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Review Article

A Review on Microencapsulation Technology

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ABSTRACT

This review depicts the microencapsulation is about techniques, properties, morphology, used in pharmaceuticals and other field applications. Basically microencapsulation is an interaction or strategy by which thin coatings can be applied reproducibly to little particles of solids, droplets of liquids, and dispersion in this way shaping microcapsules. The reason is that microcapsules are not a finished result, but rather by and large a procedure to conquer measure limits.

Key words: Microencapsulation, Morphology of Microcapsule, Terminology

INTRODUCTION

Different kind of materials utilized for coating have been produced by the various pharmaceutical industry as well as research to help in preparation of different pharmaceutical dosage form, for example, tablets, capsules, injectable, powders and topical. The later consequence of pharmaceutical research is that the ingestion rate of a drug can be controlled by controlling its rate of release from the pharmaceutical dosage form. Microencapsulation is a physical or chemical process in which the very small droplets or particle of liquid and strong material are encompassed or coated with an incessant film of polymeric material. Microencapsulation of pharmaceuticals was initially researched in the year 1931 through small sphere of gelatin utilizing coacervation system(1). It incorporates Bio encapsulation which is more limited to the entrapment of an organically dynamic substance (from DNA to whole cell and grupu of cells.) normally to enhance its execution and/or upgrade its shelf life (2). According to the French Pharmacopeia Microcapsules is solid material comprising of a solid envelope containing a solid or liquid or a pale substance. The microcapsules happen as powder with particles under 1250 ìm in diameter. Microencapsulation gives the methods for converting liquid to solids, of adjusting colloidal and surface properties. Which are giving natural insurance and of controlling the release properties. A few of these properties can be achieved by macro packaging procedures; be that as it may, the uniqueness of microencapsulation is the littleness of the covered particles and their resulting use and adjustment to a wide variety of dosage forms (3-5).

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Morphology of Microcapsule

The morphology of microencapsulation is mainly depends on core and coating material

1. Mononuclear (Core shell):This contain the shell around the core
2. Polynuclear: This capsule have many core enclosed within the shell.
3. Matrix encapsulation: In this process core material is distributed homogeneously into shell material.

Microencapsulation Materials(6-9)

Core Material	❖ It may be liquid or solid ❖ Liquid core may be dissolved or dispersed material ❖ Composition of coating material • Drug or active constituent • Additive like diluents • Release rate enhancers
Coating Material	❖ Controlled release under specific conditions. ❖ Inert toward active ingredients. ❖ Compatible with the core material ❖ Stabilization of core material. ❖ Composition of coating • Inert polymer • Colouring agent • Plasticizer ❖ **E.g. Coating materials:** • **Gums:** Gum arabic, sodium alginate, carrageenan • **Celluloses:**Carboxymethylcellulose, methycellulose. • **Carbohydrates:** Starch, dextran, sucrose • **Proteins:** Gelatin, albumin. • **Lipids:** Bees wax, stearic acid, phospholipids.

Advantages (10)

- This technique is more effective for the masking taste and odor for various drugs.
- It is easy to administration other dosage form such macro-sized implants
- Drug release profiles can be provided the therapeutic needs of the patient.
- Site of absorption can be reached through the microencapsulation.
- It also reduce the Incompatibility among the drugs
- Various drugs reduce toxicity by this method.
- Protection against UV, heat, oxidation, acids, bases (e.g. colorant sand vitamins). Like Vitamin A / monosodium glutamate
- Improved shelf life due to preventing degradative reactions (dehydration, oxidation).
- Enhance visual aspect and marketing concept.
- Handling liquids as solids
- Improved processing, texture and less wastage of ingredients.
- Control of hygroscopy
- Enhance flow ability and dispersibility
- Dust free powder
- Enhance solubility

Disadvantages of microencapsulation

- Production cost
- Possible cross reaction which may occur between the core and wall material selected
- Due to foreign ingredients in foods, customers with allergies may not be aware
- Shelf life of Hygroscopic drugs is reduced

