ISSN: 2640-7477

Review Article

Journal of Gastroenterology & Digestive Systems

Microsphere: A Unique and Useful Drug Delivery System

Sanjita Das* and Naveen Kumar

Noida Institute of Engineering and Technology (Pharmacy Institute), Plot N0.19, Knowledge Park-II, Greater Noida, India

***Corresponding author**
Sanjita Das, Noida Institute of Engineering and Technology (Pharmacy Institute), Plot N0.19, Knowledge Park-II, Greater Noida, India

Submitted: 16 April 2020; **Accepted:** 18 May 2020; **Published:** 25 May 2020

Citation: *Sanjita Das* and Naveen Kumar (2020) Microsphere: A Unique and Useful Drug Delivery System J Gastro & Digestive Systems 4(1): 19-21.*

Abstract

Microsphere is one the novel technology that is used to deliver the drug to it targeted site. Microsphere they are micro particle in size. They are of natural and synthetic one. There are various approaches in delivering a therapeutic substance to the target site in a sustained controlled release fashion. For preparation of microsphere protein physiochemical property to be optimized this include optimal pH, protein stochiometry and protein concentration. Some of the important microsphere technology includes Ceformin microsphere technology Ceformin EI, Ceformin TI, Ceformin EA/CR, Silk microsphere and gelatin microsphere. Microsphere drug delivery system has gained enormous attention due to its wide range of application as it covers targeting the drug to particular site to imaging and helping the diagnostic features. Microsphere is excellent polymer used for buccal delivery. It is also used to deliver pacilitaxel at the tumor site. In the present study valuable and selective information on microsphere is enlightened with its important applications which will be beneficial for further newer drug development.

Keywords: Nanomedicine, Cyanoacrylate, Encapsulation, Bio-Adhesive, Stochiometry

Introduction

One of the major novel delivery system is microsphere. Microspheres are characteristically free flowing powders consisting of proteins or synthetic polymers, which are biodegradable in nature and ideally having a particle size less than 200µm. This is the important approach in delivering therapeutic substance to the target site in sustained and controlled release fashion. Microsphere is also known as micro particle because the drug is enclosed in micro system form. This prolonged the drug efficacy. They are made of polymer. The concentration of the medication gets increased by application through microsperes in some parts of the body relative to others. This means of delivery is largely founded on nanomedicine, a novel drug delivery system in which the drug is targeted to it therapeutic site and complete it action. It allow scientist to overcome many challenges one of the challenges it antihypertensive drug therapy. The targeted release system is to reduce the frequency of the dosages taken by the patient, having a more uniform effect of the drug, reduce drug side-effects, and reduce the fluctuation in circulating drug levels [1]. The size of micro particle is 1-1000µm [2]. Microspheres provide constant and prolonged therapeutic effect. They are made of polymer. The main aim of novel drug delivery system is to increase the bioavailability of drug decrease toxicity and allergic reaction and increase the half-life of drug.

Type of Microsphere

On the basis of synthesis it can be:

- **Biodegradable** – microsphere that are made my polymer which are obtained from natural sources like lactides glycoside and their copolymer, poly alkyl cyano acrylate, polyanhydride etc.
- **Synthetic polymer-** it include the microsphere that are made from the synthetic polymer polymethacrylate, glicidyl methacrylate and epoxy polymer etc are the example [3].

Microsphere Formation Process

Microsphere changes the pharmacokinetic and pharmacodynamics property of drug. Microsphere is controlled interaction and assembly of protein with another one of them is acidic and another one is basic. For preparation of microsphere the protein physiochemical property to be optimized this include

- Optimal pH
- Protein concentration
- Protein stoichiometry

Optimal pH: For association of protein to form microsphere pH is important because acidic protein dissociate in basic medium and basic protein in acidic medium for association we need protein that is un-dissociated appropriate pH is important factor for the

aggregation.

Protein Concentration: AppropriateAcidic protein to basic protein concentration is important for formation of stable microsphere e.g. α-lacta albumin and β lacta globulin.

Protein Stoichiometry: Stoichiometry is internal structure of the protein for preparation of microsphere suitable protein coupling is required this is done by stoichiometric analysis of the protein and if required suitable modification in the protein structure is done.

