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NOVEL DRUG DELIVERY SYSTEM MICROENCAPSULATION TECHNIQUE

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ABSTRACT

Novel drug delivery system also known as New drug delivery system or Traditional drug delivery system those techniques can improve therapy by increasing the efficacy and duration of drug activity and also increases patients compliance through decreased dosing frequency and convenient route of administrationto reduce unwanted side effects as compared to conventional drug delivery system in past several years, great advances have been made on the development of NDDS of arthritis and anticancer drug NDDS. A variety of novel formulations like Microencapsulation, Liposome, nanoparticles and phytosomes the current review focuses on the current state of innovative formulation development and methods of preparation, type of active ingredient. Currently in this NDD System commonly used Microencapsulation technique this technique used in several fields such as medicine and various pharmaceutical food industries it helps in the preservation and storage of products method of preparation, history applications research work was discussed briefly in this review.

KEYWORDS: Microencapsulation, Wall material, Target site, Self-assembling structure, Controlledrelease.

INTRODUCTION

Microencapsulation is a process in which solid liquid and gases may be enclosed in microscopic particles, forming thin coating of wall material around the substances.

Firstly, bungee burg de Jon and Kan discovered the Microencapsulation procedure in 1931. Which weredeals with the preparation of gelatine coacervation process this technique used to reduce or control problems associated with conventional therapy and improve the therapeutic

efficacy of a given drug they show minimum side effects and optimal rate of the target tissue.

Microencapsulation process helps to convert process like oxidation-reduction reaction changing physical characteristics it provides environmental protection and controlling the release characteristics of different coated material Generally microencapsulated product (microparticles is considered as larger than 1 micrometre and up to 1000 micrometres in diameter). Microencapsulation is spherical in shape and is covered by a uniform coating known as a wall or shell. The material which is to be enclosed is called core material. Micro encapsule depends on physical and chemical properties that are to be encapsulated. Core particles to be enclosed in a micron-sized capsule of gelatine, polymer Microencapsulation may be a single layer or evenly multiple layers based on the character of the material. When two important questions are asked when considering Microencapsulation.[1]

1. What type of material do they want to enclose?

2- What properties does the wall need to have?

For ex. The method is the formulation of a drug containing albumin microsphere in a particular procedure, albumin is a protein commonly water fluid in f bloodstream that forms a hydrophilic coating around hydrophobic drugs because of its compatibility with the human immune system human serum albumin.

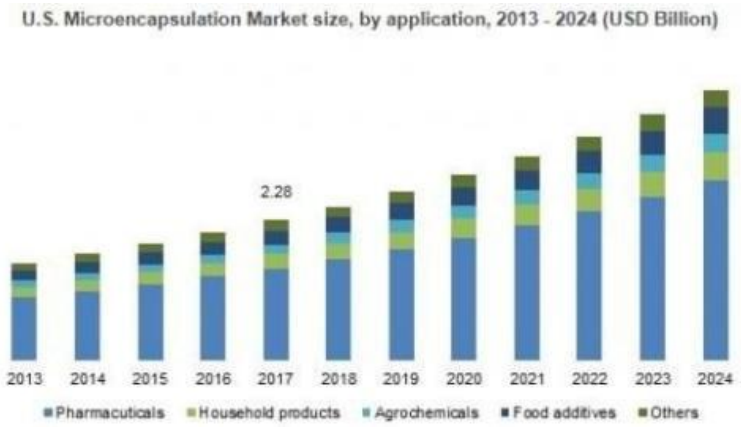

Fig no 1.

Pharmaceutics

One of the major applications of the encapsulation technique is pharmaceutical for controlled drug delivery systems. Potential applications of this drug delivery system are replacement of therapeutic agents, gene therapy and use of vaccines for treating AIDS, tumours, cancer and diabetes protein such as insulin, growth hormone and erytropotential (used in treating

anaemia) ex. Of drug would benefit from this new form of oral delivery. Based on this novel drug delivery technique.[13]

Benefits of Microencapsulation Technique

Protection of reactive material from the environment

1. Hygroscopic properties
2. Stability of vitamin A
3. Reduce volatility
4. Taste Masking of bitter Drugs

Bitter to better e.g., Aspirin, acetaminophen, ampicillin fig. Odour Masking e.g., Castor oil Stabilization to oxidation e.g., vitamin.

