International Journal for Pharmaceutical Research Scholars (IJPRS)

V-3, I-2, 2014 ISSN No: 2277 - 7873

RESEARCH ARTICLE

Preparation and Evaluation of Chlorpheniramine Maleate Microcapsules by Ionic-gelation Method

Pandey S[*1], Kumar S[2]

[1]*Deparment of Pharmaceutics, Aryakul College of Pharmacy and Research, Lucknow, India.*

[2]*Research Scholor, Department of Pharmacy IFTM, University Moradabad, India.*

Manuscript No: IJPRS/V3/I2/00261, Received On: 10/05/2014, Accepted On: 20/05/2014

ABSTRACT

The study was conducted for preparation of microcapsules of CPM. (chlorpheniramine maleate) By ionic gelation method by different combinations of hydrophilic polymers. Microcapsules were characterized for particle size and shape by scanning electron microscopy, angle of repose, drug content CPM **:** Chlorpheniramine maleate is a first generation alkylamine antihistamine used in the prevention of the symptoms of allergic conditions such rhinitis and urticaria through the literature survey it was found that no significant work was done on preparation of microcapsules of CPM through ionic gelatin technique. Microcapsules were characterized by particle size analysis, SEM studies, IR spectrophotometry and *in vitro* release studies. SEM and IR studies indicated that microcapsules were spherical, free flowing and there was no significant interaction between drug and polymer. The percentage yield was found to be in the range of 60 %to 72% indicated good yield of microcapsules.

KEYWORDS

Microcapsules, Chlorpheniramine Maleate, Ionic Gelation Method, *In-Vitro* Release

INTRODUCTION

Microcapsules are widely used in applications in which an active compound needs to be protected from the environmental conditions (UV, oxygen, and moisture) either to avoid the side effect of the active or to prolong the storage life time of the active. Other applications are when controlled release, or prevented chemical reaction between the active and surrounding is required[1]. For example, controlled release of an active medical agent can be a mean to make available the drug during a long time to achieve, e.g. a once-daily dosing of the medicine[2]. A microcapsule is a core-shell system, where the core can be, e.g. an active substance, often dissolved in a liquid and the shell is a polymer.

***Address for Correspondence:**
Pandey Swarnima
Assistant Professor, ACPR,
Lucknow. U.P., India.
E-Mail Id: yesgoldi@gmail.com

A large number of liquid and solid materials can be encapsulated[3]. Microcapsules is able to immobilize and protect the core substance or the active from UV, moisture oxygen, etc. Microencapsulation prevents probable chemical reactions between the core and the surrounding environment[4]. Having control over the release of the active material in the core is also another advantage of microencapsulation[5].

MATERIALS AND METHOD

Materials

All the chemicals were of laboratory grade CPM was obtained as a gift sample. Following chemicals were used sodium carboxy methyl cellulose hydroxyl propyl methyl cellulose and sodium carboxy methyl cellulose. All the chemicals were of laboratory grade sodium

alginate calcium chloride were of central drug house Mumbai.

Method

CPM Microcapsules were prepared by ionic orifice gelation technique. The alginate microcapsules were prepared by employing the sodium alginate in combination with the two hydrophilic, polymers-sodium carboxy methyl cellulose and hydroxypropyl methyl cellulose[6]. These polymers as a coat materials, that is used for the preparation of the alginate microcapsules In this method sodium alginate solution and the other polymers like sodium carboxy methyl cellulose & hydroxyl propyl methyl cellulose in 1:2, 2:1, 1:2 solution is prepared by dissolving the weighed polymer in 25ml of purified water and the viscous solution is prepared[7]. Then separate 300mg chlorpheniramine maleate is dissolved in 7ml of purified water and dispersed and add few drops of glacial acetic acid for preparation of clear dissolved drug solution. This drug added to the above polymer solution and mixed well. The resulting dispersion of drug-polymer solution was added manually drop wise into the 15% calcium chloride solution through a syringe with a needle of size of 26. The added droplets were retained in the calcium chloride solution for 30 minute to complete curing reaction and after completion of rigidization the spherical rigid microcapsule obtained. Microcapsules were separated or decanted and washed with the n-hexane repeatedly and then dried at 40^0C for 12 hrs.

