2022/2023

Fifth Stage

First Semester/ Industrial Pharmacy II

Microencapsulation

Lectures 14

13/12/2022

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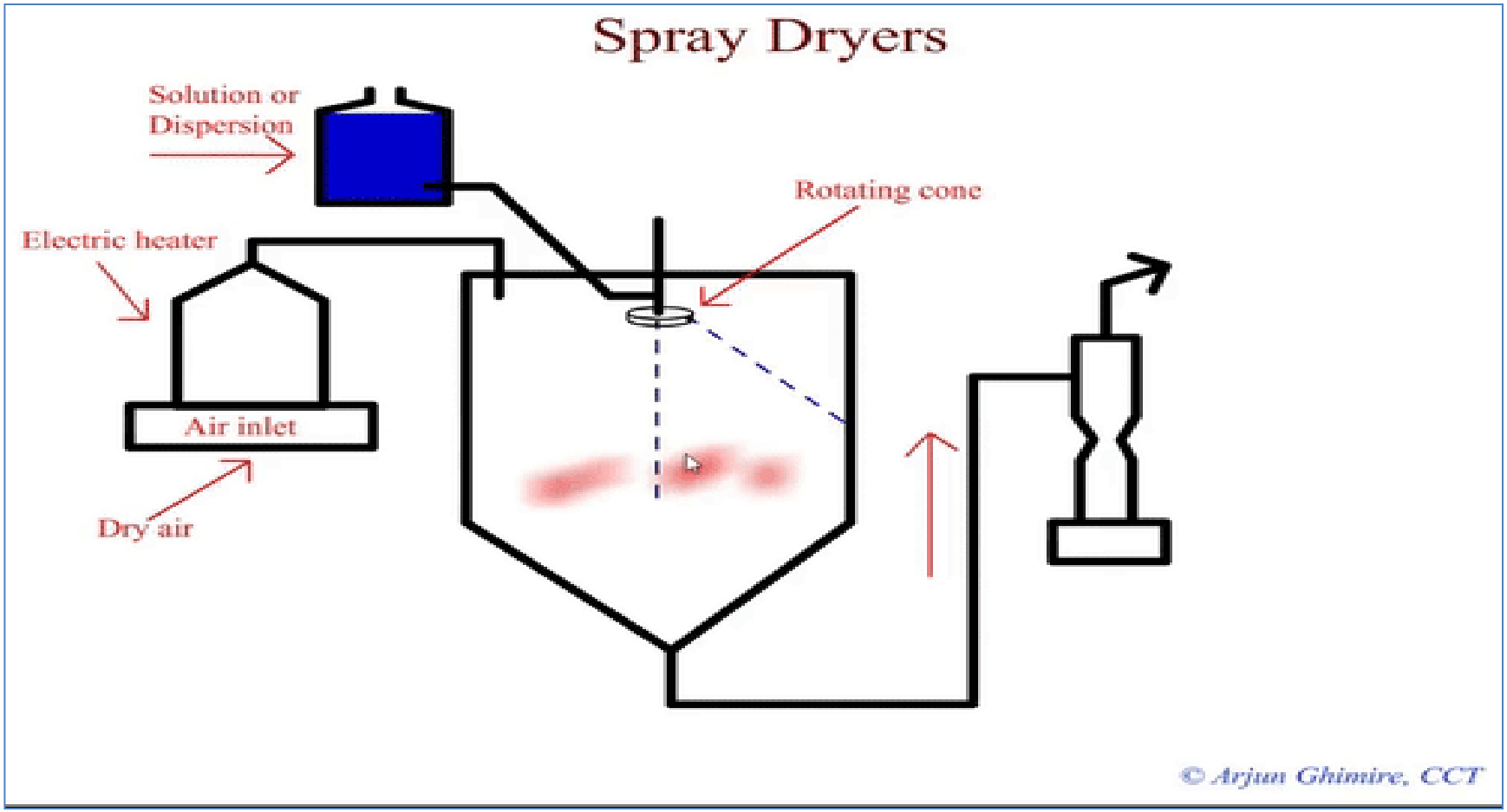

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- ✓ Involve dissolving of the wall material in a volatile solvents, and the core material is dispersed within it.
- ✓ Spraying of dispersion (the mixture) as droplets into the warmed chamber of equipment.
- ✓ Drying at low temperature, so can be used for encapsulation of heat sensitive drugs (like proteins).
- ✓ Collection of the free flow, dry microcapsules (with spray dried particles properties) within a cyclone.