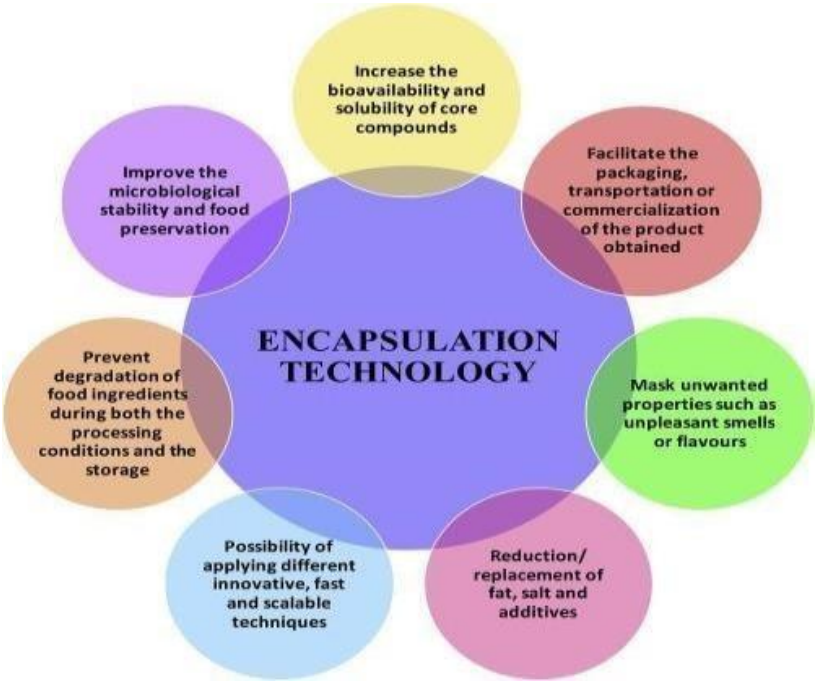

Fig. no: 2.

Fundamental Principles for Microencapsulation

Core Material

Core Material defines as specific material to be coated can be liquid or solid in nature. The solid core be active constituents, stabilizers, diluent excipients and release rate retards. The ability to vary the core material composition provides. Definite flexibility and utilization of these characteristics offend allow effectual design and development of the desired microencapsulation. characteristics often allow effectual design and development of the

desired microencapsulation.[4]

Coating Material

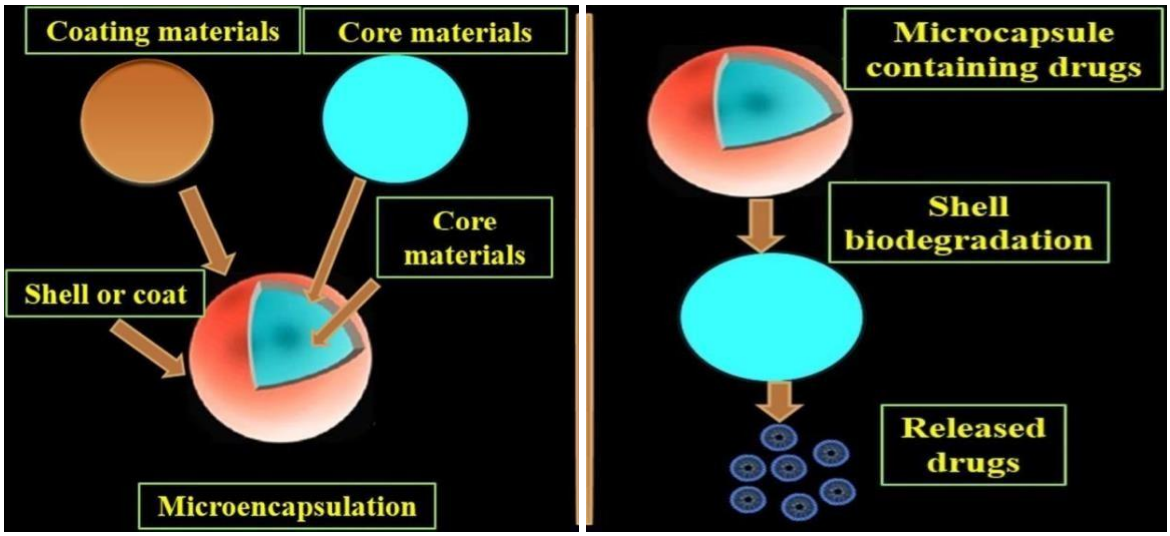

Fig. no. 3.

Those materials used in the microencapsulation method are enabled to some extent to *instul modifications*Selection of given coating often can be aided by a review of existing literature and by the study of free or cost films although practical use.

Coating material properties

Inert towards active ingredient

1. Controlled release under specifications
2. Non-Hygroscopic nature, No viscosity
3. Soluble in the aqueous phase and coating can be flexible hard and thin

Composition of Coating Material

1. Inert Polymer
2. Colouring agent
3. Plasticizer

POLYMERS- POLY- means ManyMers- means parts

Polymers are long chain organic molecules assembled from many smaller molecules called monomers or polymers.

Polymers are used for the preparation of coating Material for microencapsulation. There are mainlytwo types of Polymers.

- Natural polymer
- Synthetic polymer

Natural polymer- for example cellulose, protein, carbohydrates.

