

BME449 Tissue Engineering



Lecture #12 Scaffolds in Tissue Engineering-II

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PARTICLE AGGREGATION

FREEZE DRYING

FREEZE DRYING

Properties

- Removal of water at low temperature
- Ease of reconstitution
- Compatible with aseptic operations
- More precise fill weight control
- Done properly, the freeze-dried solid has relatively high specific surface area, which promotes rapid, complete reconstitution

FREEZE DRYING

Disadvantages

- The drug may not be stable as a freeze-dried solid
- A pore size distribution (from center to the sides) can occur.
- Interconnectivity is not very high.
- Many biological molecules are damaged by the stresses associated with freezing, freeze-drying, or both
- Not all solutes can be freeze-dried to form a pharmaceutically acceptable cake
- Cost may be an issue, depending on the product

THERMALLY INDUCED PHASE SEPERATION

The temperature of a polymer solution is decreased to induce a phase separation into two phases, one having a high polymer concentration (polymer-rich phase) and one having a low polymer concentration (polymer-lean phase).

CENTRIFUGATION METHOD

SUPERCRITICAL CO₂ METHOD

FIBER PRODUCTION METHODS

Melt-spinning

Dry-spinning

Wet-spinning

Fiber bonding technique

Production of 3D scaffolds from fibers

KNITTED

BRAIDED

WOVEN

NONWOVEN

ELECTROSPINNING

Taylor cone: A Taylor cone is caused by equilibrium between the electric force of the charged surface and the surface tension. A higher voltage leads to an elongated cone; when it exceeds its threshold voltage, a jet is emanated.

ELECTROSPINNING

Collector types

Single ground

rotating ground

Dual bar

Dual ring

Single horizontal ring

Electrospinning in vitro onto cells

Dual spinneret

Electrospinning cells with polymer

Electrospinning +electrospraying
With parallel spinneret

Electrospinning +electrospraying
With perpendicular spinneret

SOLID FREEFORM FABRICATION

SFF= Rapid Prototyping; is a collective term for a group of technologies that can manufacture objects in a layer-by-layer fashion from the 3D computer design of the object

- 1) Data input
- 2) Data file preparation
- 3) Object building

Types:

- 3D printing (3DP)
- Fused Deposition Modelling (FDM)
- Ink-jet Printing and indirect casting (IC)
- Stereolithography (SL)
- Selective Laser Sintering (SLS)