydrates.
- It is a valuable industrial chemical.

Microorganisms Used

1. Yeasts

- Commonly used:
- Saccharomyces species

2. Some Bacteria

- Certain bacteria may also produce glycerol.

Raw Materials Used

1. Sugars.
2. Molasses.
3. Glucose solutions.

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Principle of Glycerol Production

- Carbohydrates are converted into glycerol by microbial metabolism.
- Fermentation conditions influence product formation.

Steps in Bioprocessing of Glycerol



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