Synthetic polymer- example Glycosides and their copolymer, Epoxy resins polymer, Acrolein.

Role of Polymer

Polymers are substances of high molecular weight made up of repeating monomer units.

Polymer molecules may be linear or branched, and separate linear or branched chains may be joined bycrosslinks.

Polymers are used widely in pharmaceutical systems as coating materials and, ingredients of controlled, site-specific drug delivery systems and also increase therapeutic efficiency. (5)

Purpose of Microencapsulation Technique

The main purpose for Microencapsulation is found to be prolonged drug release.

This technique is widely used for masking the taste and odour of many drugs to improve compliance. The drug which is sensitive to oxygen, moisture or light, can be stabilized by microencapsulation. Incompatibilities among the drug can be prevented by microencapsulation Vaporization of many volatile substances like peppermint oil can be prevented by microencapsulation. Many drugs have been microencapsulated to reduce toxicity and GI irritation including potassium chlorate kcl. Alternation in the site of absorption can also be achieved by microencapsulation.[7]

Release Mechanism

Encapsulated material provide controlled sustained or targeted release of the core material. Generally, three different types of the core material are released from a microencapsulation mechanical rupture of the capsule wall dissolution or melting of wall and diffusion through the wall-less common release mechanism including ablation and biodegradation.

Diffusion, Hydrolysis and polymer degradation

Diffusion

In the content of the aqueous fluid in the Gastrointestinal (GIT) tract water diffusion into interiorparticles. Drug dissolution occurs and drug solutions diffuse across the release coat to the exterior.

Hydrolysis

Destruction of tissue by physical or chemical reactions.

Polymer Hydrolysis- loss of Polymer Hydrolysis of Polymer begins with a change in the microstructureof carrier water.

Osmosis

The Polymer coat acts as a semipermeable membrane and allows the formation of an osmotic pressure difference between the inner and outer side of the microcapsule and this pressure drives drug solution through small pores in the coat (Patel etc. at. 2012).

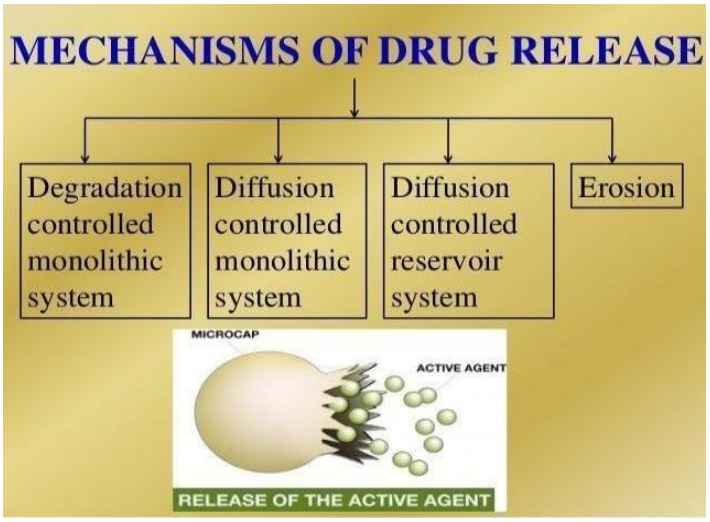

Fig. No. 4.

Methods of Microencapsulation Technique

The following are different mechanical methods that are employed during the process of microencapsulation.

This technique is based on the physical and chemical properties of material to be encapsulated.

- Pan coating and spray coating
- Coacervation phase
- Air Suspension
- Fluidized bed coating
- Freeze drying and spray ceiling.

Different mechanical methods involved in encapsulation

1. Fluidized bed Technology

Fluid bed coating another mechanical encapsulation method is restricted to encapsulation of solid core material, including liquids absorbed into porous solid. This technique is used extensively to encapsulate pharmaceuticals. Solid particles to be encapsulated are suspended on a jet of air and then convert by a sprayof liquid coating materials. The capsules are then moved to an area where their shells are solidified by cooling is repeated until the capsule walls are of the desired thickness. The process is known as the wusterprocess when the spray nozzle is located at the bottom of the Fluidized bed of particles.

The liquid coating is sprayed into the particles and the rapid evaporation helps in the form of an outer layer on the particles. The thickness and formulation of the coating can be obtained as desired. Differenttypes of fluid bed coaters include top Spray, bottom spray and tangential spray.[8]

The Fluidized bed coating process is three types.

1) Top Spray, 2) Bottom spray, 3) Tangential spray

Top Spray

The classification of top Spray bottom spray and tangential spray is based on the direction in which the core material and wall material sprayed. In top Spray the coating material is sprayed from the top to downwards in order to meet the core material which is ejecting from the bottom. The core material comes in contact with the wall material and their will be formation of protective covering around the core material. As wall material is Sprayed from the top there is increased encapsulation efficiency.

