



Release of Drug (Metformin)-Chitosan Microsphere: A Review

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Abstract— In the recent past, substantial scientific and technological advancements have been made in the research and development of rate controlled oral drug delivery systems to counter the adversities of conventional drugs and its administration. Several attempts have been made towards developing biodegradable polymeric nanoparticles as potential drug delivery devices. The release of drug was not affected by the changes in parameters but was affected when sodium alginate concentration was changed. In the last few years, drug delivery systems have enormously up their execution, forwarding from simple pills to sustained/controlled production and sophisticated programmable delivery systems. Therefore, the present study target to produce the controlled ejects formulation of metformin hydrochloride deployed in the chitosan microspheres. In this paper we study about the processes exist in market for release of drugs.

Keywords— Metformin, micro particles, drug, chitosan microsphere, iguanid, Drug delivery systems

I. INTRODUCTION

Now days, Nano-particular concept of drug delivery system is gaining importance due to many issues. Nanoparticles are examined as particulate dispersions or hard particles with a size in the limit of 10-1000nm. In Nano-particular process of drug delivery system, the drug is mixed, entrapped, encapsulated or addition to a nanoparticle matrix. Based upon the method of preparation, nanoparticle, Nano-spheres or Nano-capsules can be obtained. This process of system can be worked for various ways of administration considering oral, nasal, parenteral, intra-ocular etc. There are reports that Nano-particular drug delivery systems deserve for various merits over these corresponding conventional drug deliveries process systems. Some of these are

- Particle size and surface characteristics of nanoparticle can be easily manipulated to gain both passive and active drug aim for different ways of drug administration.
- Controlled release and particle degradation features can be readily modulated by the optional of matrix constituents. Drug importing is relatively increased and drugs can be incorporated into those systems without production of any chemical reaction; this is an important factor for preserving the drug activity.
- Site-specific aim can be gained by attaching aim ligands to surface of particles or use of way of magnetic particle.

The aim of this paper is to model metformin polymeric nanoparticles and consume the instances related to the currently worked polymer and drug during production. This will further point out the most promising strategies in the experiments, according to the biomedical community requirements. A liable drug delivery system considers two elements: the ability to aim and to control the drug production. The reduction or prevention of side effects can also be achieved by controlled release.



II. LITERATURE SURVEY

Metformin is a BCS Class III (high-solubility, low-permeability) drug widely used in type-2 diabetes mellitus. Because of its low accessibility, many try are done to increase the permeability of Metformin by transforming Metformin in to proniosoms, microsphere, Nano spheres, or Nano capsules for increasing the consumption of the drug so also increase the permeability of the drug by using various absorption enhancers. Some of the background reports are cited below.

In the year 2010, they prepared microspheres presentation for prolonged drug production (8 h). The mean particle size step up and the drug eject rate step down at higher polymer concentration. No significant effect of the stirring rate during processing on drug eject was consumed. In many cases good in vitro floating behavior was observed and a broad variety of drug release pattern could be achieved by variation of the polymer and solvent ratio, which was beat to compare target release data. The produced floating microspheres of metformin hydrochloride may be used in clinic for prolonged drug eject in stomach for at least 8 hrs, thereby performing up the bioavailability and patient disease [1].

In the year 2011, they present review highlights on several carriers used in the preparation of micro particles, preparation methods of micro particles, their release mechanisms, evaluation parameters, their advantages and applications.

Therefore micro particles open up new way of research in the design of novel drug delivery systems. Drug delivery systems (DDS) that can precisely handle the ejection rates or target drugs to a specific body site have an enormous impact on the health care structure. Carrier technology give options for an intelligent method for drug delivery by coupling the drug to a carrier particle such as microsphere, nanoparticles etc, which modulates the ejection and absorption properties of the drug.

Microspheres/micro particles constitute an important part of this particulate drug delivery system by virtue of their small size and optimize carrier properties. That delivery systems give option for numerous merits compared to conventional dosage forms, which include improved efficacy, down toxicity, improved patient ordinance and convenience. These systems often use macromolecules as carriers for the drugs. The present review highlights several carriers used in the preparation of micro particles, preparation methods of micro particles, their release mechanisms, evaluation parameters, their advantages and applications.

Therefore micro particles open up new vistas of research in the development of novel drug delivery systems [2].

In year 2012, they studies about acute toxicity that were investigated in male albino rats following oral ordering of the microspheres. The rats were observed with best precaution for any clinical signs for 7 days, and gross evolution of the organs was performed at 14 days. The level of blood glucose was stayed to normal values till 12 h with microspheres using chemical of carbopol 934P polymer and the chitosan microspheres. No toxic signs or mortality were get for all the formulations up to dose ratio 2 g/kg body weight. Curing with all formulations for 14 days significantly attenuated ($p < 0.01$) the elevated total cholesterol and triglyceride levels in matching with the vehicle treated diabetic rats [3].

