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Micro Encapsulation and its Techniques

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A B S T R A C T

Microencapsulation is described as a process of enclosing micron sized particles of solids or droplets of liquids or gasses in an inert shell and protects them from the external environment. Particles have a diameter between 3-800 micrometers which differs from other technology like Nanotechnology and the particle's morphology. It is a process in which tiny droplets of solid or liquid are coated with a continuous film of polymeric material, allowing immobilization, protection, release and functionalization of active ingredients. This gives an overview on the general aspects in drug loaded micro particles to improve the efficiency of various medical treatments. This review discusses microencapsulation, advantage, disadvantage, methods and its application in the pharmaceutical field. This article is a survey of microencapsulation and materials required in it, morphology of microcapsules, microencapsulation advancements, reasons for microencapsulation, and advantages of microencapsulation.

Keywords: Microencapsulation, core material, coating material, method of preparation

Introduction

Microencapsulation is defined as the process of enclosing solids, liquids and gasses within a second material with a continuous coating of polymeric material. Microencapsulation process is used to modify and delay drug release from the dosage forms. The product obtained by the process of microencapsulation is called microspheres. Microspheres include micro particles and microcapsules of 1-1000 micrometers in diameter.

Diameter and Type of particle

Diameter	Type of particle
Less than 1 micron	Nanoparticle
3-to-800-micron	Micro particle
Larger than 1000-micron	Macro particle

Advantages of Microencapsulation.

- It masks the taste of bitter drugs and improves patient compliance. Eudragit E100 is the most commonly used coating material for this purpose.
- Vaporization of numerous unstable medications e.g. methyl salicylate and peppermint oil can be avoided by microencapsulation.
- It enhances solubility of poorly soluble drugs
- Conversion of liquid dosage form to pseudo solids

Disadvantages of microencapsulation

- Cost of material is high
- Reproducibility is less
- Effect of polymer matrix, polymer additives and their degradation products on environment in response to heat hydrolysis, biological agents.
- Core particle is affected by changes in temperature pH
- Complicated process and requires talented work to oversee

Composition of micro capsules

1. Core materials

The material to be coated. It may be liquid solid or gas. Liquid core may be dissolved or dispersed material

It includes; Drug or active constituents

Additive like diluents

Stabilizers

2 .Coating Materials

The coating material used in microencapsulation should be such that it is able to form a cohesive film on the core, stabilize it and provide strength to the capsule.

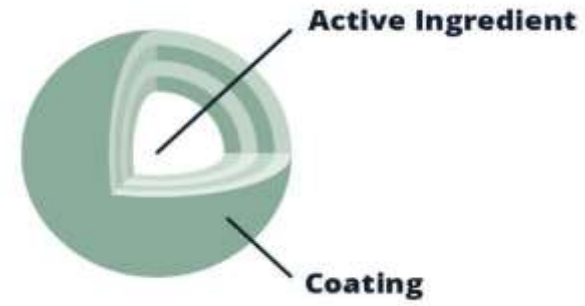

Fig.1. Composition of micro capsules[31]

Coating Material Properties

- Controlled discharge under particular conditions.
- Film-shaping, malleable, bland, stable.
- Non-hygroscopic, no high consistency, efficient.
- Dissolvable in a fluid media or dissolvable, or liquefying.
- The covering can be adaptable, weak, hard, thin and so forth.

Examples of Coating Materials

· Water soluble resins – Gelatin, Gum Arabic, Starch

· Water insoluble resins – Ethyl cellulose, Polyethylene, Polymethacrylate, Polyamide (Nylon)

. Waxes and lipids – Paraffin, Spermaceti, Beeswax, Stearic acid

· Enteric resins – Shellac

Classification of micro capsules

- Mono nuclear: Contain shell around the core
- Poly nuclear; Having many core enclosed within the shell
- Matrix type: Distributed homogeneously into the shell material

