☆ BIOREACTOR :→

A bioreactor is a device in which a substrate of low value is utilized by living cells to generate a product of higher value.
These r used for food processing, fermentation, waste treatement etc.
On basis of agent used, they r grouped into broad classes:

i) those based on living cells
ii) those employing enzymes.

A Bioreactor provide:

- Agitation (for mixing of cells & medius
- Aeration (for O_2 supply)
- regulation of factors like temp, pH, pressure liquil level etc.

Typs :→ 1) Batch Bioreactor :→

In batch culture, a bioreactor is filled with fresh medium & inoculated At the end of fermentation, contents r removed for downstream processing.
The reactor is cleaned & steilized
It is riffiled for next fermentatia.

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Adv :>
- Reduced risk of contamination
- More flexibility with varying product
- Higher raw material conversion levels

Disad :> Lower productivity level
Higher cost for labour

2.) Continuous Bioreactor :> In this, there is continuous inflow of fresh medium & outflow of used medium.
A Spin-filter Bioreactor is a good ex. of conti flow bio.
Adv :> Increased potential for automating the process
Decreased toxicity risks to staff
Reduced stress on instruments
Less non-productive time
Disadv :- Minimal flexibility, Higher investment costs in control & automation equipment.
Higher risk of contamination & cell mutation

TYPES :> Continuous Cultivation :>
1.) Chemostat :> In this, medium is pumped continuously & Vol. is constant.
2. Turbidostat :> It employs feedback control of pumping rate to maintain a fixed turbidity of the culture
3.) Auxostat :> It is method of feeding fresh nutrient based on the conc^n of metabolic product & related parameter change like pH & diss. O_2.

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- These r 3 substrate flow possibilities in packed
  * Downward flow method
  * Upward " "
  * Recycling Method
- Air-lift Bioreactor!⇒ Also b/as tower reactor. Greater air throughput & higher pressure r needed It is divided into 3 parts
  - Air riser ; downcomer,
  - disengagement

In this no mechanical stirrer r used & agitation is achieved by air bubbles These r of closed or batch type but continuous flow reactor r used.

* Adv. over conventional bioreactors.
- Less risks of defects & easier sterilization.
- Large, Specific contact area with low energy input
- Well-controlled flow & efficient mixing.

* Disad:- Higher initial capital investments due to large scale processes
- Lower efficiency of gas compression.
- Inefficient gas separation when foaming occurs.

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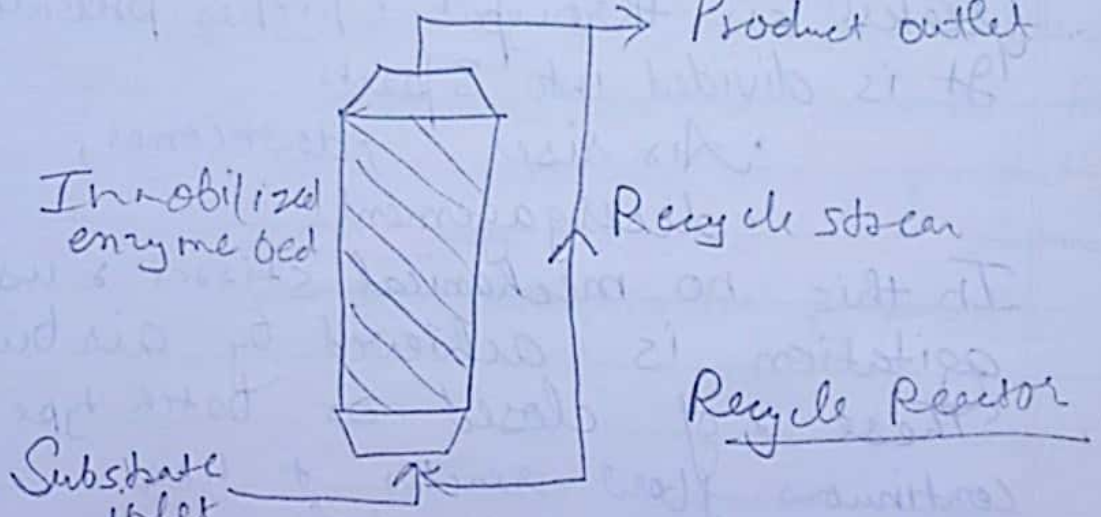
Recycled Reactor :⇒ It is simply a reactor with recycle system. It is not seen very often, but is very imp. to consider when studying immobilized enzymes. In this, a portion of product stream is recycled & mixed with inlet flow to reactor. If entire product stream is recycled back to inlet stream, then it is called total recycle reactor.



Recycle Reactor.

