2022/2023

Fifth Stage

First Semester/ Industrial Pharmacy II

Microencapsulation

Lectures 16

19 /12 /2022

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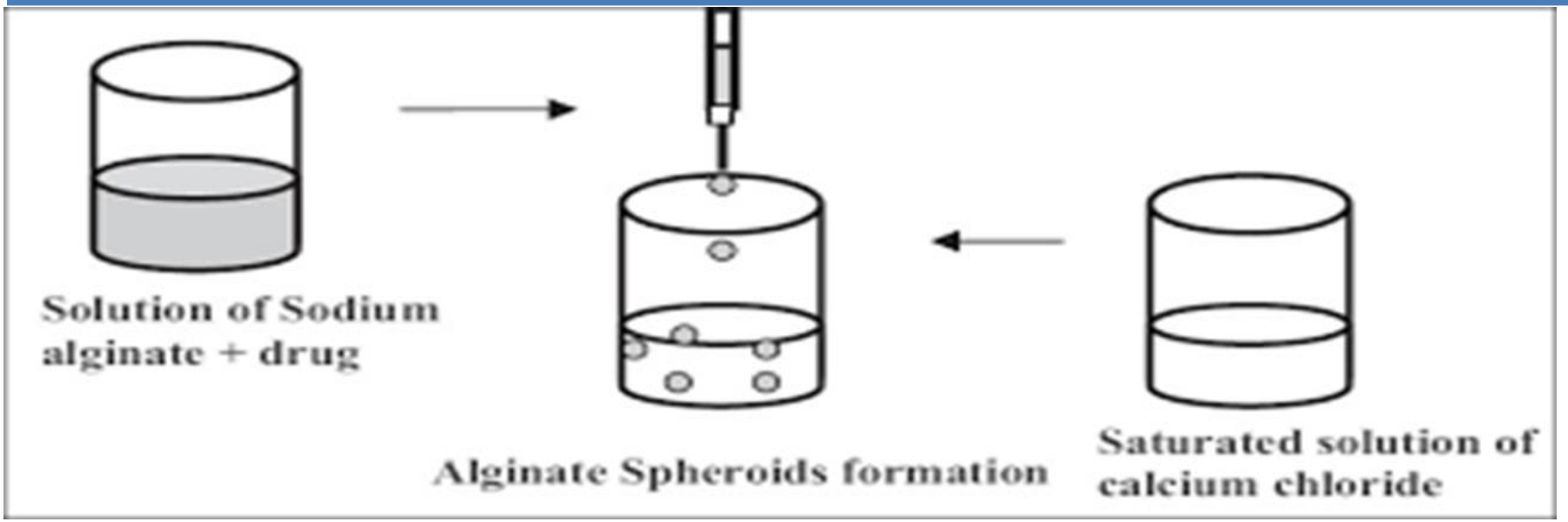
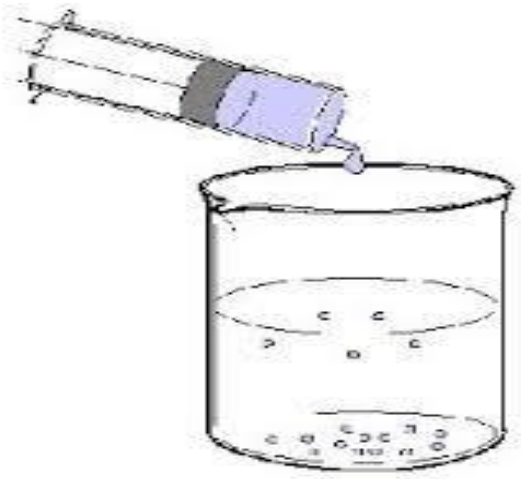
Gelation

