Available online on 15.2.2025 at http://ajprd.com

Asian Journal of Pharmaceutical Research and Development

Open Access to Pharmaceutical and Medical Research

© 2013-24, publisher and licensee AJPRD, This is an Open Access article which permits unrestricted non-commercial use, provided the original work is properly cited

Open Access

Review Article

Pharmacetutical and Economical Prospective of Microsponges Drug Delivery System

Rohit Kumar Jilta, Deepak Prashar*, Avneet Gupta, Priya Thakur, Vivek Kumar

LR Institute of Pharmacy, Jabli-Kyar, Solan HP-India

A B S T R A C T

Microsponges are considered as one among the most proficient carrier for the delivery of Active Pharmaceutical Ingredients (API).In the recent past many articles have been published on the microsponges because of its long lasting efficacy. The uses of microsponges are basically focused on the treatments of skin ailments. Cosmeceuticals are cosmetic products with bioactive ingredients purported to have medical benefits where microsponges plays the vital role as drug delivery carrier. In the present article the focus is to highlight the pharmaceutical as well as the economical prospect of the microsponges.

Keywords: Microsponges, NDDS, Cosmetics, Economical, Patents.

A R T I C L E I N F O: Received 14 Sept. 2024; Review Complete 19 Dec. 2024; Accepted 10 Jan. 2025. ; Available online15 Feb. 2025

Cite this article as:

Jilta RK, Prashar D, Gupta A, Thakur P, Kumar V, Pharmacetutical and Economical Prospective Of Microsponges Drug Delivery System, Asian Journal of Pharmaceutical Research and Development. 2025; 13(1):81-83,

DOI: http://dx.doi.org/10.22270/ajprd.v13i1.1507

*Address for Correspondence:

Deepak Prashar, LR Institute of Pharmacy, Jabli-Kyar, Solan HP-India

INTRODUCTION:

The novel drug delivery system is one of the prime fields of research in the present scenario [1-8]. The ongoing research on the universal scale has suggested that NDDS has been one of the leading prospects for research. Today's scenario has been focused on developing the drug delivery system with less irritation, better drug release profile, long lasting effects, better bioavailability and controlled release system. All these requirements are difficult to achieve in a single drug delivery carrier. But some of the drug delivery carriers are promising with at least fulfilling these parameters to a great extent. In this context, microsponges are one among such carriers which fits better than the other available novel drug delivery carriers [9-11]. The advantages that the microsponges provides as a drug delivery carrier are better stability over a vide range of pH (1-11), temperature (upto 130^0C), self- sterilizing as their average pore size is about 0.25µm where the bacteria cannot penetrate the pores. Moreover, the microsponges have high entrapment efficiency (50-60%), compatible with most of the ingredients, continuous extended release (upto 12 hours), and superior formulation flexibility and cost effective with ability to absorb oil up to 6 times its weight without drying [12-17].

Benefits of microsponges drug delivery systems [18-20]:

- Enhanced product performance.
- Extended release.
- Diminish irritation and hence enhanced patient Compliance.
- Improved product elegancy.
- Improved oil control as it can absorb oil up to 6 times its weight without drying.
- Allows for novel product forms.
- Improves efficacy in treatment.
- Cure or control confirm more promptly.
- Improve control of condition.
- Improve bioavailability of same drugs
- Flexibility to develop novel product forms.
- Non-irritating, non-mutagenic, non-allergenic and non-toxic
- Improves stability, thermal, physical and chemical stability
- Allows incorporation of immiscible products.
- Improves material processing eg. liquid can be converted to powders.

Microsponges are being formulated by the number of techniques among which the most common is Quasi Emulsion Solvent Diffusion Method (QESD)

technique consists of the emulsification of organic solution of drug which is miscible with water and it also contains stabilizers. On shifting a temporary O/W emulsion into water, droplets solidify promptly as a result of the diffusion of the organic solvent out of the droplets to the external phase. In this method, the intermediate step of agglomeration is establishing an emulsion, which is turned into agglomerates. The process is reliant on sensitive to the selection of solvent and the stabilizer.

