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PREPARATION AND INVESTIGATIONS ON THE MICROSPONGES LOADED WITH PEPPER EXTRACT

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ABSTRACT

The modified mythology is used to plan different drug delivery systems in order to achieve controlled release drugs are used for topical application along with carrier system from the past few years. The micro sponge is used to modify drug delivery system consisting of patent, porous, polymeric microspheres to protect the active ingredients of drugs. While non- conventional dosage forms such as non hydrophillic ointments having short resistance on the skin. Now a days, Cosmetics, sunscreens, OTC skin care products, prescription products are prepared by this micro sponge method the preparation of Piper extract microsponges as it is a rapid, easy, consistent method and has an advantage of nullifying solvent toxicity. It was observed that as drug: polymer ratio increased, particle size decreased. This is likely due to the fact that at higher relative drug content, the amount of polymer available per microsponge to encapsulate the drug becomes less, thus reducing the thickness of the polymer wall and hence, smaller microsponges.

Keywords: Microsponge, Piper extract, Gels, Drug delivery.

INTRODUCTION

The modified mythology is used to plan different drug delivery systems in order to achieve controlled release drugs are used for topical application along with carrier system from the past few years. The micro sponge is used to modify drug delivery system consisting of patent, porous, polymeric microspheres to protect the active ingredients of drugs. Microsponge particles cannot through into the skin due to the presence of inert and small size of sphere. The tiny nooks & crannies may gather the micro sponge particles in the skin to deliver the active ingredient of drugs in required dose. The micro sponge size ranges from 5 to 300um in diameter. The higher amount of ingredients accumulated in the skin are prevented by micro sponge system. Therefore, the drugs which produces irritation are decreased but their effectiveness remains same. The conventional topical dosage forms like ointments, gels, lotions, creams, and powders are delivered through the skin. While non- conventional dosage forms such as non hydrophillic ointments having short resistance on the skin. Now a days, Cosmetics, sunscreens, OTC skin care products, prescription products are prepared by this micro sponge method

MATERIALS AND METHODS

Piper longum was supplied by the local herbal store and was authenticated. It is dried and powdered properly and extracted with Ethanol using Soxhlet. It is then filtered and the crude filtrate is collected. This is used as such in further experiments. Carbopol- 940, Ethyl cellulose (EC), poly vinyl alcohol (PVA), Dichloro methane and Tri-ethanol amine are purchased from bross chemicals, Tirupathi.

Compatibility studies

Pure drug and polymer (ethyl cellulose) and their physical mixture were examined by Fourier Transform Infrared (FT-IR) spectra. The spectra were recorded in a Thermo-IR 200 FTIR spectrophotometer. Potassium bromide pellet method was employed and background spectrum was collected under identical conditions. Each spectrum was derived from 16 single average scans collected in the range of 400-4000 cm-1 at the spectral resolution of 20 cm-1.

Preparation of Piper longum microsponges

Four batches of micro sponges coded by A1, A2, A3, A4 employing dissimilar proportions of ethyl cellulose (EC) and poly vinyl alcohol (PVA) were prepared by emulsion solvent diffusion method. briefly, the dispersed phase consists of Piper extract (100mg) and required quantity of ethyl cellulose (table No. 1)

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the dispersed phase consists of Piper extract (100mg) and required quantity of ethyl cellulose (table No. 1) dissolved in 20ml of dichloromethane was slowly added to a certain amount of poly vinyl alcohol (table No.1) in 150 ml of aqueous continuous phase.

The reaction mixture was stirred at 2000 rpm for two hours on a mechanical stirrer. The microsponges were collected by filtration and dried at room temperature for 24 hours. The dried microsponges were stored in vacuum desiccators to ensure the removal of residual content [5, 6, 7].

