

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.)

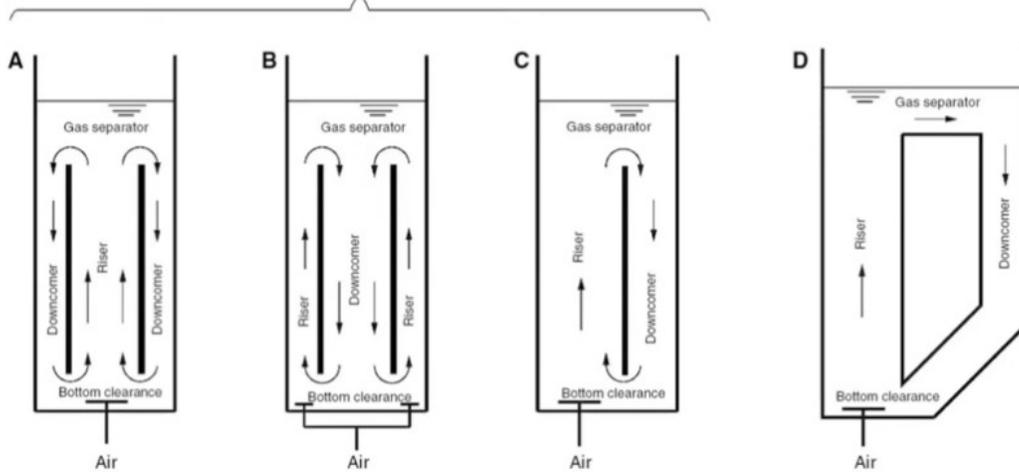
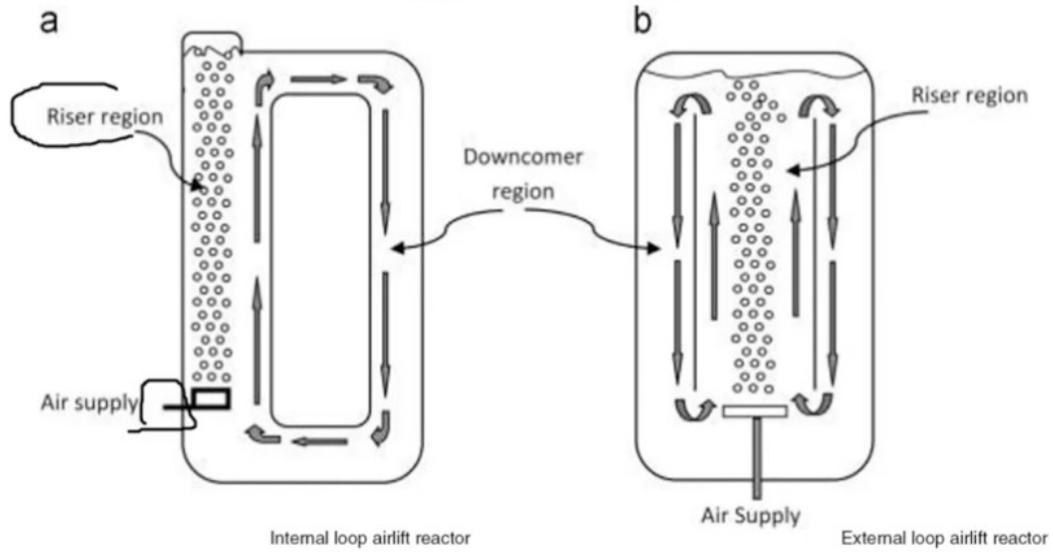
agitated bioreactors

- Stirred tank bioreactors, spinner flasks, Wave bioreactors

Gas bioreactors

- Airlift reactors*

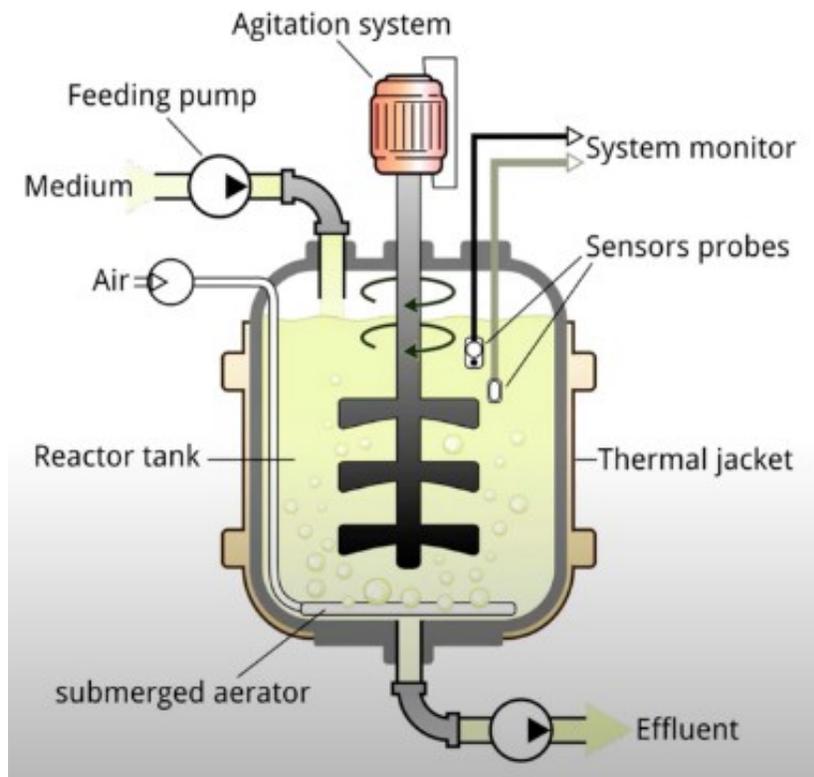
Airlift Bioreactor



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