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MICROENCAPSULATION: IS A NEED OF TODAY'S MODERN DRUG FORMULATION & DEVELOPMENT IN HERBAL AS WELL AS SYNTHETIC DRUG FOR DESIRED THERAPEUTIC EFFECT

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Keywords:

Microcapsule, herbal microcapsule, FDA-food & drug administration, capsule coating, GRAS-generally recognized as safe, coating technique**,**GMP-Good manufacturing practices

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ABSTRACT

The microencapsulation is a technique which is modern &widely used in the pharmaceutical industries for different purposes& drug development. For the reduction of cost, to increase the stability of product, to mask unpleasant tastes,prevention of drug damages in gastric fluid and to improve the release properties of drug, in pharmaceutical industries this type of technique is generally used. The objective of this paper is to study the different techniques of microencapsulation of pharmaceutical ingredients by different processes. Microencapsulation is a rapidly growing technology in herbal as well as synthetic drug formulation industry. In this process of form relatively thin coatings to tiny particles of solids or droplets of liquids and dispersions. The different types of microcapsules and microspheres are form from a wide range of wall materials like monomers and polymers. By the help of physicochemical properties of the core, the wall composition and the microencapsulation technique used, different types of particles can be obtained.It is economic feasibility of large-scale production, including operating and other miscellaneous things, such as transportation cost, regulatory cost.Microencapsulation often contain a basic understanding of the general properties of microcapsules, that is nature of the core and coating materials, the stability and release property of the coated materials and the microencapsulation methods. By mechanical method microencapsulation has been in the addition of oily medicines to tableted dosage forms. This has been used to avoid problems inherent in producing tablets from otherwise tacky granulations. This was accomplished through improved flow properties. Significances of is method, For Sustained or prolonged drug release formulation, For Masking test and odor of many drugs. For converting liquid into free flowing properties, drugs which are sensitive to Light, oxygen, moisture they are easily convert to stable form. Microencapsulation technologies are applied in any area of the industry for formulation.

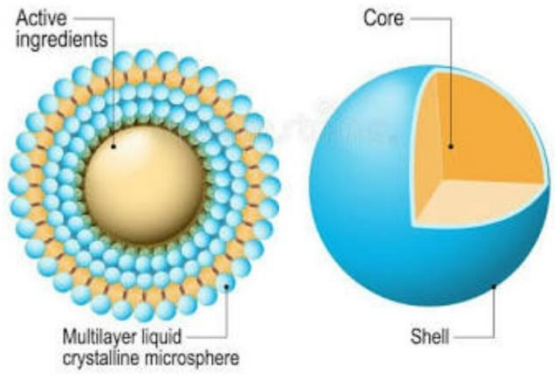
INTRODUCTION

Now a day, here is a trend to form a healthier way of living, which contains a growing awareness by consumers of what they eat and what benefits certain ingredients have in maintaining healthier life. Microencapsulation process is used to encapsulate small particles of liquids, solids, or gases in one or two polymers. The coated particle contain the core material, and polymers that is variously such as wall material, shell, coating, carrier, or encapsulate.

The purpose of microencapsulation is to protect the core material from environmental factors such as light, moisture, temperature, and oxygen, to increase stability and to modify the release properties of compounds.Microencapsulation has been applied in formulation of new materials not only for the food industry but also for pharmaceuticals, cosmetics, and textiles, where the stability, efficiency, and bioactivity of compounds are importantparameter.Microencapsulation has many applications in different industry such as to protect, isolate or control the release of a given substance which is of growing interest in many sectors of many product development. Converting a liquid into a powder allows use of different ingredient. [1]In simplest form, a microcapsule is a small sphere with a uniform wall around particulars. By practically, the core may be a crystalline material, observed adsorbent particle, an emulsion, a suspension of solids or a suspension of smaller microcapsules.[2]