The other method used for the formulation of the microsponges includes Liquid-Liquid Suspension Polymerization Method where the microsponges are prepared by suspension polymerization process in liquid-liquid systems. Firstly, the monomers are dissolved along with active ingredients (non-polar drug) in an appropriate solvent solution of monomer, which are then dispersed in the aqueous phase with agitation. Aqueous phase typically consist of additives such as surfactants and dispersants (suspending agents) etc in order to facilitate the formation of suspension. Once the suspension is established with distinct droplets of the preferred size then, polymerization is initiated by the addition of catalyst or by increasing temperature as well as irradiation. The polymerization method leads to the development of a reservoir type of system that opens at the surface through pores. During the polymerization, an inert liquid immiscible with water however completely miscible with monomer is used to form the pore network in some cases. Once the polymerization process is complete, the liquid is removed leaving the Microsponges [21-23].

Economical Aspects of Microsponges [24-25]

Microsponge's drug delivery systems are being available in the market for numerous categories. These categories are basically focusing on the skin treatment and management of skin related ailments. The microsponges are being utilized and preferred over the other drug delivery system because of its controlled release and better stability criteria.

Table 1: Microsponges Based Commercial Products

S. No.	Product	Company	Pharmaceutical Uses	Cost (INR)
1.	0.04% Tretinoin Microsphere Gel	Ortho McNeilPharmaceutical, Inc	Acne vulgaris	430
2.	Retinol 15 Night cream	Sothys	Anti-wrinkle	1299
3	Retinol Cream	Biomedic	Helps maintain healthy skin	1209
4	EpiQuin Micro	SkinMedica Inc	Hyperpigmentation	9321
5	Ultra Guard	Scott Paper Company	Protects baby's skin	550
6	Salicylic Peel 20	Biophora	Excellent exfoliation	2000
7	Dermalogica Oil Control Skin protectant	John and Ginger Dermalogica Skin Care Products	Skin protectant	5500
8	Oil-free matte block SPF 20	Dermalogica	Sunscreen	3000
9	Lactrex™12% moisturising cream	SDR Pharmaceuticals, Inc	Moisturiser	1800
10	Aramis fragrances	Aramis inc	High- performance antiperspirant	6100
11	NeoBenz®Micro	Intendis Inc Morristown	Antibacterial	150
12	Salicylic peel 30	Biomedic	Freeing the skin of all dead cells	3000
13	Carac Cream	Avon	Diminishes appearance of fine lines, wrinkles and skin discolorations associated with ageing	2800

Patents in Drug Delivery through microsponges [26-41]:

There are the large numbers of patents being filed and published taking microsponges into consideration. This happens because of the versatile nature of microsponges. The large number of researches from all over the world showed their interest in advancement of this drug delivery carrier. The microsponges are commercially being favored by the cosmetologist but in the recent past the commercial drug delivery of many therapeutic agents are being carried out through this system.

Table 2: Tries To Highlight the Microsponge's Based Patent.

S. No.	Patent Number	Description	Publication Year
1.	KR20160131487A	Microsponges having controlled solubility and improved redissolution property	2018
2.	CN107469141B	A medical dressing containing microsponge and preparation method thereof	2020
3.	KR101900387B1	Microsponges having controlled solubility and improved redissolution property	2018
4.	US7426776B2	Nonwoven towel with microsponges	2008
5.	WO2000072827A2	Porous drug matrices and methods of manufacture thereof	2000
6.	US5955109A	Methods and compositions for topical delivery of retinoic acid	1999
7.	US5679374A	Anti-acne composition for the simultaneous treatment of the surface layers and deep layers of the skin, and use thereof	1997
8.	US5725869A	Microsphere reservoirs for controlled release application	1998
9.	US5316774A	Blocked polymeric particles having internal pore networks for delivering active substances to selected environments	1994
10.	US5292512A	Cosmetic or pharmaceutical composition containing microspheres of polymers or of fatty substances flled with at least one active product	1994
11.	US5145675A	Two-step methods for the preparation of controlled release formulations	1992
12.	JPS63170436A	Production of Microsponges	1988
13.	WO2016181365A1	Hyaluronic acid micro-sponges and method of production thereof	2016
14.	CA1288370C	Weighted collagen microsponge	1991
15.	US5100783	Weighted microsponge for immobilizing bioactive material	1992
16.	US5100783	Weighted Collagen microsponge for immobilizing bioactive material	1991

