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Photostability enhancement by microsponge drug delivery system: An overview

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Abstract

Normal topical preparations have some disadvantages like unpleasant odour, greasiness, and skin irritation reported in study cases. Many topical preparations fail to reach the systemic circulation in sufficient amounts in few cases. Controlled release of drugs onto the epidermis with assurance that the drug remains primarily localized and does not enter the systemic circulation in significant amounts is an area of research that is successively done by the microsponge delivery system. This problem is achieved by the present formulation as microsponge in the areas of research. MDS is a microscopic sphere capable of absorbing skin secretions, therefore reducing the oiliness of the skin. Microsponge having particle size of 10-25 microns in diameter, have wide range of entrapment of various ingredients in a single microsponges system and release them at desired rates. Drug release in microsponge is done by the external stimuli like (pH, temperature, rubbing). It has several advantageous over the other topical preparations are non allergenic, non toxic, non irritant, non mutagenic reduced side effects, improved stability, increased elegance, and enhanced formulation flexibility.These MDS's are closely related to microspheres, and used in the sun screens, gel, creams, cosmetics, prescription products, ointments, (OTC) over- the-counter skin care preparations, recently used in oral drug delivery Microsponge used for photostability.

Keywords: Microsponge, microspheres, oral delivery

Contents

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1. Introduction

Common types of fungal infections are caused by the fungus tinea. Fungal infections are broadly classified either superficial or systemic. Systemic fungal infections need extensive treatment by oral or intravenous administration of antifungal drugs. Whereas, superficial fungal infections of the skin and mucous membrane respond readily to topical

application of antifungal agents. Common types of superficial fungal infections are ringworm (Tinea), Candida, Dermatitis etc[1].

Topical preparations are used for the localized effects at the site of their application by virtue of drug penetration into the underlying layers of skin or mucous membranes. The main advantage of topical delivery system is to bypass first pass metabolism. Avoidance of the risk and inconvenience of intravenous therapy and of the varied conditions of absorption, like pH changes, presence of enzymes, gastric emptying time are other advantage of topical preparations. The antifungal agents that have been or are currently being evaluated for use in treating invasive mycoses are categorized by their site of action in fungal cells. These classes include the polyenes, nucleoside analogues (fluorinated pyrimidines), azoles, pneumocandins-echinocandins, pradimicins-benanomycins, nikkomycins, allylamines and thiocarbamates, sordarins and other targets[1].

The Microsponge Delivery System (MDS) is a unique technology for the controlled release of topical agents and consists of macro porous beads, typically 10–25 nm in diameter, loaded with active agent. When applied to the skin, the MDS releases its active ingredient on a time mode and also in response to different stimuli like rubbing, temperature, pH, etc. MDS technology is being used currently in cosmetics, over-the-counter (OTC) skin care, sunscreens and prescription products. Microsponge technology offers entrapment of ingredients and is believed to contribute towards reduced side effects, improved stability, increased elegance and enhanced formulation flexibility. In addition, numerous studies have confirmed that microsponge systems are non-irritating, non-mutagenic, non-allergenic, and non-toxic[2, 7].

Hydrogels, the swellable polymeric materials, have been widely investigated as the carrier for drug delivery systems. Hydrogels being biocompatible materials have been recognized to function as drug protectors from *in vivo* environment, especially for peptides and proteins. Also these swollen polymers are helpful as targetable carriers for bioactive drugs with tissue specificity[3]. Conventional formulations of topical drugs are intended to work on the outer layers of the skin. Such products release their active ingredients upon application, producing a highly concentrated layer of active ingredient that is rapidly absorbed. When compared to the Microsponge system these can prevent excessive accumulation of ingredients within the epidermis and the dermis. Potentially, the Microsponge system can reduce significantly the irritation of effective drugs without reducing their efficacy[4].

Ointments are often aesthetically unappealing due to greasiness and stickiness which often result into lack of patient compliance. These vehicles require high concentrations of active agents for effective therapy because of their low efficiency of delivery system, resulting into irritation and allergic reactions in significant users. Other drawbacks of topical formulations are uncontrolled evaporation of active ingredient, unpleasant odor and potential incompatibility of drugs with the vehicles[4]. Microsponges should be uniform and spherical having the cross linked polymeric system, noncollapsible structure consisting of porous void space for the large entrapment of various active ingredients in the spaces and it should offer higher shear strength. These should be non irritant, non mutagenic, non toxic and non greasy. It should be stable at high temperature, and high shear. It should shows improved stability. It should show extended release up to 12 h [5].