Evaluation of Microcapsules

Particle Size Analysis

The particle size of drug loaded microcapsules was determined by optical microscopy by mounting on a clean glass slide and observing under microscope.

Scanning Electron Microscopy

SEM photograph were obtained to examine shape and surface morphology of microcapsules. The microcapsules were dusted onto double sided tape on a copper stub, which were coated with gold by a sputter. Then the sample was imaged at an accelerating voltage of 15 kv.

The SEM analysis was carried out by using LEO 430 scanning electron microscope photograph indicated that the microcapsules were spherical and completely cover with the coat polymer[8].

Percentage Yield

It was calculated according to the following formula

$$\text{Percentage yield} = \frac{\text{Total mass of microcapsules}}{\text{Total mass of raw materials used}} * 100$$

Determination of Encapsulation Efficiency

Drug encapsulation efficiency was determined by crushing the 200 mg microcapsules using pastel and mortar. 100 mg of this powder was added to 50 ml phosphate buffer pH 7.4 solution followed by stirring of solution at 1000 rpm for 3 hours. Then the solution was filtered and diluted appropriately for spectrophotometric analysis of Chlorpheniramine at 264 nm[9].

$$\%\ \text{encapsulation efficiency} = \frac{\text{Actual drug content}}{\text{Theoretical drug content}} * 100$$

Determination of Swelling Index

100 mg of the microcapsules were weighed and transferred to a beaker containing 50 ml phosphate buffer pH 7.4 solution .this solution was left for 24 hours and after completion of time the solution was drained and microcapsules were weighed again. The swelling index was calculated by the following formula

$$\text{Swelling index} = \frac{wf - wi}{wi} * 100$$

Where wf = final weight of microcapsules

wi = intial weight of microcapsules

Drug Loading Capacity

Drug loading was determined by dissolving 50 mg of the microcapsules in PBS 7.4. The prepared solution was filtered and assayed spectrophotometrically at 264 nm. The drug loading was calculated according to the formula

$$\%\ \text{Drug loading} = \frac{\text{Amount of Drug in Microcapsules}}{\text{Amount of Preparation}} * 100$$

In-Vitro Drug Release of Microcapsules

Microcapsules equivalent to 100 mg of the chlorpheniramine were loaded in the paddle type dissolution apparatus Dissolution experiments were performed using a dissolution apparatus (USP II) with 100 rpm maintained paddle rotational speed was used in studies. The temperature was maintained at constant temperature 37^0C. Drug release studies for microcapsules were performed in 900 ml. of simulated gastric fluid (pH: 1.2), phosphate buffer ph 7.4, 0.1 N HCl initially for four hours. The dissolution study was carried out of the formulation which showed complete taste masking. The 5 ml of sample is withdrawn from the from dissolution bowl and replaced with 5ml of fresh dissolution media at interval of 10 minutes for one hour and then at an interval of 30 minutes for rest of the study. The withdrawn sample is filtered through funnel and analyzed for the chlorpheniramine maleate concentration spectrophotometrically by U.V., at 264 nm. These studies were performed in triplicate for each sample and average values were considered for data analysis.

RESULTS

Spectral Studies

The spectral studies carried out by IR spectrophotometry the spectral arrangement did not depicted any extra peaks which confirmed that there was no significant effect of drug and polymer on the formulation.

