Introduction to USP – What is a Bioreactor?

Your Objectives:

At the end of the lesson, you should be able to distinguish different types of bioreactors.

The Bioreactor vessel

A **large-scale** [ ] is a closed mechanical system designed to contain and grow genetically engineered cells at large-scale commercial [ ]. A bioreactor is built according to strict [ ] guidelines and is designed to control all [ ] parameters critical to cell growth.

A **stirred tank bioreactor** will typically be cylindrical with a curved [ ]. Its curved base assists in the mixing of vessel contents.

The bioreactor vessel itself is a double-walled, glycol-jacketed, sanitary pressure vessel designed to provide primary containment for the cell culture.

The bioreactor **vessel wall** consists of four layers:

Interior wall

The interior wall provides the sterile contact [ ] for the cell culture and is made of [ ] steel. It is electropolished to produce a smooth, cleanable **finish***. Electropolishing is an [ ] method of smoothing,

deburring, polishing and cleaning stainless steel. This process also improves [ ] to corrosion.

***** A 'finish' is a particular surface texture (e.g. on wood, metals, or other materials) designed to give a [ ] condition.

Glycol jacket

The glycol jacket is a heat-transfer surface welded to the outside of the interior wall. The jacket serves as a heat exchanger to [ ] the cell culture temperature inside the bioreactor vessel.

Glycol jackets can be one of two types:

- dimpled
- half-pipe

Glycol is basically pumped into the base of the jacket and exits through the top. This flow path is designed to eliminate air pockets that might [ ] the efficiency of the heat transfer.

Insulation

Located between the glycol jacket and the outer sheath is a layer of fire-retardant insulation that reduces [ ] loss of the bioreactor [ ].

Outer sheath

The outer sheath is the [ ] layer of the bioreactor. It envelops both insulation and glycol jacket. In contrast to the mechanically polished and electropolished

interior wall, the surface of the outer sheath is finished by [ ] polishing only. The outer sheath is not part of any sterile operation, though.

Watch this useful YouTube video on fermentation processing: https://youtu.be/5eKdZ0dVCCo?t=144

Principle types of bioreactor

Stationary bioreactors (i.e. where cell cultures are not [ ])

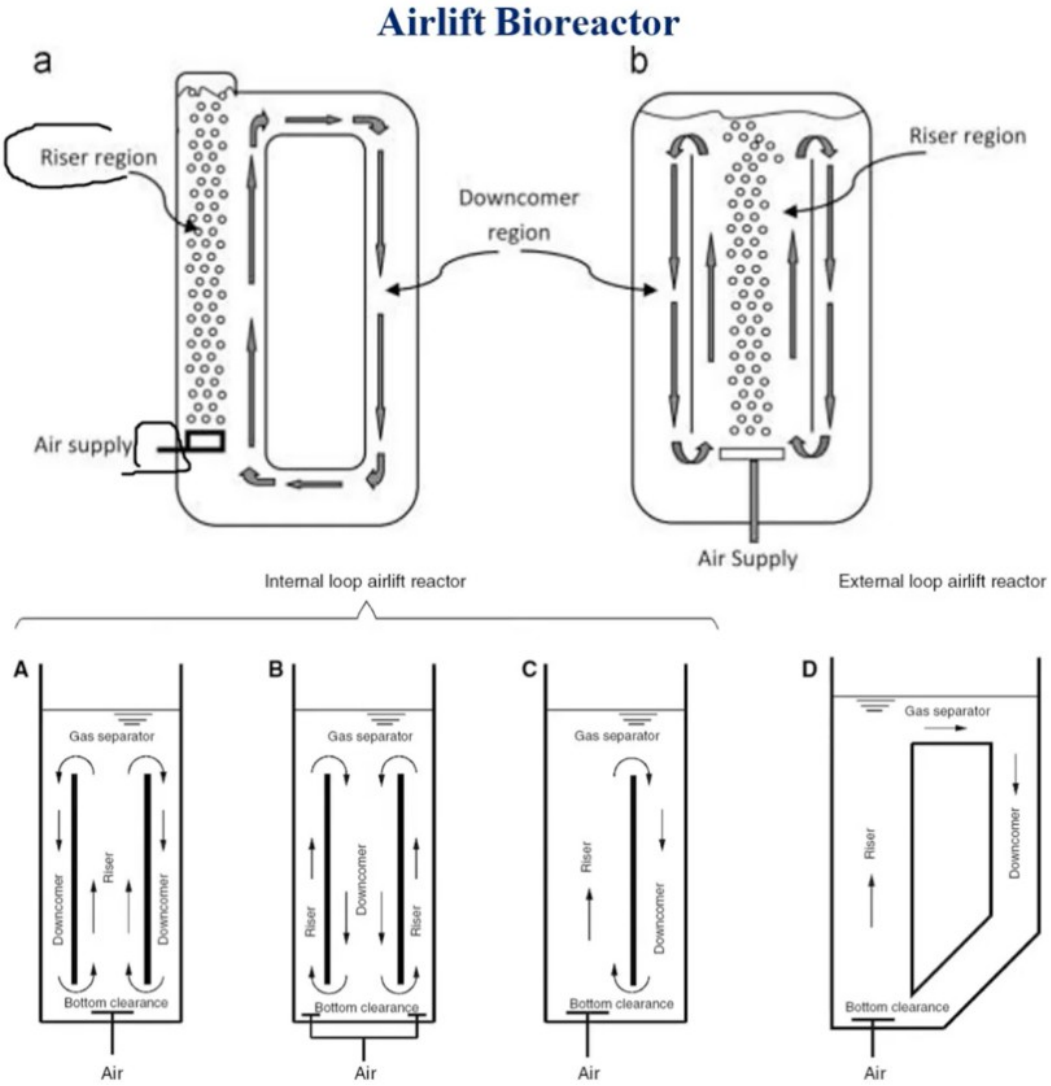
- T-flasks, 6-well plates, microtitre plates, roller bottles, shake [ ] (etc.)