CHARACTERIZATION

Determination of loading efficiency

A sample of dried microsponges equivalent to 10 mg was taken in to mortar and pestle and add little amount of phosphate buffer of pH 5.5 and allowed to stand for 24 hours [8]. Then transfer content in to 100 ml volumetric flask and make up volume to 100 ml with phosphate buffer of pH 5.5. The solution was filtered through whatmann's filter paper. From the resulting solution take 1 ml in to 100 ml volumetric flask and then make up volume to 100 ml with phosphate buffer of pH 5.5. Drug content was determined by UV spectrophotometer at 253 nm. The entrapment was calculated by using following formula.

The loading efficiency (%) of the microsponges can be calculated according to the following equation:

Loading efficiency = (Actual drug in microsponges / Theoretical drug concentration) 100

Size analysis of microsponges

The mean diameter of 100 dried microsponges was determined by optical microscopy (Metzer, India). The optical microscope was fitted with a stage micrometer by which the size of microsponges could be determined [9].

EVALUATION

Drug content studies

1.0 g of each gel formulations were taken in 100 ml volumetric flask containing 20 ml of phosphate buffer (pH 5.5) and stirred for 30 minutes and allowed to stand for 24 hours in case of microsponge loaded gel formulations. The volume was made up to 100mL and 1mL of the above solution was further diluted to 50 mL with phosphate buffer (pH 5.5). The resultant solution was filtered through membrane filter (0.45 μm). The absorbance of the solution was measured spectrophotometrically at 319 nm using placebo gel as reference.

In vitro diffusion studies

Modified frenz diffusion cells were used in the in-vitro diffusion studies. The egg membrane was mounted between the compartments of the diffusion cell. In this study, 200 ml of phosphate buffer (pH 5.5) solution was used as receptor medium. The receptor medium was maintained at 37±0.5°C and stirred magnetically at 500 rpm. 1 ml of sample were withdrawn from the receptor compartment at predetermined time interval for 8 hours period, and replaced by same volume of fresh pre-warmed phosphate buffer (pH 5.5) solution to maintain constant volume. The amounts of Piper extract in the samples were assayed spectrophotometrically at 319 nm against appropriate blank.

RESULTS AND DISCUSSION

Compatibility studies

FTIR spectrum of Piper extract micro sponges along with ethyl cellulose and physical mixture were obtained. The characteristic peaks of Piper extract shows 1069.04 (C-O stretch), 2882.55 (C-H stretch), 1361.92 (N=O stretch). Whereas the FTIR spectrum of Piper extract microsponge formulation shows characteristic peaks at 1052.72 (C-0 stretch), 2972.70 (C-H stretch), 1371.94 (N=O stretch).This indicates that characteristic peaks were present even in formulated Piper extract microsponges, indicates that the drug was found to be compatible with the polymers used.

Characterization of micro sponges

Loading efficiency

The loading efficiency of Piper extract microsponge formulations are given in Table 2. The loading efficiency calculated for all microsponges ranged from 90.38 to 95.21 Loading efficiency is varied by changing the proportions of drug, polymer, and emulsifier. Higher loading efficiency is achieved with the formulation consists of drug, PVA, EC the ratio of 1:3:3 coded by M2 which is selected for the gel preparation.

Particle size

Particle size of micro sponges is varied along with the change in the ratio of polymer (ethyl cellulose) and emulsifier (PVA). By keeping polymer concentration constant, particle size is increased by decreasing the emulsifier (A1), (A4). Optimum size is obtained by taking polymer and emulsifier at equal proportions (A2). Lesser size is obtained by taking lesser proportion of emulsifier than polymer (A3).

