Frequently Asked Questions (FAQs)

Q1: What do you mean by a fermenter?

Ans: A fermenter (bioreactor) is a closed vessel with adequate arrangement for aeration, agitation, temperature and pH control, and drain or overflow vent to remove the waste biomass of cultured microorganisms along-with their products. It is also called as heart of fermentation or bioprocess technology.

Q2: What are the two basic types of fermenters?

Ans: The two basic types of fermenter are:

- 3. A glass vessel with a round or flat bottom and a top flanged carrying plate .The large glass containers originally used were borosilicate battery jars. All vessels of this type have to be sterilized by autoclaving. The largest practical diameter for glass fermenters is 60 cm.
- 4. A glass cylinder with stainless-steel top and bottom plates these fermenters may be sterilized in situ, but 30 cm diameter is the upper size limit to safely withstand working pressures (Solomons, 1969). Vessels with two stainless steel plates cost approximately 50% more than those with just a top plate.

Q3: Explain the use of computer in fermenters?

Ans: Computer technology has produced a remarkable impact in fermentation work in recent years and the computers are used to model fermentation processes in industrial fermenters. Integration of computers into fermentation systems is based on the computers capacity for process monitoring, data acquisition, data storage, and error-detection. Some typical, on-line data analysis functions include the acquisition measurements, verification of data, filtering, unit conversion, calculations of indirect measurements, differential integration calculations of estimated variables, data reduction, and tabulation of results, graphical presentation of results, process stimulation and storage of data.

Q4: Briefly mention downstream processing?

Ans: Downstream processing refers to the recovery and purification of biosynthetic products, particularly pharmaceuticals, from natural sources such as animal or plant tissue or fermentation broth, including the recycling of salvageable components and the proper treatment and disposal of waste. The downstream part of a bioprocess refers to the part where the cell mass from the upstream are processed to meet purity

and quality requirements. Downstream processing is usually divided into three main sections:

- Cell disruption,
- A purification section and
- A polishing section.

Q5: What do you mean by fermentation?

Ans: Fermentation is an anaerobic process in which energy can be released from glucose even though oxygen is not available. Fermentation occurs in yeast cells, and a form of fermentation takes place in bacteria and in the muscle cells of animals.

Q6: What is the importance of yeast in the food process?

Ans: Yeast is a living organism used in bread (to make it rise), beer, wine, and spirits (to make ethanol). In bread dough the yeast will consume the natural sugars in the flour as soon as water is added. As it consumes the sugars ferments producing pockets of CO_2 and alcohol. When baking, the heating process gets rid of the ethanol to leave the pockets, making the bread light and fluffy.

Q7: What is a bioreactor and what is it used for?

Ans: A bioreactor may refer to any manufactured or engineered device or system that supports a biologically active environment. In one case, a bioreactor is a vessel in which a chemical process is carried out which involves organisms or biochemically active substances derived from such organisms. Bioreactors are used in the biotechnological production of substances such as pharmaceuticals, antibodies, or vaccines, or for the bioconversion of organic waste.

Q8: What is a dilution rate?

Ans: The rate of nutrient exchange is expressed as the dilution rate (D). At steady state, the specific growth rate (μ) of the micro-organism is equal to the dilution rate (D). The dilution rate is defined as the flow of medium per time (F) over the volume of culture (V) in the bioreactor.

Q9: What is fed batch culture?

Ans: Fed-batch culture is, in the broadest sense, defined as an operational technique

in biotechnological processes where one or more nutrients (substrates) are fed (supplied) to the bioreactor during cultivation and in which the product(s) remain in the bioreactor until the end of the run.

Q10: Explain photo-bioreactor with important functions?

Ans: Photo-bioreactors are used for precise phototrophic cultivation of algae and cyanobacteria. Photo-bioreactors are equipped with a flat-vessel design that enables bringing uniform illumination over the whole volume of cultivated culture. The various advantages of photo-bioreactor include:

- Cultivation of algae is in controlled circumstances, hence potential for much higher productivity
- Large surface-to-volume ratio. PBRs offer maximum efficiency in using light and therefore greatly improve productivity. Typically the culture density of algae produced is 10 to 20 times greater than bag culture in which algae culture is done in bags – and can be even greater.
- Better control of gas transfer.
- Reduction in evaporation of growth medium.
- More uniform temperature.

Q11: What is a fluidized bed and fluid bed reactor?

Ans: A fluidized bed is a physical phenomenon occurring when a quantity of a solid particulate substance (usually present in a holding vessel) is placed under appropriate conditions to cause a solid/fluid mixture to behave as a fluid. A fluidized bed reactor (FBR) is a type of reactor device that can be used to carry out a variety of multiphase chemical reactions.

Q12: What is the meaning of fluidization?

Ans: Fluidization (or fluidisation) is a process similar to liquefaction whereby a granular material is converted from a static solid-like state to a dynamic fluid-like state. This process occurs when a fluid (liquid or gas) is passed up through the granular material.

Q13: What is the importance of cooling jacket in industrial fermenter?

Ans: Cooling jacket is necessary because sterilization of the nutrient medium and removal of the heat generated are obligatory for successful completion of the

fermentation in the fermenter. For very large fermenters, insufficient heat transfer takes place through the jacket and therefore, internal coils are provided through which either steam or cooling water is run.

Q14: Distinguish between sparger and impeller?

Ans: The sparger is typically just a series of holes in a metal ring or a nozzle through which filter-sterilized air (or oxygen-enriched air) passes into the fermenter under high pressure. The air enters the fermenter as a series of tiny bubbles from which the oxygen passes by diffusion into the liquid culture medium.

The impeller (also called agitator) is an agitating device necessary for stirring of the fermenter. The stirring helps in mixing the gas bubbles through the liquid culture medium and it also mixes the microbial cells through the liquid culture medium. In this way, the stirring ensures uniform access of microbial cells to the nutrients.

Q15: Sealing between top plate and vessel is an important criterion in a fermenter. Explain why and how it is done?

Ans: Sealing between top plate and vessel is an important criteria to maintain airtight condition, aseptic and containment. Sealing have to be done between three types of surfaces viz. between glass-glass, glass- metal and metal-metal. There are three types of sealing. They are gasket, lip seal and 'O' ring. This sealing ensures tight joint in spite of expansion of vessel material during fermentation. The materials used for sealing may be fabric-nitryl or butyl rubbers. The seals should be changed after finite time. There are two way of sealing in O ring type simple sealing and double sealing with steam between two seals.