Microsponges are microscopic spheres capable of absorbing skin secretions, therefore reducing oiliness and shine from the skin. Spherical particles composed of clusters of even tinier spheres are capable of holding four times their weight in skin secretions. Microsponge particles are extremely small, inert, indestructible spheres that do not pass through the skin. The microsponge system can prevent excessive accumulation of ingredients within the epidermis and the dermis. Potentially, the microsponge system can significantly reduce the irritation of effective drugs without reducing their efficacy. The empty spheres are then washed away with the next cleansing. The microsponge delivery system fulfills these requirements and has resulted in a new generation of very well-tolerated and highly efficacious, novel products. These products are typically presented to the consumer in conventional forms like creams, gels or lotions and they contain a relatively high concentration of active ingredients[2, 7].

Microsponges should be uniform, spherical having the cross linked polymeric system, non collapsible structure consisting of porous void space for the large entrapment of various active ingredients in the spaces and it offers higher shear strength which are commonly used in the area of creams, lotions, powders, having maximum payload of (50% to 60%), and inter connected void space of particle size range 5-500µm[8].
A Microsponge Delivery System (MDS) is patented, highly cross-linked, porous, polymeric microspheres that can entrap wide range of actives and then release them onto the skin over a time and in response to trigger. This system was employed for the improvement of performance of topically applied drugs. It is a unique technology for the controlled release of topical agents and consists of microporous beads, typically 10-25 microns in diameter, loaded with active agent. When microsponge delivery system applied to the skin, the release of drug can be controlled

through diffusion or other variety of triggers, including rubbing, moisture, pH, friction, or ambient skin temperature[8].

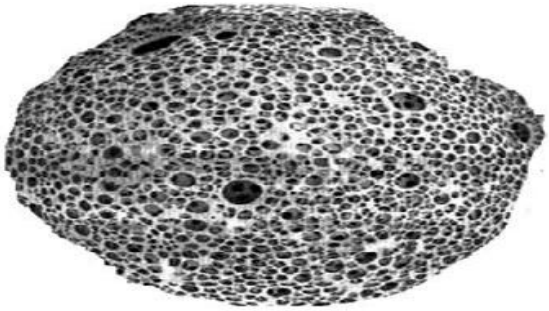

Figure 1. View of Microsponge

Characteristics of Microsponges[9]:

a. Microsponge formulations are stable over range of pH 1 to 11.
b. Microsponge formulations are stable at the tem-perature up to 130 ^{0}C.
c. Microsponge formulations are compatible with most vehicles and ingredients.
d. Microsponge formulations are self sterilizing as their average pore size is 0.25µm where bacteria cannot penetrate.
e. Microsponge formulations have higher payload (50 to 60%), still free flowing and can be cost effective.

Advantages of Microsponge[9]:

Advantages over microencapsulation and liposomes:

The MDS has advantages over other technologies like microencapsulation and liposomes. Microcapsules cannot usually control the release rate of actives. Once the wall is ruptured the actives contained within microcapsules will be released. Liposomes suffer from lower payload, difficult formulation, limited chemical stability and microbial instability. While microsponge system in contrast to the above systems are stable over range of pH 1 to 11, temperature up to 130^{0}C; compatible with most vehicles and ingredients; self sterilizing as average pore size is 0.25µm where bacteria cannot penetrate; higher payload (50 to 60%), still free flowing and can be cost effective.

Advantages over ointments:

Ointments are often aesthetically unappealing, greasiness, stickiness etc. that often results into lack of patient compliance. These vehicles require high concentrations of active agents for effective therapy because of their low efficiency of delivery system, resulting into irritation and allergic reactions in significant users. Other drawbacks of topical formulations are uncontrolled evaporation of active ingredient, unpleasant odour and potential incompatibility of drugs with the vehicles, when microsponge system maximize amount of time that an active ingredient is present either on skin surface or within the epidermis, while minimizing its transdermal penetration into the body.