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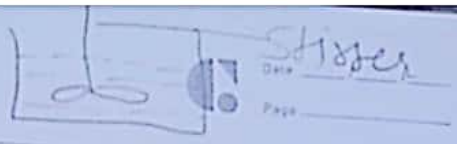
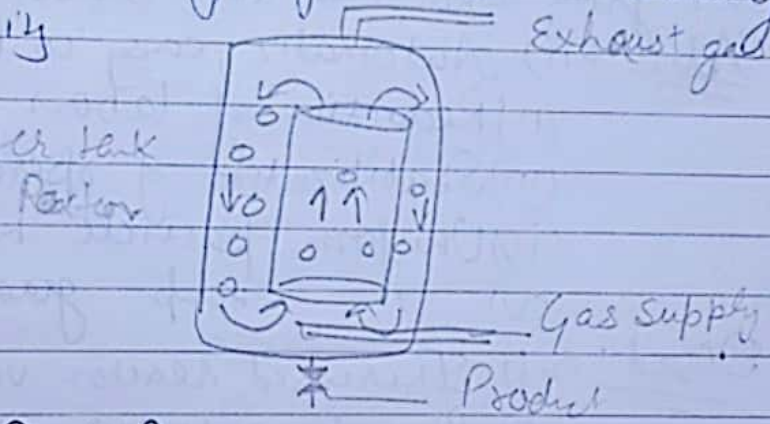


3) Stirred Tank Reactor :- These reactors are simple & consist of tank containing a stirrer & fixed baffles to improve mixing. These r used in batch mode & free enzyme can be employed. Efficient arrangement r provided to maintain temp., pH.
It is most common type of aerobic bioreactor in use today.
This reactor is useful for substrate sol^n of high viscosity



4) Fluidized Bed Reactor :→ It is combination of 2 most packed bed & Stirred tank, continuous flow reactors. In these reactors, immobilised enzyme particles r fluidized i.e the particles becomes suspended in substrate stream due to flow of substrate stream. In this, substrate is passed upward through the immobilized enzyme bed at high velocity.

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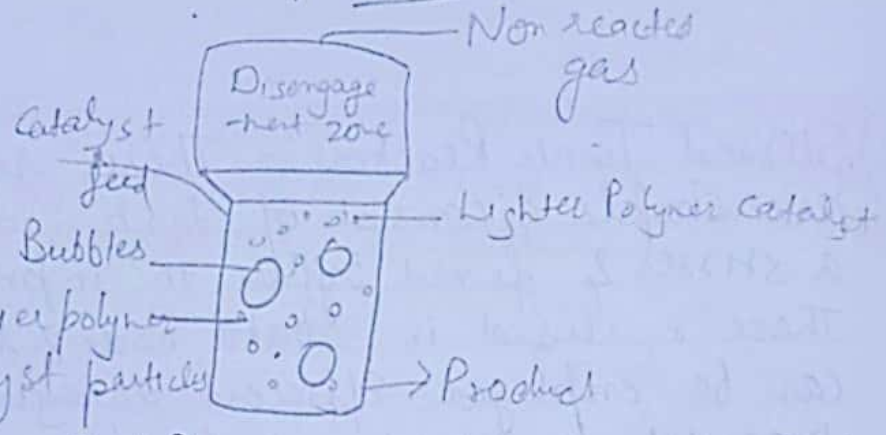
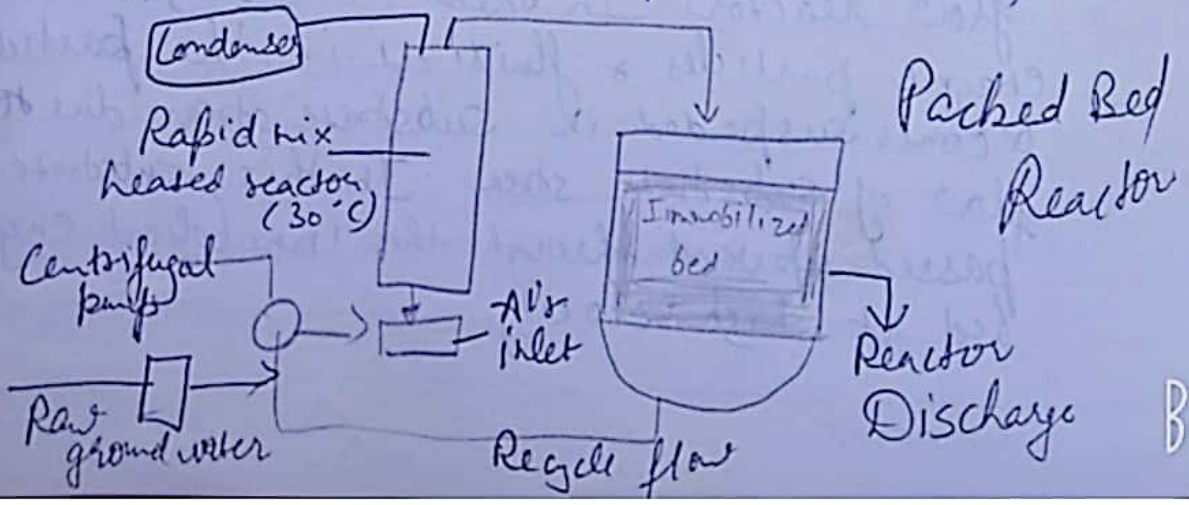
Fluidized



5) Packed Bed Reactor :→ These reactors contains a settled bed of immobilized enzyme particles; Reaction mix continuously enters from one end & product moves out from other end. These reactor s like columns

Adv! → (i) Automatic, easy control & operation
(ii) Reduction of labour costs
(iii) Stabilization of operating conditions
(iv) Uniform particle mixing.
(v) " temp. gradients

Disad! → (i) Increased reactor vessel size.
(ii) Particle entertainment
(iii) Erosion of internal components
(iv) Pressure drop



Packed Bed Reactor

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