Bottom spray

This process is particularly suitable for a controlled release of active constituents. In the waster process a complete sealing of the surface can be achieved with low usage of coating materials. The spray nozzle is fitted in the base plate resulting in a spray pattern that is concurrent with the air feed. By using a waster cylinder and a base plate with different perforations the particles to be coated are accelerated inside the wuster tube and fed through the spray cone concurrently.

As the particles continue traveling upwards, they dry and fall outside the wuster tube back

towards the base plate. They are guided from the outside back to the inside of the tube where they are once again accelerated by the spray. This produces an extremely even film Particles of different sizes are evenly coated.

Tangential spray

Ideal for coating with high solid content. The product is set into a spiral motion of rotating base plate, which has air fed into the powder bed add its set. The spray nozzle is arranged in tangentially to the roter disk and also Sprays currently in bed. A very thick layer can be applied by means of rotor method.

2. Spray Drying

Spray drying is a microencapsulation technique when an active material is dissolved in a polymer solution and becomes trapped in dried particles. The main application of this technique ability to handle liable material because of the short contact time in dryers. The Spray drying process involves the atomization of the solution, emulsion containing one or more ingredients of desired product intodroplets by spraying followed by the evaporation of sprayed droplets into solid powder by hot air ata certain temperature.

Microencapsulation by spray drying is a low-cost commercial process which is widely used for the encapsulation of fragrances and flavors. Steps Core particles are dispersed in a p polymer solution and sprayed into a hot chamber The microencapsulate obtained for polynuclear.

3. Air Suspension Coating

Air Suspension coating first described by professor *Dale Erwin Wuster at the University of Wisconsin in1959* gives control and flexibility compared to pan coating. In this process the particulate core material, which is solid, is dispersed into the supporting air stream and these suspend particles are coated with polymer in volatile solvent leaving a very thin layer of Polymer on them. The air suspension process offers a wide variety of coating materials Candidates for Microencapsulation. The process has capabilityof applying coating in the form of solvent solution, aqueous solution and emulsion or hot melts in equipment ranging in capacities from one pound to 999 pounds. Core material comprised of micron particles can be effectively encapsulated by air suspension technique, but an agglomeration of particles to some large size is normally achieved by in this method.

4. Evolution of microencapsulation technique

Particle size and shape

The most widely used procedure to visualize microcapsule is converted light microscopy and scanning electron microscopy (SEM). Both techniques can be used to determine the shape and outer structure of microcapsule SEM provides higher resolution in contrast to light microscopy which allows characterisation of structure not only on surface but also inside particle.

1. Density Determination

The density of the microcapsule can be measured by using a multi volume/pycnometer Accurately weighed sample in a cup is placed in pycnometer, helium is introduced at the constant pressure in chamber and allowed to expand. Form two pressure readings the volume and hence density of microcapsule can be determined.

Isoelectric point

The micro electrophoresis is an apparatus used to measure electrophoretic mobility of microsphere fromwhich the Isoelectric point can be determined. The electrophoretic mobility can be related to surface contained charge ionisable behaviour of microsphere.

Contact angle

The angle of contact is measured to determine the wetting property of microcapsule. It determines the nature of microsphere in terms of hydrophilicity or hydrophobicity. The angle of contact is measured atsolid/air/water surface by placing a droplet in circular cell mounted above the objective of inverted microscope. Contact angle is measured at 20oC within a minute of decomposition of microsphere.

INVITRO RELEASE STUDIES

Release studies for micro-encapsules can be carried out in different PH condition like PH 1.2 and pH 7.4 using USP rotating basket apparatus The samples are taken at specific time intervals and are replaced by same amount of fresh medium. The samples withdrawn are analysed as per the Monograph requirement and release profile is determined using the plot of amount released as a function of time.

CAPTURE EFFICIENCY

The capture efficiency of microcapsule or the percent drug entrapment can be determined by

allowing washed microcapsule to lyse. The lysate is then subjected to determination of active ingredient as per Monographs. The precent encapsulation efficiency is calculated using following equation. % Entrapment =Actual content/Theoretical.[9]

Result of micro-encapsulation technique

In future using of this microencapsulation technique to enhance personal care formulation include improvinganaesthetic protecting the encapsulated compound improving stability and increasing the self life of the finished product preventing incompatibilities within the formula controlling the release.[10]

CONCLUSION

The micro-encapsulation technique offers a variety of opportunities like protection and masking reduced dissolution rate facilitation of handling and spatial targeting of active constituents.

A technique approach facilities accurate delivery of small quantities of potent drug reduced drug concentration at sites other than the target organ or tissue and protection of liable compounds before and after administration and prior to appearance at the site of action. In future by combining various other approaches in microencapsulation technique will find the vital place in Novel drug delivery system.[11]

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