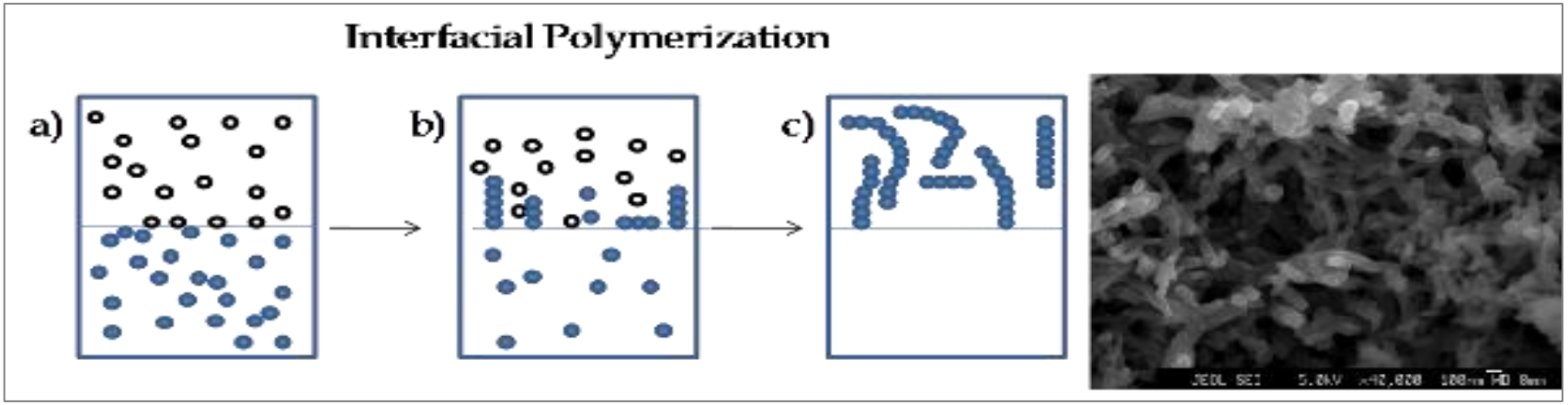
- Is **a specific method** using alginate salts (like sodium) as a wall material by forming gels from reaction with calcium salts (ex, 1-2% of calcium chloride).
- The method involve dissolving of polymer into water, dispersing of the core into polymer solution, dropping into calcium chloride solution to form calcium alginate beads or spheroids of drug (beads are aggregates of microcapsules).

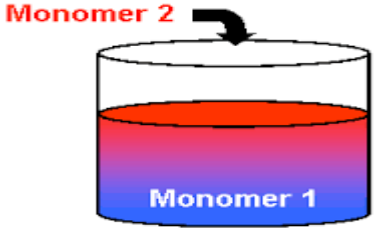

Solution of Sodium alginate + drug
Alginate Spheroids formation
Saturated solution of calcium chloride



Interfacial polymerization

- Involves the condensation of two monomers at the interface of the organic and aqueous phases (like water and n-hexane), forming the polymeric membrane.





Note:

For each methods there are factors affecting the quality of microcapsules, which are either general or specific ??.

As general factors are:

1) Polymer type and amount

2) Core type and amount

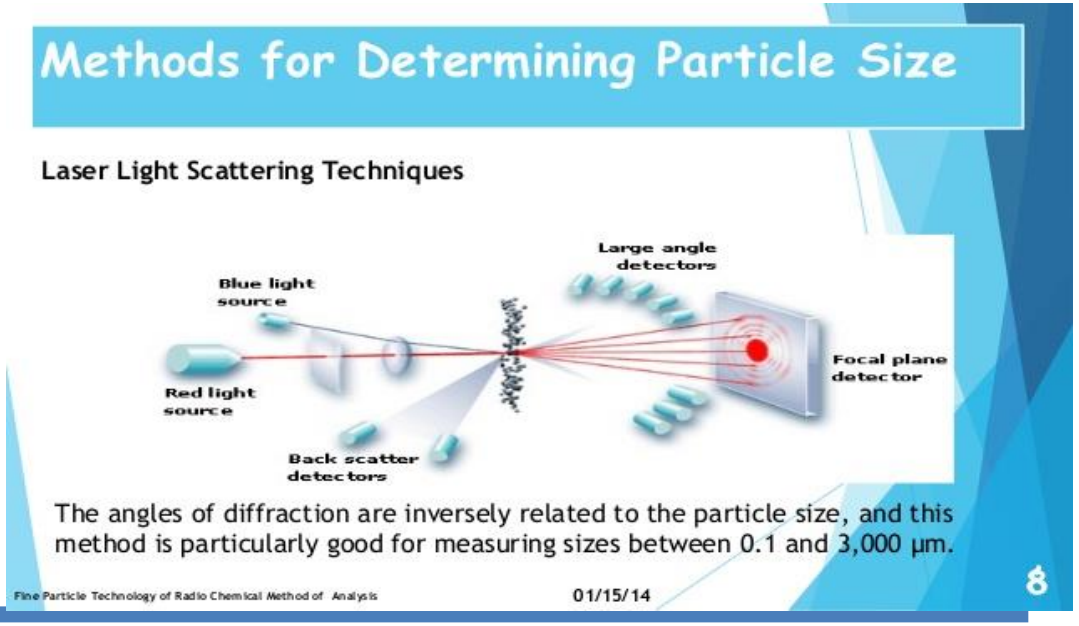
3) Solvent system type and amount

4) Core: wall ratio

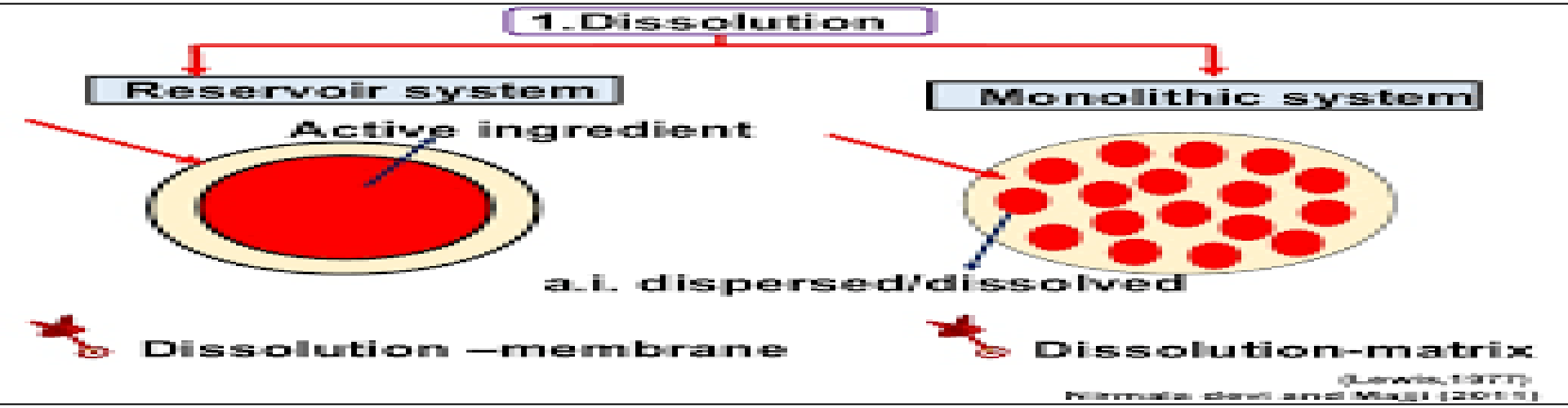
Evaluation of microcapsules

Generally involves:

1) Particle size analysis (size, homogeneity and shape) using microscopical methods and light / laser scattering methods.