Coacervation phase separation

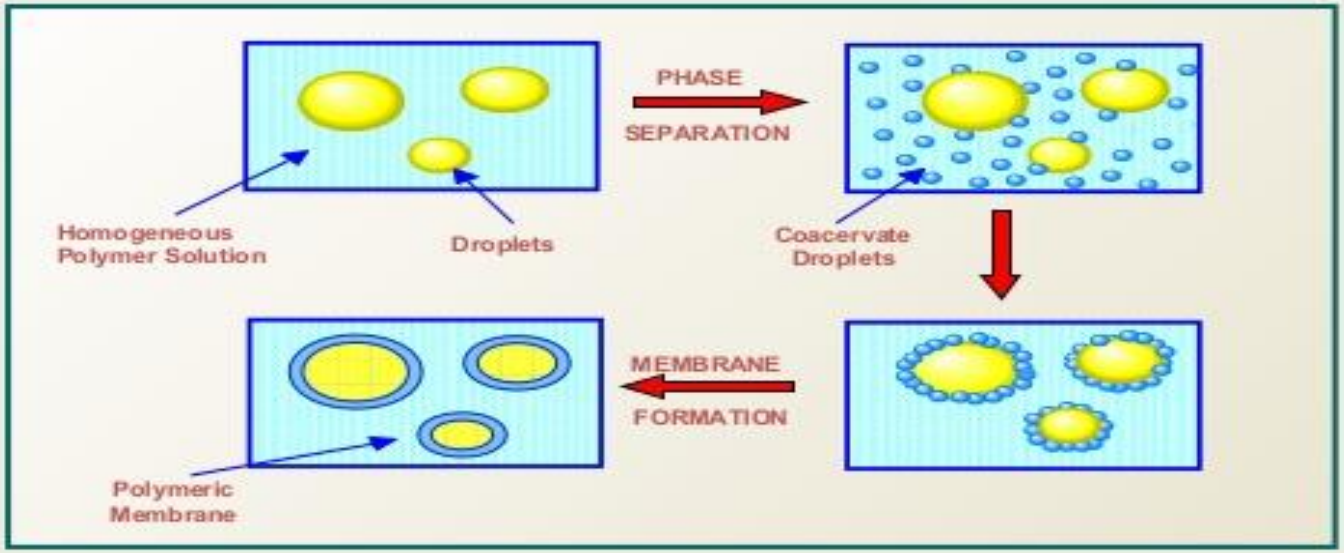
Involves three main steps,

1) Stabilization of three phase system ?? by coacervation, in which the core materials are coated with the wall material and the resulted microcapsules are dispersed in the liquid carrier medium.

2) The dispersed particles of core are continuously coated with the wall materials.

3) Hardening of the microcapsules wall using a suitable hardening agents

COACERVATION / PHASE SEPARATION



1. Formation of three immiscible phase
2. Deposition of coating
3. Rigidization of coating.

Other steps may be involved like:

1) Washing with suitable solvent (aq. or organic)
2) Drying at suitable conditions
3) Collection of yield to be evaluated

Monitoring of microcapsules formation within process is needed using microscopes to get idea about the time required for process and microcapsules quality.

- The coacervation or phase separation can be induced by different effects resulting into simple (containing single wall material) or complex (contain complex wall material) coacervation:

1) Temperature change ----------simple
2) Addition of non-solvent---------simple
3) Addition of salt (salting out)---------simple
4) Incompatible polymer addition---------simple
5) Polymer-polymer interaction (complex coacervation)

Temperature Change effect

- The phase separation of the dissolved polymer particles occurs in the form of immiscible liquid droplets and if the core materials are present in the system, under proper conditions (polymer concentration, temperature and agitation), the liquid polymer droplets coalesce around the dispersed core particles, thus forming microcapsules (simple coacervates).

- The temperature change <u>alone</u> is used to induce phase separation, assuming a mono-disperse polymer system, so decrease the temperature may result in formation of two phases: one phase becomes polymer-poor (the microencapsulation vehicle phase) and second phase (the wall material phase) becomes polymer-rich.