Table 1. Composition for microsponges of Piper extract

Ingredient	A1	A2	A3	A4
Drug (mg)	100	100	100	100
PVA (mg)	300	300	200	200
EC (mg)	200	200	300	300
DCM (ml)	20	10	20	10
Distilled water (ml)	150	150	150	150

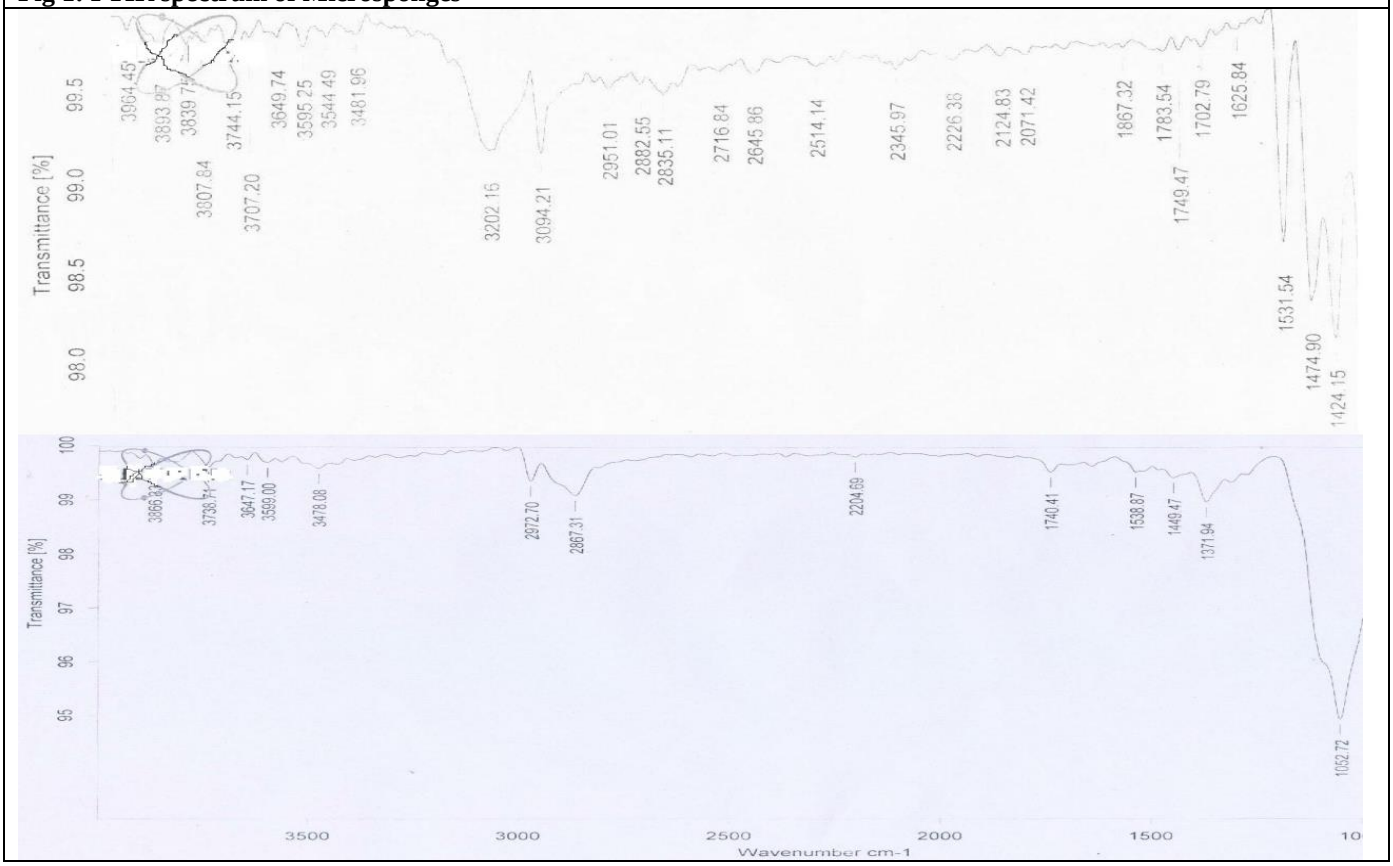
Table 2. Evaluation of microsponges

S. No.	Microsponge	Loading efficiency (%)	Mean particle size (µm)
1	A1	91.64	43.2
2	A2	95.21	38.6
3	A3	90.38	32.7
4	A4	93.75	46.4