Terminology of microencapsulation

Terminology	Description	Size range
Microcapsules (narrow sense of Meaning	Products of coating liquid Nuclei with solid walls.	μ m
Nanocapsules	Same structure as microcapsules, but Smaller.	μ m
Microspheres or Microparticles	The cores and walls are Both solid. Often, there is no clear distinction between them: the thick solid wall functions as a porous matrix where active substances are Embedded.	μ m
Nanospheres or Nanoparticles	Same structure as microspheres, but Smaller.	nm

Methods of Microencapsulation(11-12)

Technique	Particle size range [µm]	Methods used
Coacervation	2 – 1200	Physico – chemical
Polymer-polymer incompatibility	0.5 – 1000	Physico – chemical
Encapsulation by supercritical Fluid Encapsulation by Polyelectrolyte multilayer	0.02 – 20	Physico - chemical
Phase Inversion	0.5—5.0	Physico – chemical
Hot Melt	1—1000	Physico – chemical
Spray-drying	5 – 5000	Physico – mechanical
Fluidized- bed technology	20 – 1500	Physico – mechanical
Pan coating	600 – 5000	Physico – mechanical
Spinning disc	5 – 1500	Physico – mechanical
Co-extrusion	250 – 2500	Physico – mechanical
Interfacial polymerization	0.5 – 1000	Physico – mechanical
In situ polymerization (0.5 – 1100 um)	0.5 – 1100	Physico – mechanical
Layer-by-layer (LBL) assembly	0.02–20	Physico - chemical
Sol-gel encapsulation	2–20	Physico - chemical

APPLICATION

Agriculture

The most important application of microencapsulated products are in the region of crop protection. These days' insect pheromones are getting to be feasible as a biorational contrasting option to regular hard pesticides. In particular, sex attractant pheromones can reduce insect populaces by upsetting their mating procedure. Pheromone is dispersed during the mating season, raising the foundation level of pheromone to the point where it conceals the pheromone crest release by its Female mate(13-15)

Pharmaceutics

- Pharmaceutical applications area of encapsulation method id biomedical for sustained and controlled drug delivery system (16).
- Potential applications o are replacement of therapeutic agents, gene therapy and inuse of vaccines for treating AIDS, cancer, tumors and diabetes (17).
- Protein like growth hormone, insulin, and erythropoietin used to cure for anemia which is new form of oral drug delivery.
- The delivery of gene sequences in the form of plasmid DNA which could provide convenient therapy like hemophilia (18).
- The spheres are engineered to stick tightly even penetrate linings in the gastrointestinal track

Food Industry

In food industry microencapsulation are for overcome all these challenges by providing viable texture blending, appealing aroma release, and taste, odor and color masking. Microcapsules also help fragile. This methods are enables food companies to incorporate minerals, vitamins, flavors and essential oils. Microencapsulation can simplify the food manufacturing process by converting liquids to solid powder, decreasing production costs by allowing batch processing using low cost, powder handling equipment.

Beverage Production:
Today wine, vinegar, beer, and other food drinks manufacture are utilization immobilization. Technologies to change aromas, boost yield, improve quality.

Catalysis
Transition metal based reactant forms are of imperative significance to pharmaceutical, agrochemical and fine chemicals. An immense extent of such synergist metal species is frequently costly and dangerous, along these lines making operational taking care of conceivably dangerous. Microencapsulation has as of late been perceived as a helpful elective system to empower safe dealing with, simple recuperation, reuse and transfer at an adequate financial cost (19).

Conclusion

Microencapsulation is the most pleasant method of assurance and covering reduces rate of dissolution, help of taking care. It is capsule ranging in different sizes, which protects the targeting of main active excipients from surrounding site until the appropriate time is not released. This technique is useful for that drug which does not digest in the stomach.

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