In the year 2013, spherical microspheres were obtained with significant swelling and mucoadhesivity by researchers. Dissolution study was carried out in phosphate buffer (pH 7.4) for 7 hrs. It was also mentioned to control good mucoadhesive in such a way that about 90% of microspheres rested adherent on the surface of intestinal mucosa of pig skin. The total amount of drug released from microspheres after 7 hr. was 80% [4].



In the year 2014, the microspheres prepared with high drug to polymer ratio showed higher in vitro drug release at the end of 12 h of the experiment. It was observed that the chitosan microspheres could be included for controlled drug delivery of metformin hydrochloride. The microspheres prepared with high drug to polymer ratio displayed good drug index, compressibility index, swelling index, and surface morphology and higher in- vitro drug eject [5].

In the year 2015, they release studies were carried out up to 220 hours and, depend on the eject properties; chitosan was selected as the best polymer. Thus the polymeric nanoparticle system can be considered as an effective delivery system for Metformin, which would post the drug at a handled rate for a prolonged range of time. This can help to cover the demerits of the conventional anti-diabetic drugs and provide better therapeutic efficacy [6].

III. DETERMINATION OF DRUG INCORPORATION EFFICIENCY

The recovery of nanoparticles is defined as the weight ratio of freeze dried nanoparticles to the initial loadings of polymer, excipients and drug. The nanoparticle backup, drug index and entrapment in the nan-oparticles were calculated using the following equations [6]

Percentage of Nanoparticle Recovery

$$= \frac{\text{Mass of Nanoparticle Recovered}}{\text{Mass of polymeric nanoparticle, drug any formulation excipients}} * 100$$

Percentage of Drug Content

$$= \frac{\text{Mass of Drug in Nanoparticle}}{\text{Mass of nanoparticle, Recovered}} * 100$$

IV. STUDY OF IN-VITRO RELEASE

In-vitro release was evaluated using a dialysis bag technique [7]. The in- vitro release of nanoparticles was carried out thrice in stirred dissolution cells at 37.4°C by suspending Nano particulate suspension into a beaker containing 100ml of release media: phosphate buffer saline pH 7.4. The correct in-vitro conditions required to study the release behavior of a hydrophobic drug were maintained [8]. Drug release was assessed by intermittently sampling the receptor media (5ml) at predetermined time intervals. Each time 5ml of fresh reservoir fluid was taken over. The amount of drug ejected in the buffer solution was measured by a UV spectrophotometer [9].

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V. CONCLUSION

Drug distribution into the micro-particles was found to be homogenous with a steady molecular dispersion in the polymer matrices of micro-particles. It was observed that microsphere properties changed as the parameters were changed. Smaller particles were obtained when the concentration of the spray suspension was low. The release of drug was not affected by the changes in parameters but was affected when sodium alginate and rice powder concentration were changed.



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References

- [1] Ghodake J.D.1*, Vidhate J.S.1, Shinde D.A.2, Kadam A.N., "Formulation And Evaluation Of Floating Microsphere Containing Anti-Diabetic (Metformin Hydrochloride) Drug", *International Journal of PharmTech Research*, Vol.2, No.1, pp 378-384, Jan-Mar 2010.
- [2] B. Pavan Kumar, I. Sarath Chandiran, B. Bhavya, M. Sindhuri, "Microparticulate Drug Delivery System: A Review", *Indian Journal of Pharmaceutical Science & Research*, Vol. 1, Issue 1, 2011
- [3] Navneet Garud and Akanksha Garud, "Acute toxicity studies of metformin microspheres prepared by two different methods", *Pelagia Research Library, Der Pharmacia Sinica*, 2012.
- [4] Hemanta Kumar Sharma, Jadavesh Mohapatra and Lila Kanta Nath, "Development and characterization of metformin loaded spray dried Bora rice microspheres", *Pak. J. Pharm. Sci.*, Vol.26, No.1, January 2013
- [5] A. Semalty, "Preparation and Evaluation of Chitosan Microsphere of Metformin Hydrochloride and to Study the Effect of Drug to Polymer Ratio", *International Journal Of Pharmaceutical And Chemical Sciences*, Vol. 3 (2) Apr-Jun 2014
- [6] Sanjukta Duarah, Kunal Pujari, Jyotirmoy Ghosh, and Dhanalekshmi Unnikrishnan, "Formulation and Evaluation of Metformin Engineered Polymeric Nanoparticles for Biomedical Purpose", *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, May-June 2015.
- [7] Yang, S.C., Lu, L.F., Cai, Y., Zhu, B.J., Liang, W.B., and Yang, C.Z., "Body distribution in mice of intravenously injected camptothecin in solid lipid nanoparticle and targeting effect on brain. *Journal of Controlled Release*.1999; 59: 299-307.
- [8] Avinash, B., Steven, J.S., and Karen, I., "Controlling the in-vitro release profiles for a system of haloperidol-loaded PLGA nanoparticles. *International Journal of Pharmaceutics*, 2007; 51: 87-92.
- [9] Anna, G., Hanna, A., and Anna, B., "Reversed phase thin layer chromatography of three new oral anti diabetics and densitometric determination of pioglitazone" *Journal of Liquid Chromatography and Related Technologies*, 2005