Ex. For Binary system of EC+ Cyclohexane for water soluble drug X (EC:X ratio is 2:1)

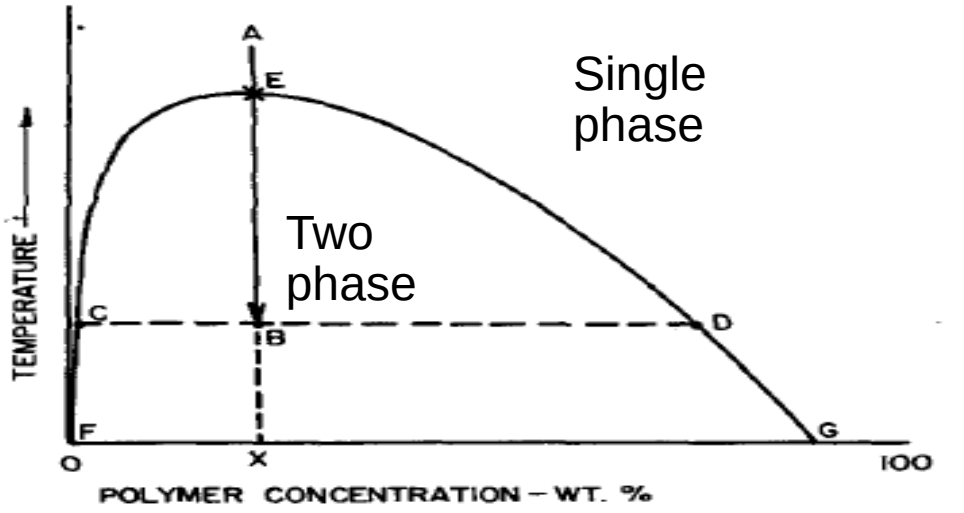


FIG. 13-39. *General phase diagram—coacervation induced thermally. (From Bakan.[28])*

Non solvent addition

A liquid that is a non solvent for a given polymer can be added to a solution of the polymer to induce the phase separation.

