BY: Infinity Supercritical Staff TAGS: Supercritical CO2 Oil Extraction, Cannabis, Oil Concentrates

Plant Cell Pressure | Strength of Plant Cell Walls | Ways to Break Cell Walls

http://www.infinitysupercritical.com

Technology Review of Cell Lysis Methods | Blog | Industry Series | July 2017 7/17/2017

How to Break Down Cell Walls:

Mechanical:

-Grinding: Mortar and pestle, which is often done with plants frozen in liquid nitrogen.

-Beadbeating: Cracking open cells using ceramic or glass beads, typically done in suspension and in a vortex.

-Sonification: Using ultrasound with plant matter in a solution, by cavitation shockwave.

-Homogenizer: Shear force by forcing cells through tubes smaller than cells, by rotor-stator (rotating blade) or outer layer shear (French Press).

REF: http://bitesizebio.com/13536/bringing-down-the-walls-part-ii-8-methods-to-break-

-Freezing: Cell rupture from freeze thaw process. Can take lots of time.

-High Temperature (and Pressure): Cells walls are disrupted, but denatures proteins, and heat can damage cell contents. Typically by autoclave, microwave, steam, etc.

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Non-Mechanical Methods:
-Enzymes: Remove cell wall by using naturally occurring enzymes.
-Chemicals: Organic solvents like ethanol (alcohol), especially for hydrophobic (doesn't like water) molecules. Commonly used with shearing forces.
-Bacteria: EDTA, negative bacteria, to chelate cations that bore holes in cell walls.

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Cell Lysis Methods:
Reagent Based Methods:
-Fast, efficient, reproducible
-Can extract total protein or subcellular fractions
-Disrupts cell wall and or lipid membrane

https://www.thermofisher.com/us/en/home/life-science/protein-biology/protein-biology-learning-center/protein-biology-resource-library/pierce-protein-methods/traditional-methods-cell-lysis.html

Cell Lysis Methods:
Physical Methods:
-Expensive equipment
-Larger footprint for equipment
-Less reproducible
-Not compatible with high-throughput and small volumes
-Aggregation and denaturation of protein may occur
-Cells disrupt at different times

https://www.thermofisher.com/us/en/home/life-science/protein-biology/protein-biology-learning-center/protein-biology-resource-library/pierce-protein-methods/traditional-methods-cell-

Tensile Strength of Cell Walls

Cylindrical Cell Shape: 100 atm or 1,470 psi
Spherical Cell Shape: 95 atm or 1,396 psi
Spherical Cell Shape: 30 atm or 441 psi

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1074911/pdf/plntphys00593-0165.pdf

Plant Cell Vacuoles

The central vacuole (may be 80 percent of space) is a membrane bound sac which provides cell support and helps the plant function with growth.

Turgor Pressure: Vacuoles help to maintain and control the rigidity of the cell (structure), by compensating the osmotic pressure from within the cell and pressure exerted from outside the cell.

https://micro.magnet.fsu.edu/cells/plants/vacuole.html

Additional Reading:

Cannabis sativa: The Plant of the Thousand and One Molecules

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4740396/

Cell Disruption Using a Microfluidizer

Using a Microfluidizer versus a French Press using the same 20,000 psi back pressure, resulted in 92 percent breakage in 8 passes, versus only 50 percent breakage for the French Press in 7 passes.

https://www.microfluidicscorp.com/sites/default/files/application-note-cell-disruption-publication-summaries.pdf

Practical Use of Continuous Processing in Developing and Scaling Up Laboratory Processes

Continuous flow reactors allow for better control of exothermic processing than do batch reactions, and allow for a more efficient and safe scale-up of rapid reactions in a smaller footprint.

http://pubs.acs.org/doi/abs/10.1021/op0100605?journalCode=oprdfk