CONCLUSION

In the present prospect on microsponges it is clear that the drug delivery carrier has many options. The advantages of the microsponges as a carrier have over taken the disadvantages which makes it a better commercial product. The stability is the key factor in the microsponges as per the cosmetology is concerned. This is the reason it is being widely used in the cosmetics and is the carrier of choice. The economical aspect of microsponges also reflects that the products containing microsponges are better option yet costly. Along with that it is also taken into consideration the other drug delivery carriers are available at the cheaper cost. The patents published containing microsponges indicates that this drug delivery carrier is being widely explored by the researcher in the past. Moreover, some advancement needs to be developed in the future to sustain its marketable importance and applications.

REFERENCES

1. Yuan S, Ma T, Zhang YN, Wang N, Baloch Z, Ma K. Novel drug delivery strategies for antidepressant active ingredients from natural medicinal plants: the state of the art. Journal of Nanobiotechnology 2023; 21, 391.
2. Makeshwar KB, Wasankar SR. Niosome: A Novel Drug Delivery System. Asian Journal of Pharmaceutical Research 2013; 3(1): 16-20.
3. Prashar D, Sharma D. Cubosomes: A sustained Drug delivery carrier. Asian Journal of Research in Pharmaceutical Sciences 2011; 1(3): 59-62.
4. Prashar D, Namrata, Kiran S , Dhiman A , Kumar V , Kumar S. Cubosomes: A Promising Vehicle for Drug Delivery. International Journal of Pharmacy and Pharmaceutical Research 2023, 26(4): 235-246.
5. Prashar D, Kumar S, Sharma S, Thakur P, Mani L. Liposomal World - An Economical Overview. Asian Journal of Pharmaceutical Technology 2013; 3(3): 132-134.
6. Kumar A, Ravishankar K, Varma AK, Prashar D, Mohammed JS, Billah AM. Liposome Nano-Particles for Therapeutic and Diagnostic Applications. Journal of Advances in Medicine and Medical Research 2022; 34 (20):101-112.
7. Liga S, Paul C, Moaca EA, Peter F. Niosomes: Composition, Formulation Techniques, and Recent Progress as Delivery Systems in Cancer Therapy. Pharmaceutics 2024; 16(2): 223.
8. Riccardi D, Baldino L, Reverchon E. Liposomes, Transfersomes And Niosomes: Production Methods And Their Applications In The Vaccinal Field. Journal of Translational Medicine 2024; 22: 339.
9. Kaity S, Maiti S, Ghosh AK, Pal D, Ghosh A, Banerjee S. Microsponges: A novel strategy for drug delivery system. Journal of Advanced Pharmaceutical Technology & Research 2010; 1(3):283-290.
10. Biharee A, Bhartiya S, Yadav A, Thareja S, Jain AK. Microsponges as Drug Delivery System: Past, Present, and Future Perspectives. Current Pharmaceutical Design 2023; 29(13):1026-1045.
11. Singhvi G, Manchanda P, Hans N, Dubey SK, Gupta G. Microsponge: An emerging drug delivery strategy. Drug Development Research 2019; 80(2): 200-208.
12. Qureshi S, Alavi SE, Mohammed Y. Microsponges: Development, Characterization, and Key Physicochemical Properties. ASSAY and Drug Development Technologies 2024 l; 22(5): 229-245.
13. Kumar L, Kumar R, Hussain SB, Kumari S, Pal Y. Development and Characterization of Polymeric Microsponge as a New Vehicle to Deliver Urea Topically. Recent Patents on Nanotechnology 2023; 17(2): 131-143.