Requirements of Materials to be Etrapped in Microsponges[10]:

a. It should be either fully miscible in monomer or capable of being made miscible by addition of small amount of a water immiscible solvent.
b. It should be water immiscible or at most only slightly soluble.
c. It should be inert to monomers.
d. It should be stable in contact with polymerization catalyst and conditions of polymerization.

Preparation of Microsponges[2]:

Drug loading in microsponges can take place in two ways, one-step process or by two-step process as discussed in liquid-liquid suspension polymerization and quasi emulsion solvent diffusion techniques which are based on physico-chemical properties of drug to be loaded. If the drug is typically an inert non-polar material, will create the porous structure it is called porogen. Poro-gen drug, which neither hinders the polymerization nor become activated by it and stable to free radicals is entrapped with one-step process.

1. Liquid-liquid suspension polymerization :

The porous microspheres are prepared by suspension polymerization method in liquid-liquid systems 22. In their preparation, the monomers are first dissolved along with active ingredients in a suitable solvent solution of monomer and then dispersed in the aqueous phase, which consist of additives (surfactant, suspending agents, etc.). The polymerization is then initiated by adding catalyst or by increasing temperature or irradiation (**Figure 3:** Reaction vessel for microsponge preparation by liquid-liquid suspension polymerization) The polymerization process continues the formation of a reservoir type of system with spherical structure. After the polymerization process the solvent is removed leaving the spherical structured porous microspheres, i.e., microsponges.

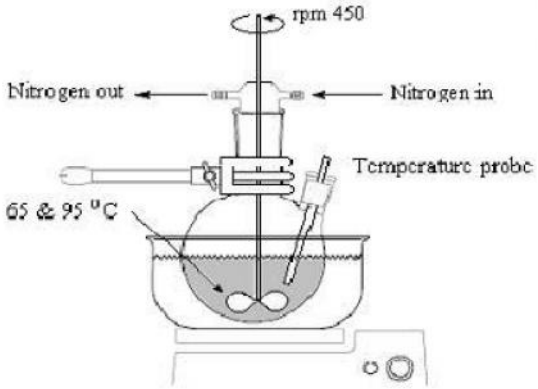

Figure 2. Reaction vessel for microsponge preparation by liquid-liquid suspension polymerization

The various steps involved in the preparation of microsponges are summarized in scheme 1 as follows

2. Quasi-emulsion solvent diffusion:

This will be a two step process where the microsponges will be prepared by quasi- emulsion solvent diffusion method (Figure 4.1) using the different polymer amounts. To prepare the inner phase, Eudragit RS 100 will be dissolved in ethyl alcohol. Drug will be then added to solution and dissolved under ultrasonication . The inner phase will be poured into the PVA in water solution (outer phase). Following stirring, the mixture will be filtered to separate the microsponges. The microsponges will be dried in an air-heated oven and weighed to determine production yield (PY)[18].

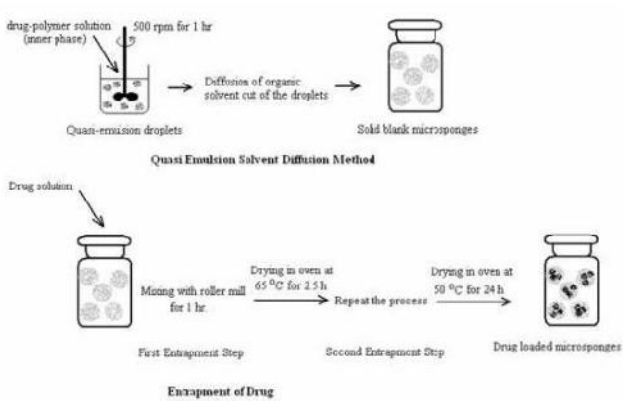

Figure 3. Method of Quasi-emulsion solvent diffusion

Evaluation Parameters of Microsponges[10-24]

1. Particle size (Microscopy) determination
2. Morphology and Surface topography
3. Loading efficiency and production yield
4. Characterization of pore structure
5. Compatibility studies
6. Resiliency
7. Drug release study
8. True density
9. Stability studies
10. Dissolution Studies

1. Particle size Determination

Particle size analysis of loaded and unloaded microsponges will be performed by scanning electron microscopy. The values will be expressed for all formulations as mean size range. Cumulative percentage drug release from microsponges of different particle size will be plotted against time to study effect of particle size on drug release.