[ ] agitated bioreactors

- Stirred tank bioreactors**,** spinner flasks, Wave bioreactors

Gas [ ] bioreactors

- Airlift reactors*



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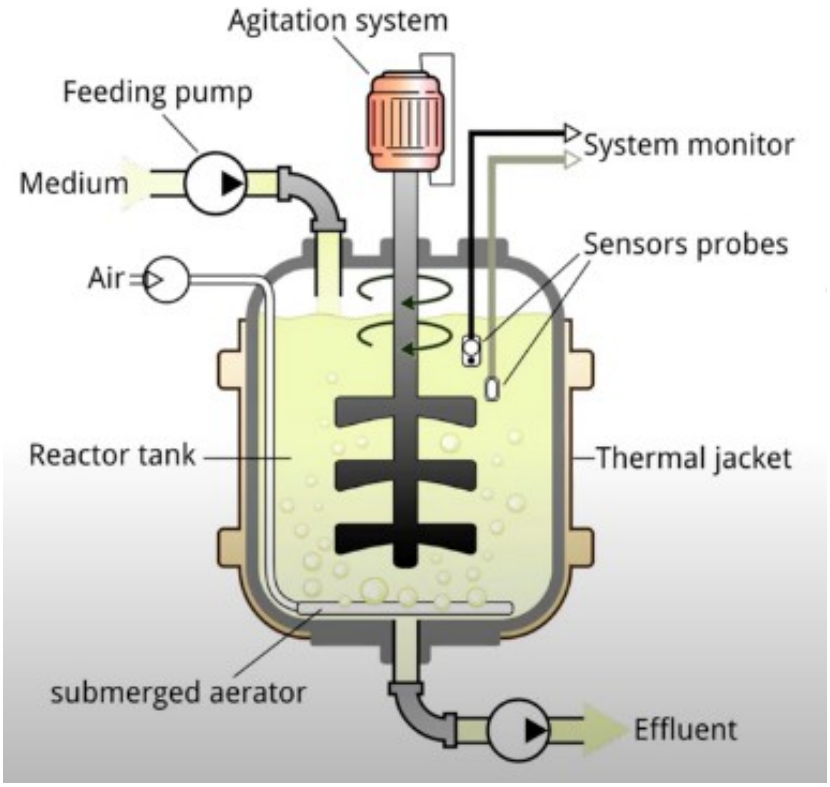
An ALR, or airlift reactor, is a pneumatically-driven bioreactor especially suitable for large-scale culture of immobilized plant cells.

Fluid agitated bioreactors (stirred-tank)

- Fixed bed bioreactors, fluidized-bed bioreactors



Membrane bioreactors

- Hollow fibre reactors, Transwells®

Modes of operation of a bioreactor

- This is different to other types of bioreactors
- The four (4) different modes of operation are:
    - Batch
    - Fed-batch
    - Continuous
    - Perfusion

- All types of bioreactors can be [ ] in any of the four modes of operation.
- The modes of operation are determined by whether, and how, a medium is supplied to the culture.

Aufgabe Lückentext:

Folgende Wörter bitte in den Lückentext einfüllen.
Jedes Wort kommt einmal vor.
Bitte Gross- und Kleinbuchstaben beachten.

agitated, agitated, bioreactor, base, culture, desired, decrease, electrochemical, flasks, heat, mechanical, Mechanically, operated, resistance, regulate, sanitary, stainless, surface, volumes, vessel, visible