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Preparation and Evaluation of Micro sponge Drug Delivery Systems: A Review

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ABSTRACT:

The Microsponge Delivery System (MDS) is a novel medicine delivery technique. To lessen systemic exposure and local cutaneous responses to active ingredients, topical medication solutions have included MDS technology to enable the controlled release of the active ingredient into the skin. Clinical trials using microsponge technology have been conducted. several active components in complete formulations, supporting robust product claims. The term "microsponge" refers to a group of extremely small. drug delivery systems control the rate or type of release of drugs to certain parts of the body. Transdermal drug delivery uses the skin as a portal of entry for drugs. Microsponge technology changes the release and absorption properties of drugs by binding them to a carrier. The delivery of microsponge medicine provides a package of ingredients and is expected to help reduce side effects and increase elegance, durability, and ease of use. Additionally, many studies have confirmed that microsponge bacteria are non-toxic, non-mutagenic, non-irritating, and non-allergenic. Today, sunscreens, cosmetics, over-the-counter skin care products, and cosmetics all use these tools. This type of drug delivery could help us understand the treatment of many diseases. Therefore, drug delivery systems based on microsponge can be developed into useful pharmaceutical materials for various medical applications.

KEYWORD: Microsponge, TDDS, Microsponge Delivery System, Medicine, Gel, Preparation and Evaluation.

Introduction:

TDDS:

Healthcare systems are greatly influenced by drug delivery systems (DDS) that can control the rate or type of release. Medicine to certain parts of the body. The technology, which changes the release and absorption properties of the drug by binding it to the carrier (liposome, nanoparticle, microsphere, etc.), intelligently enables drug delivery. Healthcare systems are greatly influenced by drug delivery systems (DDS), which can control the rate of drug release or drug utilization for a particular body. Technology that changes the release and absorption properties of the drug by binding the drug to the carrier
(microspheres, nanoparticles, liposomes, etc.) provides a smart drug delivery method. Controlling the amount of active drug delivered to a specific area of the body has always been one of the key challenges of the pharmaceutical industry. Several reliable and predictable methods for systemic drug delivery have been developed under the umbrella of transdermal drug delivery (TDDS), which uses the skin as a portal of entry. TDDS is not ideal for administering drugs whose ultimate target is the skin, but it has improved the safety and effectiveness of many drugs that can be more effectively delivered through the skin. Studies of topical agents in the strum corneum and subcutaneous layer of the skin (but not beyond the epidermis) have only recently addressed the issue of controlling drug release by the epidermis to ensure that the drug remains local and does not build up in large amounts Entering the body. Most drugs are poorly soluble in water, which causes many difficulties when creating them in prescriptions. This is the main problem of TDDS. A major problem with poorly water-soluble drugs is their low bioavailability and poor absorption. [1, 2, 3]

Microsponge Delivery System:

A Microsponge Delivery System (MDS) is a polymer system consisting of porous microspheres that can capture various active ingredients and slowly release them into the environment. Wear it on the skin and respond to the result. It is a new way to modify the local release of drugs, consisting of microporous beads, usually 10-25 microns in diameter, loaded with active ingredients. When applied topically, MDS responds to various stimuli (temperature, pH, friction, etc.) and releases its active ingredients. Cosmetics, over-the-counter (OTC) skin care products, sunscreens, and prescription medications all use MDS technology. [2]

Micro sponges:

The patented sponge delivery system (MDS) is a system made of porous microspheres made of polymeric materials. These are small sponge-like spheres consisting of many interconnected parts in a non-collapsible structure with a large pore space that controls the release of active ingredients. A new method for targeted drug delivery and release is the Abstract Micro sponge. For this reason, many scientists and researchers are interested in micro sponge drug delivery systems. Additionally, current cosmetics include microsponge technology,

which helps reduce the local reaction of the active drug and minimize side effects by promoting the release of the drug into the skin. The use of advanced techniques is increasingly being combined to maximize the effectiveness and financial value of treatment. Microsponge technology to increase Additionally, many studies have confirmed that microsponge bacteria are non-toxic, non-mutagenic, non-irritating, and non-allergenic. MDS technology is currently used. Sunscreens, cosmetics, over-the-counter (OTC) skincare products and cosmetics. Among these, the self-destructing feature of microsponges is their best feature. Advanced Polymer Systems Inc. In 1987, he was awarded the inventor of microsponge technology. He received the first patent. The company has made many changes to the process used for over-the-counter (OTC) and cosmetic products Now, Cardinal Health, Inc. is licensed to use this beautiful tool in themed products. [3]

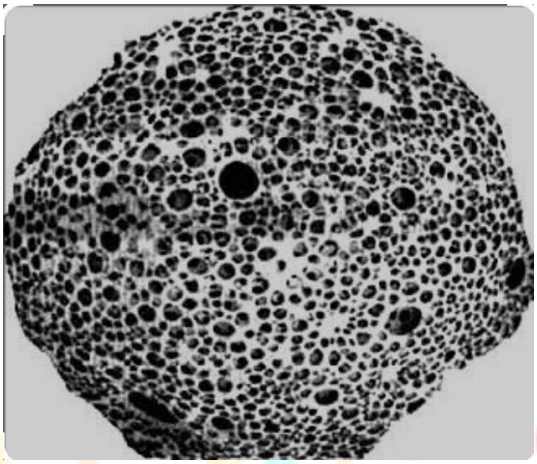

fig.- microsponge [4]

Advantages:

- Microsponge is non-toxic, non-mutagenic, non-irritating or non-allergic
- Continuous drug release up to 12 hours.
- Reduce anxiety and improve patient compliance.
- Microsponge dispersion has excellent stability, physical stability, and chemical stability.
- some products cannot be sold.
- Improve drug bioavailability.
- Improve fuel management.
- Easy to create.
- Improved stability, including physical, chemical, and thermal stability, allows active materials to be added to the material by converting the liquid into powder.
- Improve the healing effect
- Improve compliance standards. [5]

Disadvantages of Microsponges:

- A microsponge system is used to bind different particles, Particles of size 10 to 25 microns are released at a reasonable rate.
- Patients who do not comply with cosmetic rules encounter problems such as oiliness, odor, and irritation. More negative. [6]

Limitations of Microsponges:

- The preparation process is often characterized by organic solvents, some of which pose risks to the environment and public safety as they cause a lot of fire.
- The remainder of the monomer can be seen in some areas; These residues may be harmful to health. [5]

Characteristics of Microsponges:

1. Microsponge milk is stable in the pH range of 1 to 11.
2. Micro sponge milk remains stable at temperatures up to 130 0C.
3. Suitable for most car and venue microsponge products.
4. Since the microsponge structure has a pore size of 0.25µm, it can sterilize itself thanks to the ability of bacteria to grow. I can't pass.
5. Microsponge formulations are cost-effective, have a large carrying capacity (50-60%), and are also free-flowing. Practical. [7]

Mechanism of Releasing:

Microsponges can be designed to slowly release active substances in response to one or more external triggers.

a) Temperature change: A small portion of the captured material can be adhered to the skin via microsponge at room temperature. As the skin temperature increases, the flow rate increases, thus improving the discharge.

b) Pressure: The active ingredients in microsponges can settle on the skin by friction or pressure.

c)Solubility: Microsponges containing water-miscible drugs such as antibiotics and antibiotics will release the drugs when there is water. Diffusion is another way to let go; However, this method requires taking into account the distribution coefficient between the microsponge and the outside.

d) pH trigger system: The release of pH-dependent active substances can be initiated by changing the layer of the microsponge. [7]

Material and Method:

Material:

Potato starch, Modified starch (corn), Calcium hydroxide, Honey, Curcumin, Guava leaf, eudragit RS 100, Ethylcellulose, Triethyl citrate, Sucrose, PVA, etc.