14. Sher M, Sarfaraz RM, Iqbal S, Hussain MA, Naeem-Ul Hassan M, Hassan F, Bukhari SNA. Formulation and Evaluation of Hydroxypropylmethylcellulose-dicyclomine Microsponges for Colon Targeted Drug Delivery: In Vitro and In Vivo Evaluation. Current Drug Delivery 2022; 19(6):686-696.
15. Taghi HS, Abdulbaqi MR, Samein LH, Rahmani MHP. Formulation and In Vitro Evaluation of a Ramipril Entrapped in a Microsponge-based Drug-delivery System. International Journal of Pharmaceutical Compounding 2023; 27(4): 340-346.
16. Patole VC, Awari D, Chaudhari S. Resveratrol-Loaded Microsponge Gel for Wound Healing: *In Vitro* and *In Vivo* Characterization. Turkish Journal of Pharmaceutical Sciences 2023; 20(1): 23-34.
17. Li M, Gan J, Xu X, Zhang S, Li Y, Bian L, Dong Z. Preparation, Characterisation and *In Vitro* Anti-Inflammatory Activity Of Baicalin Microsponges. Heliyon 2024; 10(7): e29151.
18. Patidar K, Soni M, Saxena C, Soni P, Sharma DK. Microspongea Versatile Vesicular Approach For Transdermal Drug Delivery System. Journal of Global Pharma Technology 2010; 2(3): 154- 164.
19. Ingale DJ, Aloorkar NH, Kulkarni AS, Patil, RAP. Microsponges as Innovative Drug Delivery Systems. International Journal of Pharmaceutical Sciences and Nanotechnology 2012; 5 (1): 1597–1606.
20. D Souza J, Masvekar R, Pattekari P, Pudi S, More H. Microspongic Delivery of Fluconazole for Topical Application. 1st Indo Japanese International Conference on Advances in Pharmaceutical Research and Technology 2005, 25–29.
21. Roy A. Microsponge As A Novel Drug Carrier System: A Review. World Journal of Pharmaceutical Research 2015; 4(12): 680–701.
22. Sharma A, Hooda A, Chaudhary H. Formulation And Evaluation Of Topical Microsponges Of Sertaconazole. World Journal of Pharmaceutical Research 2016; 5(11): 1444–1461.
23. Vitthal JP, Rajasekaran S. Novel Approaches Of Herbal Microsponges Design, Formulation And Characterization: An Overview. International Journal of Pharmaceutical Research and Applications 2011; 7(5): 1280–1291.
24. Kar AK, Kar BS, Parya H, Kundu S, Hirawat R. A Novel Approach on microsponges: Multifunctional Modern Dosage Form. International Journal of Pharmaceutical Sciences Review and Research 2018; 51(2): 64-72.
25. https://www.grandviewresearch.com
26. https://patents.google.com/patent/KR20160131487A/en
27. https://patents.google.com/patent/CN107469141B/en
28. https://patents.google.com/patent/KR101900387B1/en
17. 27. https://patents.google.com/patent/US7426776B2/en
29. https://patents.google.com/patent/WO2000072827A2/en
30. https://patents.google.com/patent/US7426776/en
31. https://patents.google.com/patent/WO2000072827A2/en
32. https://patents.google.com/patent/US5955109A/en
33. https://patents.google.com/patent/US5679374A/en
34. https://patents.google.com/patent/US5725869A/en
35. https://patents.google.com/patent/US5316774A/en
36. https://patents.google.com/patent/US5292512A/en
37. https://patents.google.com/patent/US5145675A/en
38. https://patents.google.com/patent/JPS63170436A/en
39. https://patents.google.com/patent/WO2016181365A1/en
40. https://patents.google.com/patent/CA1288370C/en
41. https://patents.google.com/patent/US5100783/en
42. https://patents.google.com/patent/US5100783/en