Available online on 15.06.2019 at http://jddtonline.info

Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research

Open Access Review Article

Microsphere: A Review

Mahale Manisha M*[1], Saudagar R B[2]

[1] Department of Quality Assurance Technique, R.G. Sapkal College of Pharmacy, Anjaneri - 422213, Nasik, Maharashtra, India

[2] Department of Pharmaceutical Chemistry, R.G. Sapkal College of Pharmacy, Anjaneri - 422213, Nasik, Maharashtra, India

ABSTRACT

Microspheres having free flowing powder characteristics, which are consisting of synthetic polymers and proteins. These are biodegradable in nature having particle size less than 200um. Microspheres are the multiparticulate drug delivery systems which are consisting from natural and synthetic material. Microsphere improves bioavailability, stability and target the drug to specific site at predetermined rate. types of microspheres are bioadhesive, floating, radioactive, polymeric and biodegradable microspheres. Microspheres are particularly used in novel drug delivery system.

Keywords: microsphere, advantages, types, method of preprations.

Article Info: Received 25 April 2019; Review Completed 27 May 2019; Accepted 29 May 2019; Available online 15 June 2019

Cite this article as:

Mahale MM, Saudagar RB, Microsphere: A Review, Journal of Drug Delivery and Therapeutics. 2019; 9(3-s):854-856
http://dx.doi.org/10.22270/jddt.v9i3-s.2826

***Address for Correspondence:**

Mahale Manisha M, Department of Quality Assurance Technique, R.G. Sapkal College of Pharmacy, Anjaneri - 422213, Nasik, Maharashtra, India

INTRODUCTION[1-7]

Drug delivery system target drug to the specific body site which having enormous impact on the healthcare system[1-3]. The ideal drug delivery system delivers the drug at rate decided by need of body throughout the period of treatment therefore carrier technology find out the intelligent approach for drug delivery by coupling the drug to carrier particles example, microspheres, nanoparticles,liposomes[4-6] oral route of drug administration is most preferable route for taking medication.[1] Microspheres are small spherical particles which having diameter 1um to 100um.they are free flowing particles which are consisting of proteins or synthetic polymers this are biodegradable in nature. There are two types of microspheres

1) microcapsule-entrapped substance distinctly surrounded by distinct capsule wall

2) micromatricess-entrapped substance is dispersed throughout the matrix [1]

Controlled drug delivery system overcome the problems of conventional therapy and enhance therapeutic efficacy of given drug[7] to obtain maximum therapeutic efficacy it becomes nessesary to deliver the agent. Microspheres are used in development of new drug delivery system for controlled release of drug.[8-10]

ADVANTAGES OF MICROSPHERES [1,3]

1. They provide protection before after administration for unstable drug.
2. They reduced concentration of drug at site other than the tissue or the target organ.
3. Decrease dose and toxicity.
4. Particle size reduction for enhancing solubility of poorly soluble drugs.
5. Provide constant and prolonged therapeutic effect.

TYPES OF MICROSPHERES

1. Bioadhesive microspheres

2. Magnetic microspheres

3. Floating microspheres

4. Radioactive microspheres

5. Polymeric microspheres

I) Biodegradable polymeric microspheres

ii) Synthetic polymeric microspheres

Bioadhesive microspheres (6,3,1)

The sticking of drug to membrane by using the sticking property can be defined Adhesion of water soluble polymers. These type of microspheres exhibit a prolonged residence time at the site of application. Adhesion of the drug delivery device to the mucosal membrane such as buccal, ocular, rectal, nasal etc.

2. Magnetic microspheres (2,6)

This type of delivery system is very much important for localizes the drug to the disease site. site. In which larger amount of freely circulating drug can be replace by small amount of magnetically targeted drug. Magnetic carriers receive magnetic responses to a magnetic field.

3. Floating microspheres (2,10)

In floating microspheres the bulk density is less than the gastric fluid therefore it remains buoyant in stomach without affecting on gastric emptying rate. Drug is released slowly at the desired rate of the site. it also reduces chances of striking and dose dumping Produces.