Preparation method of Microsponge:

1 Liquid-liquid suspension polymerization

2) Quasi-emulsion solvent diffusion method

There are two methods of loading drugs into microsponges:

one-step method and two-step method Dumb process. The physical and chemical power of the drug is somewhat armed. If most chemicals are inactive, nonpolar substances that form pores are called pyrogens. The drug Porogen does not interfere with polymerization or activation and also can protect against free radicals. Stuck

- **Quasi-emulsion solvent diffusion:**

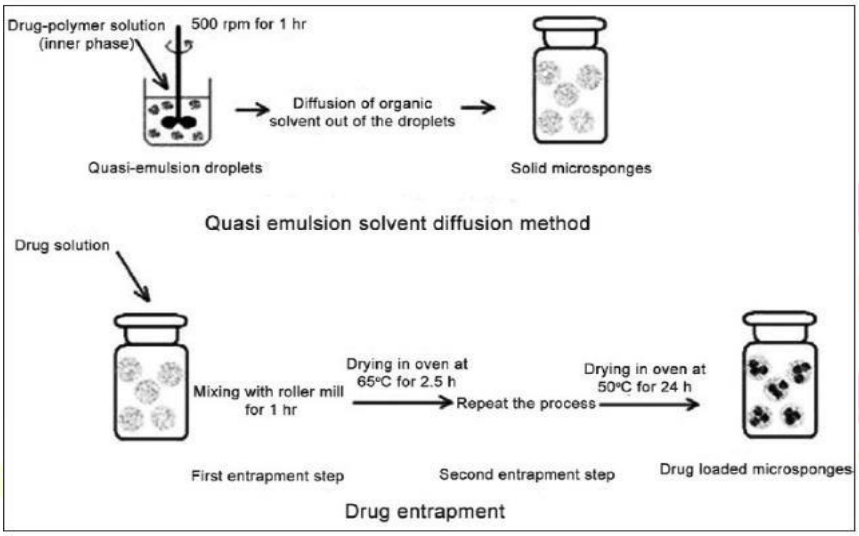

fig.- quasi-emulsion solvent diffusion method. [9]

Formulation of Microspongial Gel:

Gel was prepared by cold mechanical methods: polymer. A mixture of gelling agents.

Put enough water in another container.

After the polymer is completely immersed in water, mix it again with a mechanical mixer.

Let it sit at room temperature for a day.

This season is still lively.

Add preservatives, antibiotics, and disinfectants.

Add some neutralizer.

A quote is given at the end.

Make, close, and collect collapsible metal tubes [8]

Evaluation of Microsponges:

1)**Determination of Particle Size:** Particle size analysis of loaded and unloaded microsponges is performed by laser diffraction or other suitable methods. Each recipe and size has a numerical indicator. To examine the effect of the size of the drug released, the percentage of drugs released by microsponges of different sizes will be plotted over time. Particles larger than 30 µm have the potential to create negative reflection; therefore, particles between 10 and 25 µm are preferred when used in final cosmetics

2)**Research electron microscopy:** The micro sponge layer can be coated with gold-palladium at room temperature in an argon atmosphere to study the surface morphology and morphology. Scanning electron microscopy (SME) can then be used to examine the surface morphology of microspore ages. The ultrastructure of a fractured microsponge particle can be obtained via SEM.

3)**Calculating production yield and loading efficiency:** The following formula can be used to determine the loading efficiency (%) of

the microsponges:

Loading efficiency = Actual Drug Content in Microsponge x100

Theoretical Drug Content

4) **Production yield:** The precise computation of the initial weight of the raw materials and the final weight of the microsponge obtained yields the production yield of the microparticles.

Production Yield (PY) = Practical Mass of Microsponges x 100

Theoretical Mass (Polymer +Drug)

5) **Calculation of true density:** The true density of Microsponges is derived from the average of several measurements made using an ultra-pycnometer in helium gas.