Some Important Microsphere Technologies

Ceformin Microsphere Technology is one of the technologies that are explored for producing uniform sized microsphere. The particle size is usually in the range of 150-180mm. It allows efficient encapsulation process. They can be used to prepare-

- Tablet
- Capsule
- Effervescent tablet
- Sachet
- Ceformin EA – enhance the absorption of drug.
- CeforminTI- taste isolation
- Ceformin EA/CR- Fast/slow release

Silk microsphere readily using fibroin regenerated solution with lipid vesicle that acts as template to efficiently load biological molecule in an active form.

Gelatin Microsphere this include CaP ceramics and polymer / CPC composite because of their strong chemical resemblance. CaP free and CaP containing gelatin microsphere loaded with radiolabelled base fibroblast prepared. The size of gelatin microsphere is 10-20µm. CaP incorporated microsphere has rough irregular base.

Application of Microsphere in Pharmaceuticals Industry

- Microsphere is excellent polymer used for buccal delivery because it has muco/bio adhesive properties can act as an absorption enhancer. Chitosan. Sodium alginate.
- Magnetic microspheres are very effective in the controlled and site specific drug delivery. Magnetic microspheres were developed to overcome two major problems encountered in drug targeting namely: RES clearance and target site specificity [4]. These are mainly used in targeting Doxorubicin to the tumor site. These are also incorporated in DNA analysis, cell isolation and protein purification [5]. In liver tumors the chemotherapeutic agents are delivered by magnetic microspheres. Drugs like proteins and peptides can also be targeted through this system [6].
- Parenteral Biomaterials are more preferred by microspheres over the last few decades as it provides controlled shape and dimension of injected particles which makes them ideally suited for treatments in which the particle size is of critical importance [7].
- Microspheres For embolization therapy microspheres are gain best chosen in which various substances are introduced into the circulation to occlude vessels, either to arrest or prevent hemorrhaging, to devitalize a structure, tumor, or organ by occluding its blood supply, or to reduce blood flow to an arteriovenous malformation.
- Paclitaxel is preferably delivered at the tumor site in therapeutically relevant concentration polymer films are fabricated. Mixture of drug has promising potential for use in controlled delivery in the oral cavity.
- Microsphere have internal cavity prepared by acidification when added to acidic and neutral medium are found buoyant and provided a controlled released of drug.
- Microsphere has good film forming property. The drug released from the devices is affected by the membrane thickness and cross-linking of the film.
- Microsphere is also used in separation of incompatible drug and excipient, That cannot be formulated previously in the industry
- Microspheres are also used to mask taste and odor of certain drugs which previously was very difficult to inhale due to the bad taste.
- In biomedical applications polystyrene microspheres are mostly used for their cell sorting and immune precipitation propertities.
- In ceramics and other materials polystyrene microsphere creates porous structures. Due to high sphericity of polyethylene microspheres with colored and fluorescence, they are used for flow visualization and fluid flow analysis, microscopy techniques, health sciences.
- Microencapsulated products are of significant advantageous as drug delivery systems, including: effective protection of the active agent against (e.g. enzymatic) degradation, the controlled release rate over a certain period, easy administration and desired, pre-programmed drug release profiles can be provided which match the therapeutic needs of the patient [8]. In biotechnology microencapsulated microbial cells are used to produce recombinant proteins and peptides.
- For diagnosis purpose microcapsules are also extensively used. Temperature-sensitive microcapsules for thermo graphic are used to detect tumors.
- Borate-based glass microspheres are used as biodegradable radiation delivery vehicles, in particular Dysprosium lithium-borate microspheres for the treatment of rheumatoid arthritis.
- Microspheres that are produced using solvent-evaporation, mainly the microspheres composed of PLGA, are extensively used as drug delivery vehicles.
- Polystyrene microspheres are used in lateral flow tests, latex agglutination tests, flow cytometry, fluorescence microscopy and as calibration particles. Poly-sciences with diameters ranges from 0.05µm to 90µm.
- Smaller microcapsules are preferred in bioreactors due to their larger surface area which allows the exchange of gases across the microcapsule membrane.
- Microencapsulation has also been used medically for the encapsulation of live cells and vaccines. Biocompatibility can be improved by the encapsulation of artificial cells and bimolecular such as peptides, proteins, and hormones.
- Microspheres are also used for effective vaccine delivery in which the vaccine is prerequisite for protection against the disease.
- Viral vectors, cationic liposomes, polycation complexes, and microencapsulated systems are used in microsphere gene delivery systems [9].
- Microorganism or its toxic product. Biodegradable delivery

systems for vaccines that are given by parenteral route may overcome the short coming of the conventional vaccines [10].