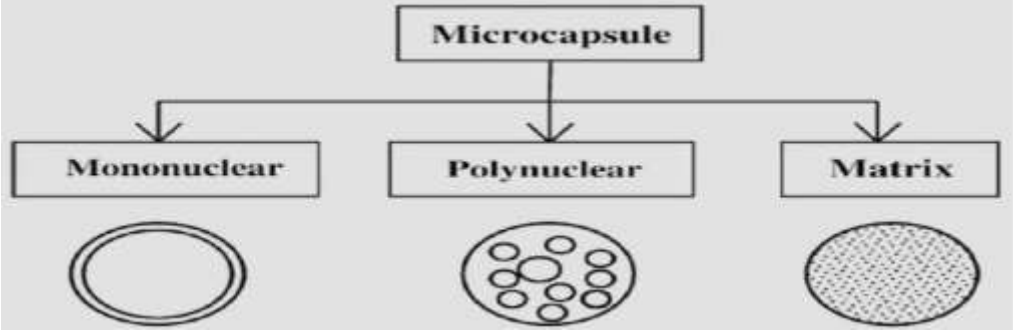

Fig.2. Classification of micro capsules[32]

Micro encapsulation techniques

Micro encapsulation techniques can be broadly divided into two main categories, namely chemical and physical with the latter being further subdivided into physico chemical and physic-mechanical techniques.

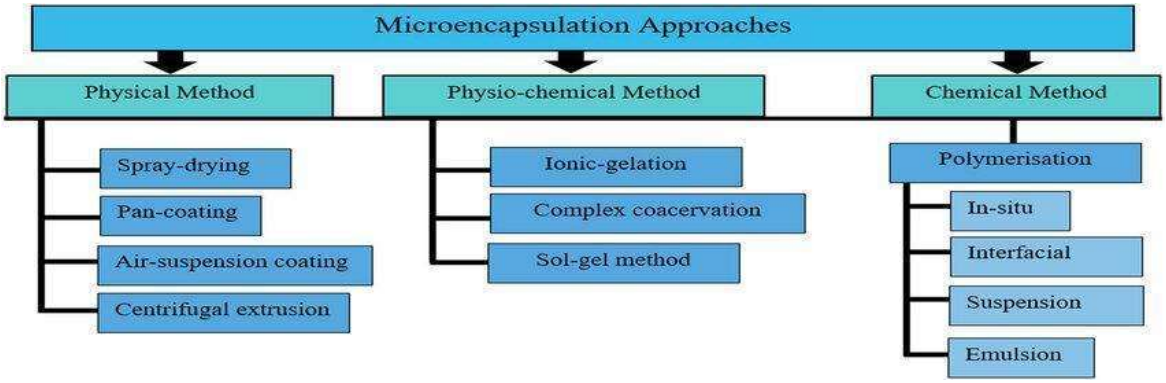

Fig.3. Micro encapsulation approaches[26]

1. **Air suspension technique:** This technique involves the dispersion of the core materials in a supporting air stream and the spraying of coating materials in the air suspended particles. The moving air stream suspends the particles on an upward motion within the coating chamber. They are supported by perforated plates having different patterns of holes inside and outside the cylindrical inserts. At the top, as the air stream diverges and slows, they settle back on to the bed and moved downward to repeat the cycle. The supporting air stream also serves to dry the product while it is being encapsulated. Drying rates are directly related to the volume temperature of the supporting air stream.

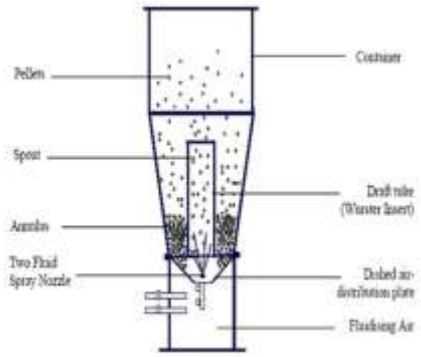

Fig.4.Air suspension technique[27]

2. Spray drying and spray congealing; spray drying is a unit operation in which a liquid preparation is atomized in a hot gas current to instantaneously obtained a powder. The gas generally used is air, inert gas or nitrogen. It is a technique used when an active material is dissolved or suspended in melt or polymer solution and becomes trapped in dried particle. In spray congealing procedures, coating solidification is achieved by thermally congealing by a molten coating material or hardening a dissolved coating by injecting the coating – core material mixture into a non-solvent.