6) **Studies on drug compatibility:** Fourier Transform Infrared spectroscopy (FT-IR) and thin-layer chromatography (TLC) can be used to examine a drug's compatibility with reaction adjuncts. With differential scanning calorimetry (DSC) and powder X-ray diffraction (XRD), the impact of polymerization on the drug's crystallinity can be investigated.

7) **Polymer/monomer composition:** Several variables, including polymer composition, drug loading, and microsphere size, affect how drugs are released from microspheres. The polymer composition of the MDS can have a direct impact on the rate of release of the entrapped medication by affecting the partition coefficient of the drug between the vehicle and the microsponge system. A useful method for studying drug release from microsponge systems with varying polymer compositions is to plot the cumulative percentage of drug release against time. [7]

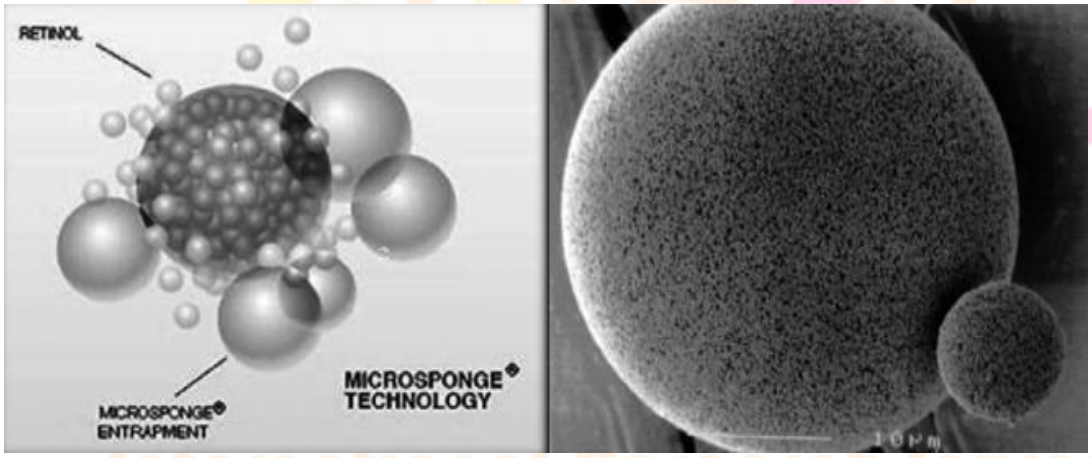

fig.- view of microsponges [10]

Applications of microsponges:

- Anti-inflammatory drugs, such as hydrocortisone: Prolonged action that lowers the skin's allergic reaction and skin tissue.
- Antifungal: Active ingredients released gradually.
- Antidandruff products, such as zinc pyrithione and selenium sulfide: Less offensive odor with decreased irritability with prolonged efficacy and safety.
- Improved and prolonged activity in antipruritics.
- Skin-depigmenting agents: enhanced stability against oxidation when using hydroquinone, for example, enhanced attractiveness and effectiveness.
- Rubefacients: Extended use with less irritation, oiliness, and smell. [4]

CONCLUSION:

The Microsponge delivery system is a novel technique that allows for the controlled release of active agent-loaded, macroporous beads, potentially reducing side effects without compromising therapeutic efficacy. The delivery of microsponge medicine provides a package of ingredients and is expected to help reduce side effects and increase elegance, durability, and ease of use. Additionally, many studies have confirmed that microsponge bacteria are non-toxic, non-mutagenic, non-irritating, and non-allergenic. Today, sunscreens, cosmetics, over-the-counter skin care products, and cosmetics all use these tools. This type of drug delivery could help us understand the treatment of many diseases. Therefore, Riyaz Ali Osmani*, Bhargav R. Harkare, Nagesh H. Aloorkar, Ajit S. Kulkarni, and Rohit R. Bhosale A drug delivery system based on microsponges can be developed into useful pharmaceutical materials for various medical applications. Medicinal plant in the form of gel possess significant topical anti inflammatory properties, supporting there traditional use for the treatment.

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