2. Morphology and Surface topography of microsponges:

For morphology and surface topography, prepared microsponges can be coated with gold–palladium under an argon atmosphere at room temperature and then the surface morphology of the microsponges can be studied by scanning electron microscopy (SEM). SEM of a fractured microsponge particle can also be taken to illustrate its ultra structure.

3. **Determination of loading efficiency and production yield:**
The loading efficiency (%) of the microsponges can be calculated according to the following equation:

$$\text{Loading Efficiency} = \frac{\text{Actual Drug Content in microsponges}}{\text{Theoretical Drug Content}} \times 100$$

The production yield of the microparticles can be determined by calculating accurately the initial weight of the raw materials and the last weight of the microsponge obtained.

$$\text{Production Yield} = \frac{\text{Practical Mass of Microsponges}}{\text{Theoretical Mass (Polymer + Drug)}} \times 100$$

4. Characterization of pore structure:
Pore volume and diameter are vital in controlling the intensity and duration of effectiveness of the active ingredient. Pore diameter also affects the migration of active ingredients from microsponges into the vehicle in which the material is dispersed. Mercury intrusion porosimetry can be employed to study effect of pore diameter and volume with rate of drug release from microsponges. Porosity parameters of microsponges such as intrusion–extrusion isotherms pore size distribution, total pore surface area, average pore diameters, shape and morphology of the pores, bulk and apparent density can be determined by using mercury intrusion porosimetry. Incremental intrusion volumes can be plotted against pore diameters that represented pore size distributions. The pore diameter of microsponges can be calculated by using Washburn equation

$$D = \frac{-4\gamma COS\theta}{P}$$

Here; D is the pore diameter (μm), ϒ is the surface tension of mercury (485 dyn cm−1), θ is the contact angle (130o), and P is the pressure (psia).
Total pore area (Atot) was calculated by using equation,

$$A_{tot} = \frac{1}{\gamma \cos\theta} \int_0^{V_{tot}} P.dV$$

Here, P is the pressure (psia), V is the intrusion volume (ml g−1), Vtot is the total specific intrusion volume (ml g−1). The average pore diameter (Dm) was calculated by using equation:

$$D_m = \frac{-4V_{tot}}{A_{tot}}$$

Envelope (bulk) density (ρse) of the microsponges was calculated by using equation:

$$\rho_{se} = \frac{W_S}{V_p - V_{Hg}}$$

Here, Ws is the weight of the microsponge sample (g), Vp is the empty penetrometer (ml), VHgis the volume of mercury (ml). Absolute (skeletal) density (ρsa) of microsponges was calculated by using equation:

$$\rho_{sa} = \frac{W_s}{V_{se} - V_{tot}}$$

Here, Vse is the volume of the penetrometer minus the volume of the mercury (ml). Finally, the percent porosity of the sample was found from equation,

$$Porosity(\%) = (1\frac{\rho_{se}}{\rho_{sa}}) \times 100$$

Pore morphology can be characterized from the intrusion–extrusion profiles of mercury in the microsponges as described by Orr.

5. Compatibility Studies:
Compatibility of drug with reaction adjuncts can be studied by thin layer chromatography (TLC) and Fourier Transform Infra-red spectroscopy (FT-IR) 27. Effect of polymerization on crystallinity of the drug can be studied by powder X-ray diffraction (XRD) and Differential Scanning Colorimetry (DSC) 28. For DSC approximately 5mg samples can be accurately weighed into aluminium pans and sealed and can be run at a heating rate of 15oC/min over a temperature range 25–430oC in atmosphere of nitrogen

6. Resiliency:
Resiliency (viscoelastic properties) of microsponges can be modified to produce beadlets that is softer or firmer according to the needs of the final formulation. Increased cross-linking tends to slow down the rate of release. Hence resiliency of microsponges will be studied and optimized as per the requirement by considering release as a function of cross-linking with time.