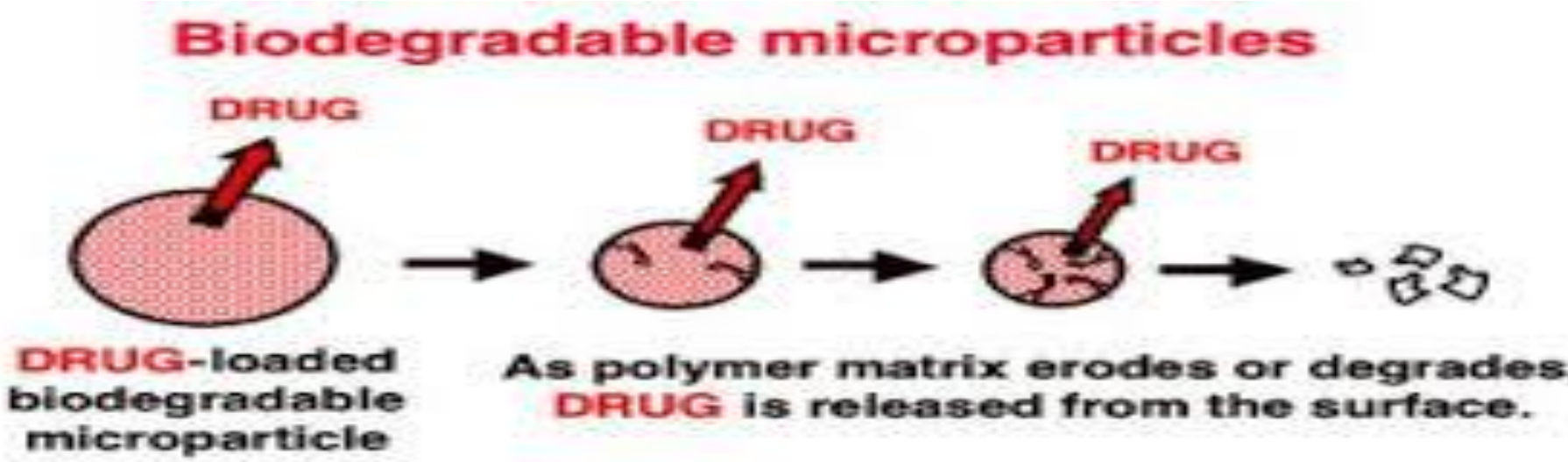
2- Yield % and encapsulation efficiency %
3- Thermal analyses (DSC, DTA and TGA): are important for detection if there are physical incompatibilities.
4- FTIR study (for chemical incompatibilities)
5- Stability study
6- Study of release mechanisms : mainly depend on the shape of microparticles.



The release mechanisms

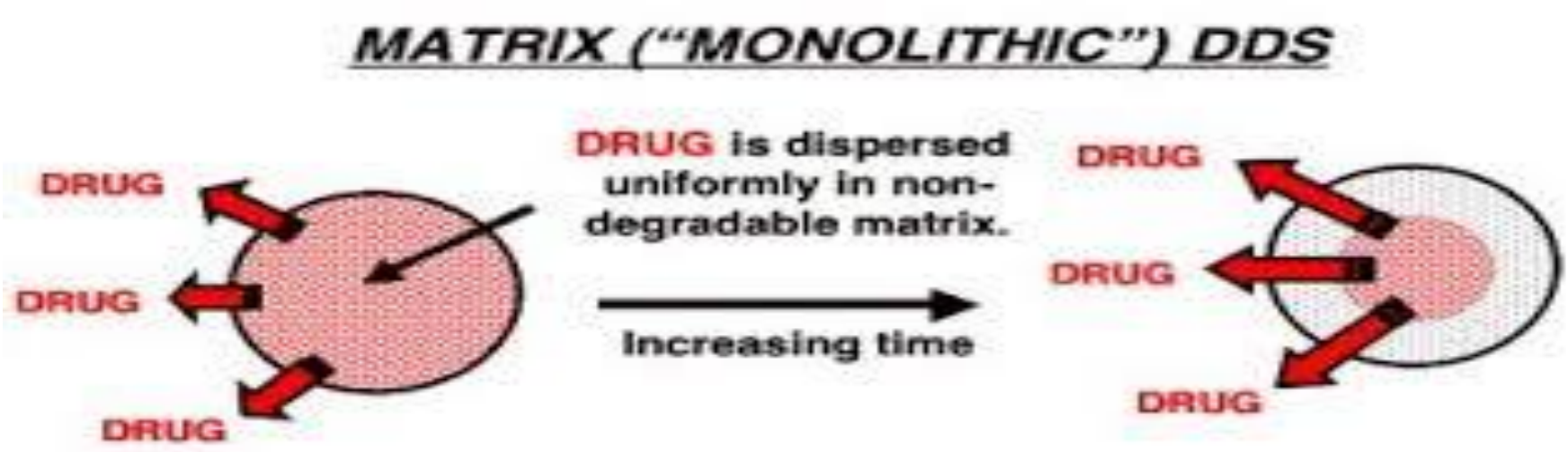
1) Degradation controlled monolithic system:

- The drug is dissolved in matrix and is distributed uniformly through out. The drug is strongly attached to the matrix. The diffusion of the drug is slow as compared with degradation of the matrix.



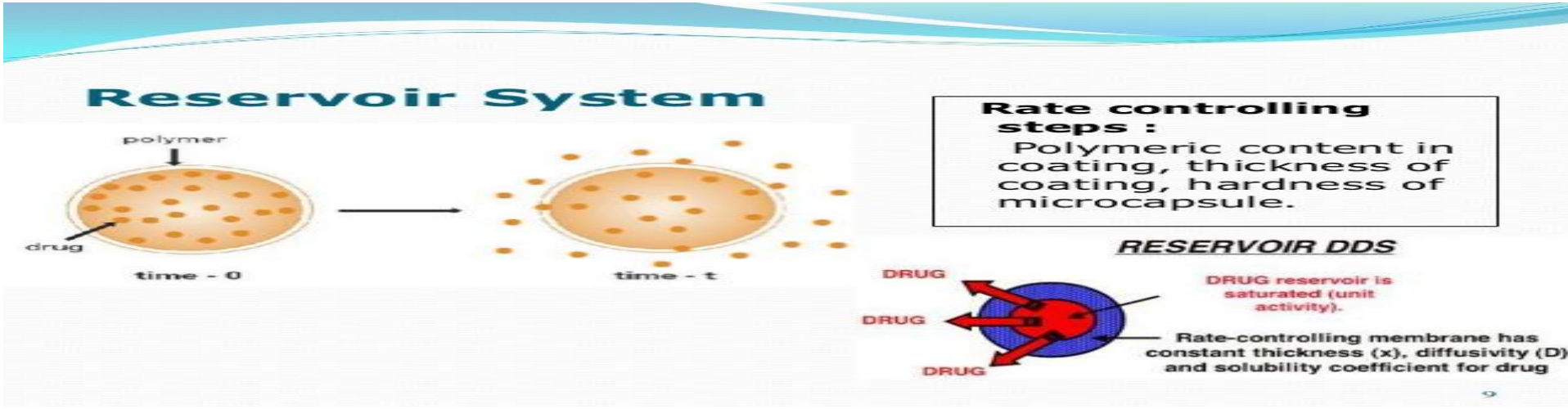
2) Diffusion controlled monolithic system :

The drug is released by diffusion prior to, or concurrent with the degradation of the polymer matrix. The rate of release also depend upon where the polymer degrades by homogeneous or heterogeneous mechanism.



3) Diffusion controlled reservoir system:

The drug is encapsulated by a rate controlling membrane through which it diffuses and the membrane erodes only after its delivery is completed. Then the drug release is unaffected by the degradation of the polymer.



4) Erosion :

Erosion of the coat due to pH and enzymatic hydrolysis causes drug release with certain coating material like glyceryl mono stearate, bees wax and stearyl alcohol.