4. Radioactive microspheres [6]

Radio emobilisation therapy microspheres having sized 10-30 nm are of larger than capillaries. They are injected to arteries which lead to tumor of interest. These radioactive microspheres deliver high radiation dose to targeted areas without damaging the normal tissues. Different types of radioactive microspheres are α emitters, β emitters, γ emitters.9

6. Polymeric microspheres

The different types of polymeric microspheres classified as

I) Biodegradable polymeric microspheres [2,6]

Natural polymers such as starch are used as concept that they are biodegradable, biocompatible, and also Bioadhesive in nature. This polymers prolongs the residence time when contact with mucous membrane due to its high degree of swelling property with aqueous medium, results get gel formation.

ii) Synthetic polymeric microspheres [10, 11, 12, 13]

Synthetic polymeric microspheres are widely used in clinical application, that are also used as bulk- ing agent, fillers, embolic particles and drug delivery vehicles etc. and proved to be safe and biocompatible but the disadvantage of these kind of microspheres, are tend to migrate away from injection site and lead to potential risk, embolism ,further organ damage.

METHOD OF PREPRATION

1. Spray Drying
2. Solvent Evaporation
3. Single emulsion technique
4. Double emulsion technique
5. Phase separation coacervation technique
6. Spray drying and spray congealing
7. Solvent extraction
8. Quassi emulsion solvent diffusion:

1. Spray Drying [1]

In Spray Drying technique, polymer is first dissolved in volatile organic solvent such as dichloromethane, acetone, etc. The drug in solid form is then dispersed in to polymeric solution with the high-speed homogenization. This dispersion is then atomized in hot air stream. The atomization leads to the form the small droplets from which the solvent evaporates instantly leads the formation of the microspheres in the size range 1-100µm. Micro particles are separated from hot air by the cyclone separator while the trace of solvent is removed by vacuum drying. major advantages of this process is feasibility of operation under aseptic conditions.

2. Solvent Evaporation: [14-17]

This process is carried out in vehicle phase of liquid manufacturing. The microcapsule coating is dispersed in the volatile solvent which immiscible with the vehicle phase of liquid manufacturing. A core material which is microencapsulated is dissolved in the coating polymer solution. Agitation With the core material mixture is dissolved in the liquid manufacturing vehicle phase to obtain appropriate size microcapsule. Then the mixture is heated if necessary to evaporate and the solvent for the polymer of the core material is dissolved in the polymer solution, around the core polymer shrinks. If core material is dissolve in the coating polymer solution, matrix type microcapsules are formed. The core materials are either water soluble or soluble materials.

3. Single emulsion technique [1]

The micro particulate carriers of the natural polymers i.e. proteins and carbohydrates are prepared by the single emulsion technique. Natural polymers are dissolved in aqueous medium which is followed by the dispersion in non-aqueous medium like oil. In next step, the cross linking of dispersed globule is carried out. The cross linking can be achieved by the heat or by using the chemical cross linkers. T chemical cross linking agents used are glutaraldehyde, formaldehyde, acid chloride. Heat denaturation is not suitable for the hermolabile substance. Chemical cross linking having the disadvantage of excessive exposure of active ingredient to chemicals if added at time of preparation and then subjected to centrifugation, washing, separation ,nature of the surfactants used to stabilize the emulsion phases can greatly influence by the size, size distribution, surface morphology and loading drug release, and bio per- formance of the final multiparticulate product.

4. Double emulsion technique: [5]

This method of microspheres preparation involves formation of multiple emulsions or double emulsion of type w/o/w and is best suited to the water soluble drugs, peptides, proteins and vaccines. This method can be used with the both natural as well as synthetic polymers. The aqueous protein solution is dispersed in the lipophilic organic continuous phase. This protein solution may contain the active constituents.

5. Phase separation coacervation technique: [1]

This process is based on the principle of the decreasing the solubility of polymer in organic phase which affect the formation of polymer rich phase called the coacervates. In this method, drug particles are dispersed in a solution of polymer and an incompatible polymer is added to system which makes first polymer for the phase separation.

6. Spray drying and spray congealing: [18]

These methods are based on the drying of the mist of polymer and drug in the air. Depending upon removal of the solvent or cooling of the solution, this two processes are named spray drying and spray congealing.

7 Solvent extraction: [1]

Solvent evaporation method is used for the manufacturing of microparticles and involves removal of the organic phase by extraction of the non-aqueous solvent. This method involves the water miscible organic solvent which is isopropanol.

8 Quassi emulsion solvent diffusion:[18,19]

A novel quasi-emulsion solvent diffusion method used for the manufacturing of the controlled release microspheres of drugs with acrylic polymers has been reported in the literature. Microsponges can be manufactured by the quassi emulsion solvent diffusion method by using external phase which contsains distilled water and polyvinyl alcohol. The internal phase consists of the drug, ethanol and polymers. Firstly the internal phase is manufactured at 60ºC and after then added to the external phase at room temperature. Then emulsification the mixture is continuously stirred for 2 hours. Then the mixture can be filtered for separate the microsponges.