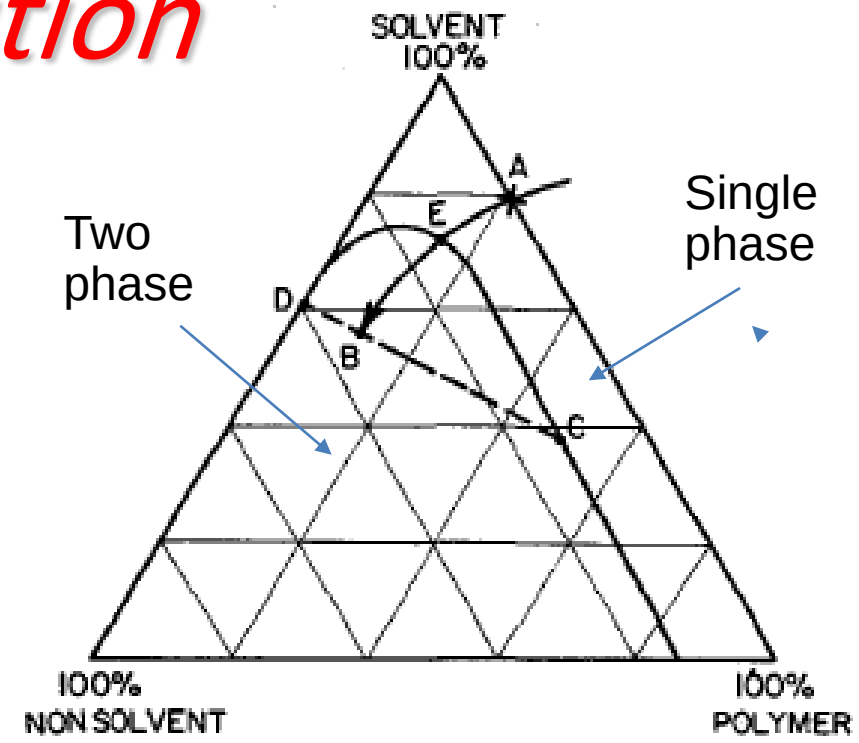
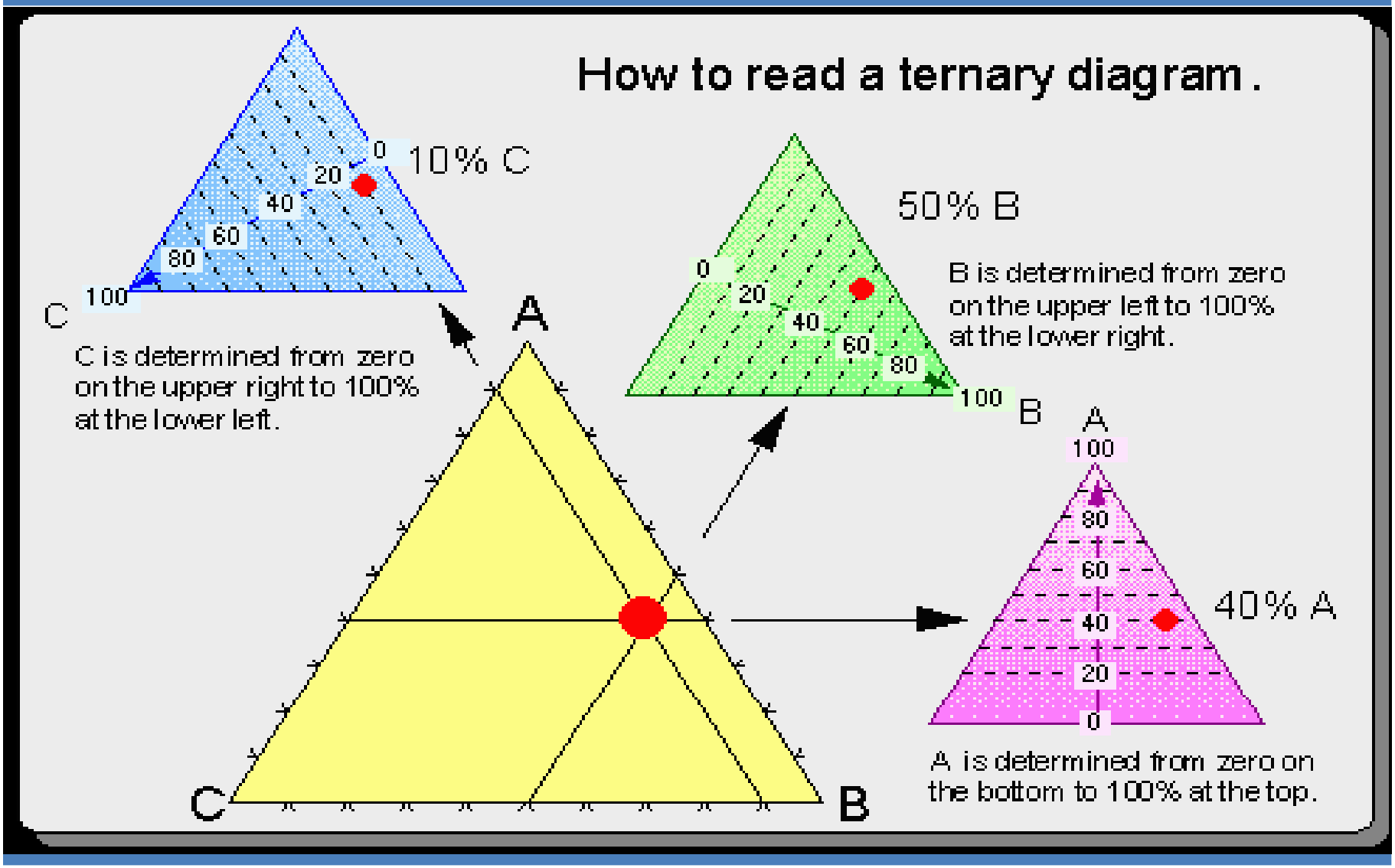


FIG. 13-41. *General phase diagram for phase-separation/ coacervation induced by the addition of a nonsolvent.*


How to read a ternary diagram.
10% C
0
20
40
60
80
100
C
C is determined from zero on the upper right to 100% at the lower left.
50% B
0
20
40
60
80
100
B
B is determined from zero on the upper left to 100% at the lower right.
A
C
B
A
100
80
60
40
20
0
40% A
A is determined from zero on the bottom to 100% at the top.