Concept of microencapsulation:-

Microencapsulation is a rapidly expanding technology. It is the process of applying relatively thin coatings to tiny particles of solids or droplets of liquids and dispersions. It provides the means of converting liquids to solids, of altering colloidal and surface properties, of providing environmental protection and of controlling the release characteristics or availability of coated materials. Microencapsulation is a relieving considerable attention fundamentally. Microencapsulation is a process in which tiny particles or droplets are surrounded by a coating to give small capsules many useful characteristics. In a relatively simplistic form, a microcapsule is a small sphere with a uniform film form around it. The material inside the microcapsule is the core, internal phase, or fill, while the wall is sometimes called a shell, coating, or membrane. By theoretically, diameters of microcapsules are in the range of 0.01 and 1,000 micrometer and the thickness of wall material is in the range of 0.5-150 micrometer[1]



(Fig .1 The core structure of Microencapsulation)

Core material

The core material, is known as the specific material to be coated, may be liquid or solid in nature also[2]. The composition of the core material can be varied as the liquid core can include dispersed or dissolved. The solid core can be a mixture of active constituents, stabilizers, diluents, excipients and release rate retardants or accelerators.

Coating materials

As per ideal requirement the coating material should be capable of forming a film that is cohesive with the core materials, be chemically compatible and inert with the core material and

formed the desired coating properties that is strength, flexibility impermeability, optical properties and stability. The total thickness of the coatings achieved with microencapsulation techniques is microscopic in size 5. In microencapsulation chemical reaction should be avoided. It involves mass transport behavior in some way between the core (the ingredient) and the shell (capsule or coating). The entrapped material is usually a liquid but may be a solid or a gas [4].

Structures of microcapsules:-

Microcapsulesare most of the small spheres with diameters ranging between a few micrometers and a few millimeters. Many of these microcapsules bear little resemblance to these simple spheres. The size and shape of microcapsule formed in micro particles depend on the materials and methods used to prepare them. The different types of microcapsules and microspheres are formulated from a wide range of coating materials like monomers and/or polymers [2]. Depending on the physicochemical characteristics of the core, the wall composition and the microencapsulation technique used, various types of particles can be obtained (Fig. 1) A particle containing an irregular shape core; Several core particles embedded in a continuous matrix of wall material; Several distinct cores within the same capsule and multi walled microcapsules.

Objectives of microcapsules:-

It has some special objectives like:

1. It alters the surface characteristics of the particles to significant extent.

2. Microencapsulation also can be used for the sustained release or prolonged-action medication.

3. It can be used to taste-masked tablets, powder, suspensions.

4.It has proved that this technique is new for formulation in creams, ointments, aerosols, suppositories, and injectable.

5. Select appropriate shell formulation from FDA-approved, GRAS (generallyrecognized as safe) materials.

6.Selecting the most effectible process to provide the desired morphology, stability, and release mechanism.

7. Economic feasibility of large-scale production, operating and other miscellaneous expenses, such as transportation cost, regulatory cost, and downtime losses[8]

Classification:-

Microcapsules can be classified on three basic categories according to their morphology as follows,

1. Mononuclear.
2. Polynuclear.
3. Matrix types.
4. Multi-wall.
5.Irregular.

In mononuclear (core-shell) the microcapsules contain the shell around the core, In polynuclear capsules have many cores enclosed within the shell, while matrix encapsulation, the core material is distributed homogeneously into the shell material. In addition to these three basic morphologies, microcapsules can also be mononuclear with multiple shells, or they may form clusters of microcapsules [4]

Coating Material used in Microencapsulation:-

A. Synthetic Polymer (Table No:1):-

Sr.No	Type of synthetic polymer	Example
A.	Non-biodegradable	PMMA
		Acrolein
		Glycidyl methacrylate
		Epoxy polymers
B.	Biodegradable	Lactides and glycolides and their copolymers
		Polyalkyl cyano acrylates

B. Natural Material (Table No:2) :-

Sr.No	Example
1	Agarose
2	Proteins
3	Albumins
4	Gelatin
5	Collagen
6	Carbohydrates
7	Starch ,