REFERENCES

1) Suvarna V, microspheres: a brief review, Asian Journal of Biomedical and Pharmaceutical Sciences, 2015; 5(47):13-19.
2) Kappor D, Patel M, Vyas RB, Lad C, Tyagi BL, A review on microsponge drug delivery system, Journal of Drug Delivery and Therapeutics 2014; 4(5):29-35
3) Nikam VK et el, Microspheres - A Novel Drug Delivery System: An Overview, INTERNATIONAL JOURNAL OF PHARMACEUTICAL AND CHEMICAL SCIENCES, 2012; 1(1) ,
4) Shukla P, Vijaya Vani CH.S, review article on microspherevolume, IJPAR, 2015; 4(3):291-301.
5) Prasanth V.V., Moy A. C., Mathew S. T., Mathapan R., Microspheres An overview, Int. J. Res. Pharm. Biomed. Sci., 2011; 2:332 8.
6) Saralidze K., Koole L.H., Knetsch M. L. W., Polymeric micro-spheres for medical applications, Materials. 2010; 3:3537-64.
7) Ramteke K.H., Jadhav V.B., Dhole S.N., Microspheres: As carrieres used for novel drug delivery system, IOSRPHR. 2012; 2(4):44-48.
8) Patel B., Modi V., Patel K., Patel M., Preparation and evalution of ethyl cellulose microspheres prepared by emulsification solvent evaporation, international Journal For Research In Management And Pharmacy. 2012; 1(1):83-91.
9) Bansal H., Kaur S. P., Gupta A. K., Microsphere: Methods of preparation and applications;A comparative study, Int J Pharm Sci Rev Res. 2011; 10(1):69-78.
10) Alagusundaram M., Chetty.C. M. S., Umashankari.K, Badar-inath A. V., Lavanya.C., Ramkanth.S., Microspheres as a novel drug delivery sytem- A review, Int J ChemTech Res. 2009; 1(3):526-34.
11) Rastogi V, Shukla S, Singh R, Lal N, Yadav P, Microspheres: A Promising Drug Carrier. *Journal of Drug Delivery and Therapeutics*, 2016; *6*(3):18-26.
12) Saravana Kumar K., Jayachandra Reddy P., Chandra Sekhar K.B., A Review on Microsphere for Novel drug delivery System. Journal of Pharmacy Research, 2012; 5(1):420-424.
13) Bansode AS, Kute VB, Vethekar KS, Kote PS, Varhadi MK, Bansode AS, Formulation, development and evaluation of Microsponge loaded Topical Gel of Nystatin, Journal of Drug Delivery and Therapeutics 2019; 9(2-s):451-461
14) Nalini M. Anandea, Sunil K. Jain A,, Narendra K. Jain, Con-A conjugated mucoadhesive microspheres for the colonic delivery of diloxanide furoate. International Journal of Pharmaceutics, 2008; 359:182-189.
15) Guojun Liu, Husheng Yang, Jiayun Zhou, Preparation of magnetic microsphere from water- in-oil emulsion stabilized by block copolymer dispersant,. Biomacromolecules, 2005; 6:1280- 1288.
16) Dutta P, Struti J, Ch. Niranajan patra, M.E. Bhaoji rao, Floating Microsphere: Recents Trends in the Development of Gastroretentive Floating Drug Delivery System. International Journal of Pharmaceutical Science and nanotechnology, 2011; 4(1):1293-1306.
17) Ahmad N, Hasan N, Ahmad Z, Zishan M, Zohrameena S, Momordica Charantia: For Traditional Uses And Pharmacological Actions. *Journal of Drug Delivery and Therapeutics*, 2016; *6*(2):40-44.
18) Kawashima Y, Niwa T, Takeuchi H, T. Hino, Y. Ito, Preparation of multiple unit hollow microspheres (microbal loons) with acrylic resin containing tranilast and their drug release characteristics (in vitro) and floating behavior (in vivo). J. Control. Release, 16, 1991, 279-290.
19) Yadav R, Bhowmick M, Rathi V, Rathi J, Design and characterization of floating microspheres for rheumatoid arthritis, Journal of Drug Delivery and Therapeutics 2019; 9(2-s):76-81