**Bioseparation** **Lab1**

**Upstream processing:**

Refers to the production of bio - product in the raw form. In biochemical engineering, this part is divided into some steps which include growing microbes for culturing process (inoculum development), media development, improvement of inoculum (by genetic engineering process) and optimization of growth kinetics so that product development: can be improved significantly

 **Downstream processing:**

Refers to the extraction and purification of the desired (wanted) product which include: recovery of product, purification and a polishing section. If it is in bio- separation process, the downstream refers to steps of separation which are removal of all impurities and product isolation. The first step includes removal of insoluble cells and separate them from broth media which can be done by choosing one of different methods like settling, flocculation, flotation, filtration and centrifugation.

 The second step of separation depends on the position of the desired product if it released to outside of cells in culture media we don’t use separated cells, we just use broth media for other steps of separation, but if it was just inside the cells we remove and threw the media and use the cells for other steps of separation by cell wall disintegration to release the desired product in to prepared buffer with all impurities inside the cells. A process of new bio-products separation techniques done by increasing the separation selectivity (extraction, purification and formulation).

**Basis of separation in bioseparation processes:** Biological products are separated based on one or more of the following factors:

1. **Size:** e.g. filtration, membrane separation, centrifugation

 2. **Density:** e.g. centrifugation, sedimentation, floatation

3. **Diffusivity:** e.g. membrane separation

4. **Shape:** e.g. centrifugation, filtration, sedimentation

5. **Polarity:** e.g. extraction, chromatography, adsorption

6. **Solubility:** e.g. extraction, precipitation, crystallization

7. **Electrostatic charge:** e.g. adsorption, membrane separation, electrophoresis

8. **Volatility:** e.g. distillation, membrane distillation, pervaporation