C. Different Microencapsulation Technique (Table No:3):-

Sr. No	Microencapsulation Technique	Physical nature of the core material	particle size(Micrometer)
1	Polymerization	Solid &Liquid	1-1000
2	Interfacial Polycondensation	Solid &Liquid	3-2000
3	Coacervation		2-5000*
4	Solvent evaporation	Solid &Liquid	5-5000*
5	Air Suspension	Solid	35-5000*
6	Pan coating	Solid	600-5000*
7	Spray drying &congealing	Solid &Liquid	600
8	Multiorifine centrifugation	Solid &Liquid	1-5000*

Recent advances in microencapsulation processes:-

1 .Fluidized bed spray coating

2. Deagglomerating jet spray coating

3. Melt prilling in fluidized bed

4. Using ultrasonic atomizer based on interfacial solvent exchange

5. Miscellaneous

Need of Microencapsulation:-

1.To achieve sustained or prolonged drug release.

2.To mask unpleasant taste and odor of drugs to improve patient compliance.

3. Environment sensitive drugs can be stabilized by this technique. Bakan and Anderson reported that microencapsulated vitamin A palmitate had enhanced stability.

4 Microencapsulation can be used for converting liquid drugs into free flowing powders.

5 Drug-drug and drug-excipient incompatibility can be prevented by microencapsulation.

6 Vaporization of volatile drugs such as methyl salicylate and peppermint oil can be prevented.

7Alteration in site of absorption can also be achieved by microencapsulation.

9 Reduction in toxicity and GI irritation caused by various drugs can be possible.

10. Toxic chemicals such as insecticides may be microencapsulated to reduce possibility of sensitization of factorial person [21].

Application of Microencapsulation:-

Some of the applications of microencapsulation can be described as given below:

1. Prolonged release dosage forms. The microencapsulated drug can be administered, as microencapsulation is perhaps most useful for the preparation of tablets, capsules or parenteral dosage forms.

2. Microencapsulation can be used to prepare enteric coated dosage forms

3. It can be used to mask taste of bitter drugs.

5. It has been used to protect drugs from environmental hazards such as humidity, light, oxygen or heat. Microencapsulation does not yet provide a perfect barrier for materials, which degrade in the presence of oxygen, moisture or heat, however a great degree of protection against these elements can be provided. For example, vitamin A and K have been shown to be protected from moisture and oxygen through microencapsulation [16].

6. The separations of incompatible substances, for example, pharmaceutical eutectics have been achieved by encapsulation. This is a case where direct contact of materials brings about liquid formation. The stability enhancement of incompatible aspirin-chlorpheniramine maleate mixture was accomplished by microencapsulating both of them before mixing[17]

Factors Influencing Encapsulation Efficiency:-

The encapsulation efficiency of the microparticle or microcapsule or microsphere will be affected by different [14]
parameters:

- High solubility of the polymer in organic solvent.
- Low solubility of organic solvent in water.
- Low concentration of polymer.
- High DP/CP ratio.

Low solvent removal rate results in slow solidification of microparticles and low encapsulation efficiency.

- Low solubility of the polymer in organic solvent.
- Solubility of organic solvent in water.
- High concentration of polymer. High solvent removal rate gives fast solidification of microparticles and high encapsulation efficiency.

Conclusion:-

Microencapsulation is one of the quality preservation techniques of sensitive substances and a method for production of materials with new valuable properties. Microencapsulation is process of enclosing micron sized particles in a polymeric shell. Significances of microencapsulation For Sustained or prolonged drug release For Masking test and odor of many drugs Converting liquid into free flowing properties Drugs which are sensitive to Light,oxygen, moisture they are easily stabilized. Microencapsulation technologies are applied in any area of the industry. It can be found in: Cell immobilization, Beverage production, Protection of molecules from other compounds, Drug delivery, Quality and safety in food, agricultural & environmental sectors, pharmaceuticals etc.

It is a very innovative technique for the different point of view such as the boosting of drug stability, purity, bioavailability & potency in well manner. For avoiding the excessive drug administration & minimized the adverse effect if drug this type of technique are mainly modified.By the survey of different literature the microencapsulation technique is confidential as well as effective technique. Significance of this method in various type of industry is probably in large amount & profitable to industry. Some time for increase the patient compliance this technique is used. So all over observation & study view microencapsulation technique is useful in various types of industry & our daily routing.

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