3. **Coacervation phase separation;**Using this method, the core material is dispersed in a coated polymer solution to generate three phases. By adding a solution and raising the temperature of the polymer solution, the coating material phase is created. The liquid polymer coating is deposited on the core material in the following stage, which is accomplished by carefully combining the liquid coating material with the core material inside the manufacturing vehicle. The next stage is the desolvation or heat crosslinking of the covering materials to create a stiff, self-supporting microcapsule.

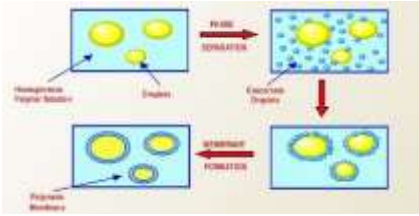

Fig.5.Coacervation phase separation[28]

4. **Solvent evaporation**: carried out in a liquid manufacturing vehicle. The coating material is dissolved in a volatile solvent; core material is dissolved or dispersed in coating polymer solution. With agitation, the core and coating material dispersed in a liquid manufacturing vehicle to obtain the microcapsule of appropriate size. The mixture is heated to evaporate the solvent of the polymer and if the co0re material is dissolved in the coating polymer solution a matrix type capsule is formed.

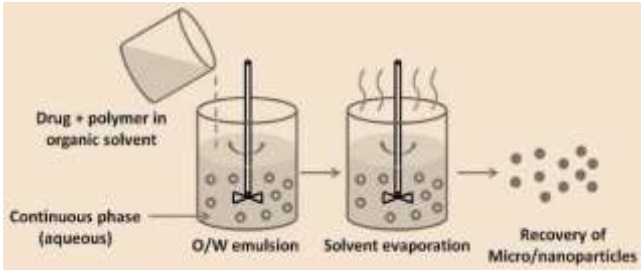

Fig.6.Solvent evaporation[29]

5. Polymerisation

- **Interfacial polymerization**: In this technique wall material is made to form at the o/w interface of dispersed oil drops. Monomers of the wall forming polymer is first dissolved in the core material and then emulsified in the aqueous continuous phase containing other polymerization reactants.
- **In Situ Polymerization:** During the micro encapsulation process, a single monomer is directly polymerized on the surface of the particle.
- .**Matrix polymerization:** Core material is imbedded in a polymeric matrix during formation of the particle. A simple example of this type is spray drying in which the particle is formed by evaporation of solvent by matrix material.

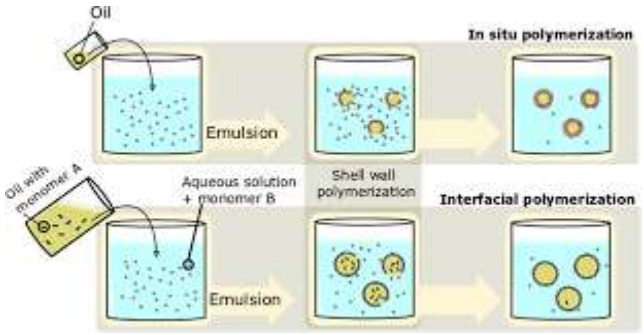

Fig.7.Polymerisation[30]

Conclusion

Micro encapsulation is a delivery system that has proved itself in a variety of commercial applications in many areas of industry. The techniques used to produce these capsules ranging from simple blend operation to complex polymer coating system.Only in concert with the micro encapsulation specialists at Formulation Company can a practical solution be developed to address particular issues with any given formulation.Features and benefits of using micro encapsulation to enhance personal care formulation include improving aesthetics, protecting encapsulated compound, improving stability, increasing shelf life of finished product.

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