7. Release Mechanisms:

By proper manipulation of the aforementioned programmable parameters, microsponges can be designed to release given amount of active ingredients over time in response to one or more external triggers.

a. Pressure: Rubbing/ pressure applied can release active ingredient from microsponges onto skin.

b. Temperature change: Some entrapped actives can be too viscous at room temperature to flow spontaneously from microsponges onto the skin. Increased in skin temperature can result in an increased flow rate and hence release.

c. Solubility: Microsponges loaded with water-soluble ingredients like anti-prespirants and antiseptics will release the ingredient in the presence of water. The release can also be activated by diffusion taking into consideration the partition coefficient of the ingredient between the microsponges and the outside system. Sustained release microsponges can also be developed.

Various factors that are to be considered during development of such formulations includes,

1. Physical and chemical properties of entrapped actives.
2. Physical properties of microsponge system like pore diameter, pore volume, resiliency etc.
3. Properties of vehicle in which the microsponges are finally dispersed.

Particle size, pore characteristics, resiliency and monomer compositions can be considered as programmable parameters and microsponges can be designed to release given amount of actives in response to one or more external triggers like; pressure, temperature and solubility of actives

1. True Density:

It is the density of particles that make up a powder or particulate solid, measures the average density of a large volume of the powder in a specific medium. The true density of microsponges and active products can be measured using an ultrapycnometer under helium gas and was calculated from a mean of repeated determinations.

2. Stability Studies:

In pharmaceutical sense, stability is technically defined as the capacity of particular formulation in a specific container or closure system, to remain within its physical, chemical, microbiological, therapeutic and toxicological specification. Durability of a product may be defined as the capability of a particular formulation in a specific container to remain with the physical, chemical, microbiological, therapeutic and toxicological specification. Stability of Microsponge gel formulation on storage is of a great concern as it is the major resistance in the development of marketed preparations. The prepared formulation was tested for stability on storing them at 4 ± 1ºC, 25 ± 2ºC and 37 ± 5ºC and RH 75%. After one month and the three months they were evaluated for the following parameters: appearance, pH, drug content analysis, drug release profiles, rheological properties etc.

3. Dissolution Studies:

Dissolution profile of microsponges can be studied by use of dissolution apparatus (USP XXIII) with a modified basket consisted of 5µm stainless steel mesh. Speed of the rotation is 150 rpm. The dissolution medium is selected while considering solubility of actives to ensure sink conditions. Samples from the dissolution medium can be analyzed by suitable analytical method at various intervals

Applications of Microsponge Systems[25]

Microsponges are porous, polymeric microspheres that are used mostly for topical and recently for oral admin-istration. It offers the formulator a range of alterna-tives to develop drug and cosmetic products. Micro-sponges are designed to deliver a pharmaceutical ac-tive ingredient efficiently at the minimum dose and also to enhance stability, reduce side effects and modi-fy drug release.

Table 1. Applications of Microsponge system (Kho-pade et al.1996)

S.No	Active agents	Applications
1.	Anti-acne e.g. Benzoyl peroxide	Maintained efficacy with decreased skin irritation and sensitization.
2.	Anti-inflammatory e.g. hydrocortisone	Long lasting activity with reduction of skin allergic response and dermatoses.
3.	Anti-fungals	Sustained release of actives.
4.	Anti-dandruffs e.g. zinc pyrithione, selenium sulfide	Reduced unpleasant odour with lowered irritation with extended safety and efficacy.
5.	Antipruritics	Extended and improved activity.
6.	Skin depigmenting agents e.g. hydroquinone	Improved stabilization against oxidation with improved efficacy and aesthetic appeal.
7.	Rubefacients	Prolonged activity with reduced irritancy greasiness and odour.

Mainly the three Fundamental ways of Microsponge Systems Are[25]:
1. As reservoirs releasing active substances over a prolonged duration of time,
2. As storage vessels for engrossing objectionable substances, such as excess skin oils, or
3. As holders to carry the particles away from the skin for superficial action.

Releasing of active ingredients from conventional topical formulations over an extended period of time is quite difficult. Cosmetics and skin care preparations are intended to work only on the outer layers of the skin. The typical active ingredient in conventional products is present in a relatively high concentration and, when applied to the skin, may be rapidly absorbed. The common result is over medication, followed by a period of under medication until the next application. Rashes and more serious side effects can occur when the active ingredients rapidly penetrate below the skin's surface. Microsponge technology is designed to allow a prolonged rate of release of the active ingredients, thereby offering potential reduction in the side effects while maintaining the therapeutic efficacy.