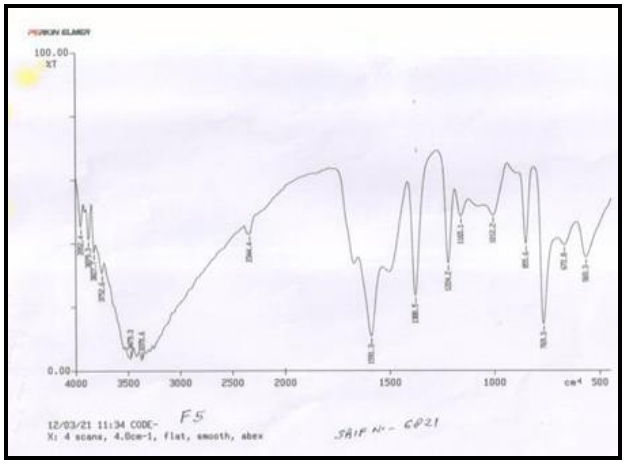

Figure 1: I.R. Spectra of CPM and polymers mixture

Scanning Electron Microscopic Studies

Drug loaded alginate microcapsules are spherical and no drug crystals were found on the surface. The placebo microcapsule have somewhat irregular surface. Irregular surfaces were observed with those prepared with lower amount of the polymer. This has greatly affected the morphological characteristics of the microcapsules. As the polymer ratios increased, more spherical microcapsules with smooth surface were obtained as suggested. Shape and surface difference between the two formulations occurred due to the different amount of polymer concentration used.

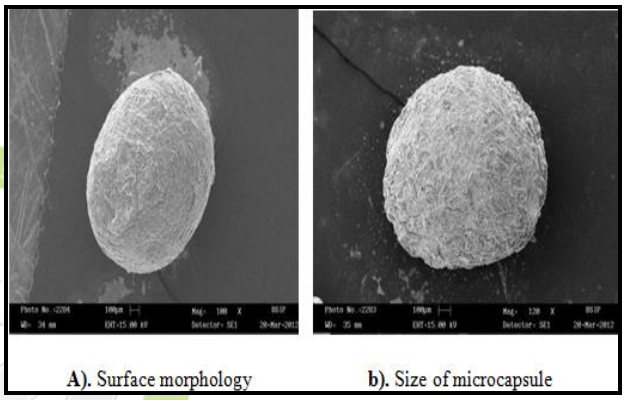

Figure 2: Scanning electron microscope images of prepared microcapsules of CPM

Swelling Index

The swelling-dissolution erosion process is highly complex. In systems based on sodium alginate cross linking with calcium chloride, the osmotic pressure gradient that exists between alginate gel and the environment comprises an important factor in the swelling process. The swelling studies showed that with increase in polymer concentration, swelling of beads were significantly increased.

In-Vitro Release Study

The *in-vitro* drug release of the completely optimized formulation MCF5 (microcapsule formulation-5) was performed in simulated gastric (pH 1.2) phosphate buffer (pH 7.4) for 4 hours to simulate the G.I.T conditions. The release profiles of chlorpheniramine maleate microcapsules prepared with different drug-polymer ratios are presented in figure.

Table 1: Graph showing various parameters of prepared formulations

Serial no.	Formulation code	Swelling index	Encapsulation efficiency%	Drug loading capacity	Mean Particle size(um)	Percentage yield
1	**MCF1**	245	37%	12%	163.68	72%
2	**MCF2**	478	42%	29.7%	167.32	51.6%
3	**MCF3**	254	30%	11.2%	197.77	68%
4	**MCF4**	54	24.5%	9.4%	251.84	76%
5	**MCF5**	145	34.5%	32%	186.61	50.4%
6	**MCF6**	201	45%	36.1%	214.12	64.8%

Release of dug from microcapsules was pH dependent. The drug release in the case of SGF 1.2 was found to be lower due to acidic environment. This may be attributed the fact that alginate is stable at lower pH and also conversion of sodium alginate to insoluble alginic acid which formed tight gel mesh work.

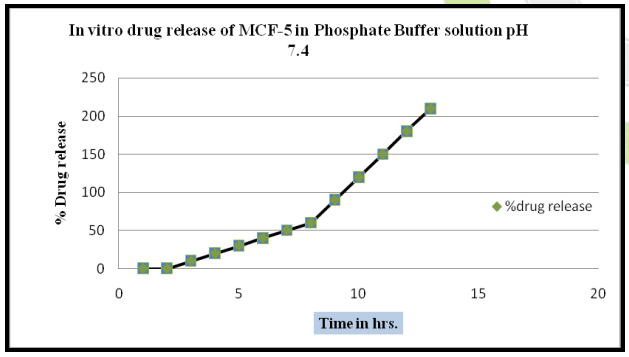

Figure 3: In vitro drug release of MCF5 in Phosphate Buffer solution pH 7.4

DISCUSSIONS

Orifice ionic gelation is the best technique for the preparation of microcapsules and also for the sustained release of the drug. In this investigation the coating of the bitter drug was also done by this technique and sustained release of the drug was also obtained. The orifice ionic gelation technique was used to prepare microcapsules by using different polymer blend concentration.