Table 3. *In vitro* drug release from microsponges

Time (hrs)	A1	A2	A3	A4
1	10.54	2.87	5.69	7.85
2	36.16	4.29	11.14	21.26
3	24.20	13.0	26.10	39.18
4	59.11	27.36	32.29	40.07
5	68.03	32.01	44.56	58.32
6	75.60	10.05	57.82	62.11
7	86.37	48.23	63.05	74.39
8	96.42	56.87	72.52	86.24

Fig 1: FTIR spectrum of Microsponges



In vitro diffusion studies

At 8th hour the drug release of all formulations in ascending order is A1>A3>A4>A2. Highest release is from A1 as it is free drug loaded i.e., 96.42%. Among microsponge loaded formulations A2 is having highest drug release at 8th hour, i.e. 56.87%. This may be due to lower viscosity and higher content of permeation enhancer. Remaining formulations A4, A3 showed drug release at 8 hours 86.24% and 72.52% respectively. Drug release profile has been depicted in graph 1.

CONCLUSION

Quasi – emulsion solvent diffusion method seems to be anticipating for the preparation of Piper extract microsponges as it is a rapid, easy, consistent method and has an advantage of nullifying solvent toxicity. It was observed that as drug: polymer ratio increased, particle size decreased. This is likely due to the fact that at higher relative drug content, the amount of polymer available per microsponge to encapsulate the drug becomes less, thus reducing the thickness of the polymer wall and hence, smaller microsponges. Piper extract formulation A2 showed a good physical parameter study and was used for formulating into gel, incorporated in the carbopol. At 8th hour the drug release of all formulations in ascending order.

REFERENCES

1. Shyam Sunder Mandava and Vedavathi Thavva et al., Novel approach: Microsponge drug delivery system, International journal of Pharmaceutical Sciences and Research, 2012; Vol. 3 (4): 967 - 980.
2. Neelam Jain, Pramod Kumar Sharma, Arunabha Banik et al., Recent advances on microsponge delivery system, International Journal of Pharmaceutical Sciences Review and Research, May – June 2011; Volume 8 (2): 99 – 104.
3. Saroj Kumar Pradhan et al ., Micro sponges as the versatile tool for drug delivery system, International journal of research in pharmacy and chemistry, 2011; Volume 1(2): 44 – 51.
4. Parikh B.N, Gothi G.D, Patel T.D, Chavda H.V, and Patel C.N. et al., Micro sponge as novel topical drug delivery system, Journal of global pharmacy technology, 2010; Volume 2 (1): 17 – 29.
5. Saboji, J. K.,1 Manvi, F. V., Gadad, A. P. and Patel, B. D.et al., Formulation and evaluation of ketoconazole microsponge gel by quassi emulsion solvent diffusion, Journal of cell and tissue research, 2011; Volume 11(1): 2691 – 2696.
6. D'souza, J.I., Jagdish, K., Saboji, S.G. and Killedar, H.N. et al., "Design and Evaluation Of Benzoyl Peroxide Microsponges To Enhance Therapeutic Efficacy In Acne Treatment", Accepted For Presentation In 20th Fapa Congress, Bangkok , Thailand , Nov'30 – Dec, Volume 3, 2004.
7. Comoglu, T., Gonul, N. and Baykara, T.et al., II Farmaco, Volume 58: 2003, 101-106.
8. Kilicarslan, M., Baykara, T. et al., The effect of the drug/polymer ratio on the properties of Verapamil HCl loaded microspheres, International Journal of Pharmaceutical sciences, Volume 25 (2), 2003: 99–109.
9. Martin A., Swarbrick J., Cammarrata A. et al., Formulation and evaluation of ketoconazole microsponge gel, In Physical Pharmacy- Physical Chemical Principles in Pharmaceutical Sciences, 3rd edition, 1991; page: 527.