Amrutiya *et al.,* developed microsponge based topical delivery system of mupirocin by using emulsion solvent diffusion method to provide sustained action in order to increase the settling of drug in the skin. Microsponges were globular, having minute holes (porous in nature) and there was no reciprocal action between drug and polymer molecules. Emulgels containing microsponges showed desired physical properties. Drug release through cellulose dialysis membrane showed diffusion controlled release pattern and drug deposition studies using rat abdominal skin exhibited significant retention of active in skin from microsponge based formulations by 24 hrs . The optimized formulations were stable and non-irritant to skin as demonstrated by Draize patch test. Microsponges-based emulgel formulations showed prolonged efficacy in mouse surgical wound model infected with S.aureus. Mupirocin was stable in topical emulgel formulations and showed enhanced retention in the skin indicating better potential of the delivery system for treatment of primary and secondary skin infections, such as impetigo, eczema, and atopic dermatitis.Disorders of hyperpigmentation such as melisma and post inflammatory hyperpigmentation (PIH) are common, particularly among people with darker skin types. Hydroquinone (HQ) bleaching creams are considered the gold standard for treating hyperpigmentation. Recently, a new formulation of HQ 4% with retinol 0.15% entrapped in microsponge reservoirs was developed for the treatment of melisma and PIH. Microsponges were used to release HQ gradually to prolong exposure to treatment to skin and minimize skin irritation.

D'souza *et al.,* developed topical anti-inflammatory gels of fluocinolone acetonide entrapped in eudragit based microsponge delivery system. Fluocinolone acetonide (FA) is a corticosteroid chiefly used in dermatology to lessen skin inflammation and relieve itching. The percutaneous absorption increases risk related with systemic absorption of topically applied formulation.

Patents Information[10]:
In 1st September 1987, Won R (Palo Alto, CA) of Advanced Polymer Systems, Inc. (Redwood City, CA) received (United States Patent 4,690,825) for developing method to deliver an active ingredient by controlled time release using a novel delivery vehicle that can be prepared by a process utilizing the active ingredient as a porogen 1. On 8th September 1992, Won R (Palo Alto, CA) of Advanced Polymer Systems, In (Redwood City, CA) received (United States Patent 5,145,675) for developing a two-step method for the preparation of controlled release formulations 45. Advanced Polymer Systems, Inc. and subsidiaries is using its patented microsponge(R) delivery systems and related proprietary technologies to increase the safety, aesthetic quality and effectiveness of topical prescription, over-the-counter ("OTC") and personal care products like Vitamin- A, tretinoin and 5-fluorouracil etc. As on 23th July 2006, the Company has a total of 10 issued U.S. patents and an additional 92 issued foreign patents. 21 patent applications are pending worldwide. Dean JR *et al*., received US patent no. 4863856 for the development of weighted collagen microsponges having a highly cross-linked collagen matrix that is suitable for use in culturing organisms in motive reactor systems. The microsponges have an open to the surface pore structure, pore volumes and pore sizes suitable for immobilizing a range of bioactive materials 46.

Marketed formulation using the MDS[17]:
The safety, efficacy and aesthetic quality of topical prescription, over-the- counter ("OTC") and personal care products can be enhanced by using the microsponge delivery system.

The immature products and the present marketed preparations exploit the MDS in three primary ways;
1. As reservoirs releasing active ingredients over an extended period of time,
2. As storage vessels for engrossing objectionable substances, such as excess skin oils, or
3. As holder to carry particles away from the skin intended to work on outer layers of the skin.

