

Cell Disruption Technology

Cellular disruption is a biotechnological method to release the biological molecules including organelles, proteins, DNA, RNA and lipids from inside a cell. Microorganisms produce many molecules or compounds that have biotechnological importance. Therefore genetic engineering were applied to such microorganisms to produce certain proteins, plasmids, polysaccharides and other biotechnological molecules which are either **Extracellular or Intracellular**

General Considerations in Selecting Cell Disruption Methods

Certain disruption methods may not be suitable for all types of cells. For example, ultrasound methods generate heat that can destroy organelles and alter the configuration of biological molecules; while shearing systems like blenders and ball mills can shatter the cell contents as well as the cell walls. Also, the amount of energy required to break the cell depends on the type of organism. Some cells can be easily broken by gentle treatment such as osmotic shock (e.g., animal cells) while other types of cells require more force (e.g., yeast cells and plant cell).

Factors Affecting the Yield of Product

- a. Location of product with in the cell.
- b. Degree of disintegration.
- c. Extent of denaturation of the product during disruption.

To achieve a good yield.

1. Minimize the number of steps.
2. Choose appropriate disruption methods.

Cell disruption methods can be classified into two categories:

1. Mechanical Methods (physical methods).
2. Non-mechanical methods (chemical methods).

Mechanical Methods (physical methods)

1. Mixers and blenders, grind cells coarsely.
2. Coarse grinding: by using pestle and mortar, useful for disruption for tissue sample, such as plant and animal tissue.
3. Fine grinding: the bead mill useful for disruption of microorganisms, by using glass beads with agitation.
4. Homogenizations. Its high mechanical methods for cell disruption include fluid processing systems that are used extensively for homogenization and disaggregation of a wide range of biological materials. (Such as chloroplast materials, unicellular organisms, homogenates of animal tissue and other biological particles)
5. Ultrasonic vibrations by using sonicator. (Having frequency greater than 18 kHz can be used to disrupt cells) useful for disruption of microorganisms. Mechanical disruption methods do not need chemicals that interfere with subsequent purification step.

Non-mechanical Methods (Chemical and Physicochemical Methods)

- 1- Detergents: disrupt the structure of cell membranes by solubilizing their phospholipids and are mainly used to rupture mammalian cells.
- 2- Enzymes: lysozyme is used for microorganisms; it lyses bacterial cell walls, mainly those of the gram positive type. The combination of lysozyme and a detergent used for gram negative type. Pectinase and cellulase treatment for plant , lipase and protease for animal .
- 3- Organic solvents: like acetone, chloroform, and ether mainly act on the cell membrane by solubilizing its phospholipids and denaturing its proteins.
- 4- Osmotic shock: is mainly used to lyse mammalian cells.

Marker Substance for Cell Disruption

To determine the degree of cell disruption, marker techniques are used

1. Biological: visible cell counting.
2. Physical: measuring the Vol. of intact cells, O.D., viscosity of the sample.
3. Chemical: measuring the protein concentration.