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# PHARMACEUTICAL BIOTECHNOLOGY

## UNIT 5

TOPIC :

- b) Large scale production fermenter design and its various controls.



# Large-Scale Fermenter (Bioreactor)

- A large-scale fermenter is a closed vessel used for industrial production of antibiotics, enzymes, vaccines, alcohol, vitamins, and organic acids using microorganisms under controlled conditions.
- It is also known as a Bioreactor.

## Fermenter Design And Parts

### 1. Fermenter Tank

#### Functions

- Main vessel where fermentation occurs.
- Usually made of stainless steel.
- Cylindrical with a rounded bottom.

#### Advantages

- Corrosion resistant.
- Easy sterilization.
- Durable.

### 2. Agitation System

#### Components

- Motor
- Shaft
- Impellers

#### Functions

- Uniform mixing of medium.
- Distribution of nutrients.
- Improves oxygen transfer.

### 3. Aeration System

#### Functions

- Supplies sterile air.
- Maintains oxygen concentration.

#### Components

- Air compressor
- Air filter
- Sparger

#### Importance

- Essential for aerobic fermentation.

#### **4. Feeding Pump**

##### **Functions**

- Supplies nutrients during fermentation.
- Maintains nutrient concentration.

##### **Importance**

- Used mainly in fed-batch and continuous fermentation.

#### **5. Sensors and Probes**

##### **Measure**

- Temperature
- pH
- Dissolved oxygen
- Foam level

##### **Importance**

- Continuous monitoring and process control.

#### **6. Temperature Control System**

##### **Components**

- Cooling jacket
- Cooling coils

##### **Functions**

- Maintains optimum temperature.
- Removes excess heat generated by microorganisms.

#### **7. Foam Control System**

##### **Functions**

- Prevents excessive foam formation.
- Improves process efficiency.

##### **Methods**

- Addition of antifoam agents.
- Mechanical foam breakers.

#### **8. Effluent Outlet**

##### **Functions**

- Removes fermented broth.
- Helps product recovery.

- Removes waste materials.

### **Location**

- Bottom portion of fermenter.

## **Characteristics of An Ideal Fermenter**

An ideal fermenter should:

1. Be sterile and contamination-free.
2. Provide efficient aeration.
3. Ensure proper mixing and agitation.
4. Allow easy cleaning and sterilization.
5. Withstand high temperature and pressure.
6. Support automatic monitoring and control.

## **Advantages of Large-Scale Fermenters**

- High production capacity.
- Better process control.
- Reduced contamination.
- Continuous production possible.
- Cost-effective industrial manufacturing.

## **Applications of Large-Scale Fermenters**

### **Pharmaceutical Industry**

- Antibiotic production
- Vaccine production
- Enzyme production
- Hormone production

### **Food Industry**

- Yogurt production
- Cheese production
- Vinegar production

### **Alcohol Industry**

- Beer production
- Wine production
- Ethanol production

### **Biotechnology Industry**

- Recombinant protein production
- Biopharmaceutical manufacturing

## Chemical Industry

- Organic acid production