The resulting benefits include extended efficacy, reduced skin irritation, cosmetic elegance, formulation flexibility and improved product stability. The list of marketed products are shown in

Table 2. List of marketed products using microsponge delivery system

Product name	Advantages	Manufacturer
Retin-A-Micro	0.1% and 0.04% tretinoin entrapped in MDS for topical treatment of acne vulgaris. This formulation uses patented methyl methacrylate/glycol dimethacrylate cross polymer porous microspheres (MICROSPONGE®SYSTEM) to enable inclusion of the active ingredient, tretinoin, in an aqueous gel.	Ortho-McNeil Pharmaceutical
Retinol cream	The retinol molecule is kept in the microsponge system to protect the potency of the vitamin A. This helps to maximize the retinol dosage while reducing the possibility of irritation. Retinol is a topical vitamin A derivative which helps maintain healthy skin, hair and mucous membranes.	Biomedic
Retinol 15 night cream	A nighttime treatment cream with microsponge technology using a stabilized formula of pure retinol, vitamin A. Continued use of retinol 15 will result in the visible diminishment of fine lines & wrinkles, a noticeable improvement in the skin discolorations due to ageing and enhanced skin smoothness.	Sothys
Sports cream RS & XS	Topical analgesic-anti-inflammatory and counter irritant actives in a microsponge® delivery systems (MDS) for the management of musculoskeletal conditions.	Embil Pharmaceutical Ltd.
Aramis fragrances	24 hour high performance anti-perspirant spray sustained release of fragrance in the microsponge. The microsponge comes in the form of an ultralight powder, and because it is micro in size, it can absorb fragrance oil easily while maintaining	Aramis Inc.

	a free-flowing powder characteristic where release is controlled due to moisture & temperature.	
Ultra guard	Microsponge system that contains dimethicone to help protect a baby's skin from diaper rash.	Scott Paper company.
Micro peel plus	The micropeel® plus procedure stimulates cell turnover through the application of salicylic acid in the form of microcrystals using microsponge® technology. These microcrystals target the exact areas on the skin that need improvement. The micropeel ® plus aggressively outperforms other superficial chemical peels by freeing the skin of all dead cells while doing no damage to the skin.	Biomedic
Oil control lotion	A feature-light lotion with technically advanced microsponges that absorb oil on the skin's surface during the day, for a matte finish and eliminates shine for hours which is formulated with oil absorbing microsponge technology and moisturizing botanicals. The naturally antibiotic skin Response Complexes soothes ignition and strained to promote healing. Acne-Prone, oily skin conditions.	Fountain Cosmetics

Benefits of Microsponge Technology[9]:

• Advanced oil control, absorb up to 6 times its weight without drying
• Extended release
• Reduced irritation formulas
• Allows novel product form
• Improved product aesthetics
• Extended release, continuous action up to 12 hours
• Reduced irritation, better tolerance means broader consumer acceptance
• Improved product aesthetics, gives product an elegant feel
• Improves stability, thermal, physical and chemical stability
• Allows incorporation of immiscible products.
• Improves material processing eg. Liquid can be converted to powders
• Allows for novel product forms.
• Improves efficacy in treatment.
• Cure or control confirm more promptly.
• Improve control of condition

• Improve bioavailability of same drugs

Future Impact of Microsponge Drug Delivery System[5]:

Microsponge is one of the novel drug delivery systems, for the topical preparations for drug delivery through skin. Not only it is limited to the topical preparations it shown its activity in colon targeting by the use of natural polymers, also shown its activity in biopharmaceuticals i.e. it is useful in drug delivery systems in various forms. Main advantage is that liquids can be transformed into free flowing powders. Its produce less toxic, non greasiness, non irritant, it requires less amount of drug due to delayed release. Normal topical preparations shows toxic reactions, incompatibilities, unpleasant odour, etc.by this microsponge products are advantageous some products are already approved and available in market; several products under development.

2. Summary & Conclusion

The MDS which was originally developed for photostability of drugs can also be used for controlled oral delivery of drugs using bioerodible polymers, especially for specific delivery. It provides a wide range of formulating advantages. Liquids can be transformed into free flowing powders. Formulations can be developed with otherwise incompatible ingredients with prolonged stability without use of preservatives. Safety of the irritating and sensitizing drugs can be increased and programmed release can control the amount of drug release to the targeted site. A Microsponge Delivery System can entrap wide range of actives and then release them onto the skin over a time and in response to trigger. Delivery System can release its active ingredient on a time mode and also in response to other stimuli. Thus microsponge has got a lot of potential and is avery emerging field which is needed to be explored.

3. Acknowledgement

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