IR confirmed cross linking reaction[10]. Chlorpheniramine maleate was successfully entrapped into polymer matrix and was stable in matrix, developed without undergoing any chemical changes during microcapsules preparation. Microcapsules were spherical but there morphologies were affected by amount of polymers used in the formulation. *In-vitro* release studies were also performed for determination of formulated microcapsules. The release of drug from microcapsules showed a dependence on the amount of polymer blend used, extent linking of the matrix as well as amount of drug[11].

CONCLUSION

I want to conclude that the chlorpheniramine maleate microcapsules were prepared by ionic gelation method and then evaluated for size, surface characterization, encapsulation efficiency, % yield and *In-Vitro* release study. . Microcapsules were found to be uniform, free flowing with smooth surface. The surface characterization was done by SEM testing. The polymer used in preparation of chlorpheniramine maleate was HPMC, Sodium Alginate and Sodium carboxy methyl cellulose. The release study was done for prepared microcapsules. The release of drug was

extended due to release of drug in sustained manner.

ACKNOWLEDGEMENTS

I am very thankful to Sushant Kumar for continuous assistance for the research and manuscript preparation. I also thankful to CDRI, Lucknow for I.R. characterization and B.S.I.P, Lucknow for providing the facility of SEM testing.

REFERENCES

1. Bentia, S. (1984) Microcapsules: New applications and characterization. *Lab. Pharma. Prob.Tech, 32(2)*, 694-701.
2. Capan, Y., Jiang, G., Giovagnoli, S., Na, K. H., & DeLuca, P. P. (2003). Preparation and characterization of poly (D, L-lactide-co-glycolide) microspheres for controlled release of human growth hormone. *AAPS PharmSciTech*, *4(2)*, 147-156.
3. Chowdary, K. P. R., & Rao, Y. S. (2003). Design and in vitro and in vivo evaluation of mucoadhesive microcapsules of glipizide for oral controlled release: a technical note. *AAPS PharmSciTech*, *4*(3), 87-92.
4. Gohel, M. C., & Amin, A. F. (1998). Formulation optimization of controlled release diclofenac sodium microspheres using factorial design. *Journal of Controlled Release*, *51*(2), 115-122.
5. Tang, L., Khan, S. U., & Muhammad, N. A. (2001). Evaluation and selection of bio-relevant dissolution media for a poorly water-soluble new chemical entity. *Pharmaceutical Development and Technology*, *6*(4), 531-540.
6. Vasir, J. K., Tambwekar, K., & Garg, S. (2003). Bioadhesive microspheres as a controlled drug delivery system. *International Journal of Pharmaceutics*, *255*(1), 13-32.
7. Woo, B. H., Jiang, G., Jo, Y. W., & DeLuca, P. P. (2001). Preparation and characterization of a composite PLGA and poly (acryloyl hydroxyethyl starch) microsphere system for protein delivery. *Pharmaceutical Research*, *18(11)*, 1600-1606.
8. Ghaderi, R., & Carlfors, J. (1997). Biological activity of Lysozyme after entrapment in PLGA-microspheres. *Pharmaceutical Research*, 14, 1556-1562.
9. Anand, V., Kandarapu, R., & Garg, S. (2001). Ion-exchange resins: carrying drug delivery forward. *Drug Discovery Today*, *6*(17), 905-914.
10. Ch'Ng, H. S., Park, H., Kelly, P., & Robinson, J. R. (1985). Bioadhesive polymers as platforms for oral controlled drug delivery II: Synthesis and evaluation of some swelling, water-insoluble bioadhesive polymers. *Journal of Pharmaceutical Sciences*, *74(4)*, 399-405.
11. Kahn, C. R., Shechter, Y. In: Theodore, W. R., Alan, S. N., Taylor, P. Gilman, A. G., eds. (1991). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 8th ed. New York, NY: *McGraw-Hill*, 1712–14.