- Microsphere sensors are playing important role as optical microspheres for label-free biochemical sensors. Light of resonant frequencies circulates on the surface of the microsphere in the form of whispering-gallery modes (WGMs) [11].

Conclusion

Microspheres offer offers several improvements and potential advantages over conventional drug delivery systems. These have emerged as an exciting new platform for biologists to adopt into their armory of techniques in the investigation of bimolecular interactions and cellular processes. In recent years there have been increasing numbers of studies in which microspheres have been used in more diverse applications and it is evident that the range of potential applications is enormous [12].

Microspheres and microcapsules are established as unique carrier systems for many pharmaceuticals and can be tailored to adhere to targeted tissue systems. Hence, microspheres can be preferred not only for controlled release but also for targeted delivery of drugs to a specific site in the body. Microsphere technology for sustained drug delivery system is one of the best approaches. In this the drug reaches the target site without any loss of drug. Microsphere can be formulated easily it is made from natural and synthetic polymer. There are various ongoing researches which are going one to make various different new varieties of microsphere. The microsphere that is made is ceformin, Gelatin and silk microsphere. Microsphere has wide range of application in the pharmacy industry such as taste masking, making drug compatible which are incompatible before. Microsphere finds it major application in cancer also. Development in the field of microsphere is very useful for the treatment of serious disease. Although significant advances have been made in the field of microspheres, there are still many challenges ahead in this field. Of particular importance are the development of cheaper biopolymers for the microencapsulation technology and the development of universally acceptable evaluation methods especially for bioadhesive microspheres. Therefore, the development of safe and efficient particular systems will require, in the future, in depth investigations of both the biological and technological aspects of these systems.

References

1. Vyas SP, Khar RK (2002) Targeted and controlled drug delivery novel carrier systems. New Delhi: CBSPublishers 418.
2. Tamizharasi S, Rathi JC, RathiV (2008) Formulation, characterization and invitro release kinetics of pentoxifylline loaded Poly (ε-caprolactone) microspheres. Indian J Pharm Sci 70: 332-336.
3. Midha K, Nagpal M, Arora S (2015) Microspheres: a recent update. Internat J Recent Sci Res 6: 5859-5867.
4. Kakar S, Batra D, Singh R (2013) Magnetic microspheres as magical novel drug delivery system: A review. J Acute Dis 2: 1-12.
5. Chandrawanshi P, Patidar H (2009) Magneticmicrospheres: as a targeted drug delivery. J of Pharm Res 2: 64-66.
6. Omkar T, Alagusundaram M, Madhu SC, Umashankari K, Attuluri VB (2009) Microspheres as a novel drug delivery system. Int J Chem Tech Res 3: 526-534.
7. Laeschke K (2004) Biocompatibility of microparticles into soft tissue fillers. Semin Cutan Med Surg 23: 214-217.
8. Singh MN, Hemant KSY, Ram M, Shivakumar HG (2010) Microencapsulation: A promising technique for controlled drug delivery. Res Pharm Sci 5: 65-77.
9. Liu G, Yang H, Zhou J (2005) Preparation of magnetic microsphere from water in-oil emulsion stabilized by block copolymer dispersant. Biomacromolecules 6: 1280-1288.
10. Kazi M, Hossain Z, Patel U, Ahmed I (2015) Development of microspheres for bioimedical applications. Prog Biomaster 2015: 14 -18.
11. Lamprecht A, Ubrich N, Hombreiro Perez M, Lehr C, Hoffman M, et al. (200) Influences of process parameters on nanoparticle preparation performed by a double emulsion pressure homogenization technique. Int J Pharm 196: 177-182.
12. Gupta PK, Hung CT (1989) magnetically controlled targeted micro-carrier systems, Life Science 44: 175-186.