A Systematic Approach on Liposomes with Microsponges as Novel Drug Delivery System with Regards to Ecosystem

J. Subashri[1], C.N Hemalatha[2]
{jssubashri@gmail.com[1], hemalathacn@psgpharma.ac.in[2]}

PSG College of Pharmacy[1], PSG College of Pharmacy[2]

Abstract. Ecosystem such as temperature, air, light, humidity, water plays a vital role in Novel drug delivery system which also affects drug delivery and it is effectually alter the drug metabolism at diverse level under the influence of pharmacogenomics, which interferes with pharmacokinetics of drug. It also occurs by work, behaviour (smoking, poor diet, liquors etc.,) which may increase an individual risk of disease due to this stressful situation which makes the Novel drug delivery system resistant. In order to avoid this condition, we are aiming to develop a variable kind of systematic approach on liposomes with Microsponges This system which ensures a better therapeutic activity towards safety, efficacy, potency and toxic free effect because of its targeted drug delivery which improves bioavailability. It can be synthesized using a variety of natural or synthetic micromolecular active ingredient with different size, structure, surface charge of nanoparticles along with suitable polymer type.

Keywords: Liposomes, Microsponges, NDDS, Ecosystem, Targeted drug delivery

1 Introduction

Novel Drug Delivery System (NDDS) are those systems with a capability of grasping the rate and extent of drug delivery there by it sustains the period of pharmacological activity or pick out the surrender of a drug to its specific site. By combining liposomes with microsponges we can achieve enhanced bioavailability and non- toxic effects. Because of an ecosystem such as temperature, air, light, humidity which affects NDDS and makes our body resistant against delivery system. By providing this kind of approach we can achieve targeted drug delivery and our body does not become resistant against environmental factors.

Novel Drug Delivery Systems (NDDS) can be defined as an recently developed approach that combines inventive formulation development with new technologies. Novel methodologies are employed to deliver pharmaceutical compounds in the body by aiming to promote maximum pharmacological effects.[1]. Liposomes comprises of colloidal spheres consisting cholesterol, non-toxic

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surfactants, glycolipids, sphingolipids, long chain fatty acids, protein membrane and drug molecule. Microsponges are made up of microscopic polymer- based microspheres which are mini sponge (spherelikeparticles) having a large porous surface through which active pharmaceutical ingredients are delivered. This paper aims for a systematic approach on liposomes with Microsponges embed in sequence to disregard ecological imbalances by prohibiting resistant on delivery system.

2 DISCUSSION

Due to ecological imbalances such as climate change, air pollution, water pollution, chemical pollution, land pollution, deadliest disease producing microorganisms. our NDDS system gets vulnerable. Ecological imbalances occur due to unplanned construction, defective policies of agriculture, deforestation, population, exploitation and also transport. By aiming to provide different technique liposomes with Microsponges we can achieve maximum bioavailability, safety, and significantly it does not make the delivery system resistant.

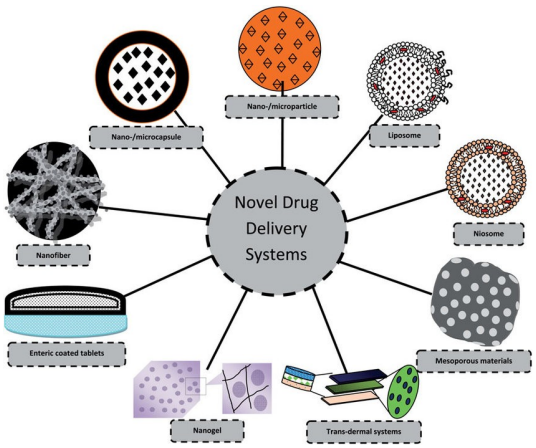

Fig. 1. Pictorial representation of a novel drug delivery system

2.1 TYPES OF NDDS

This objective switch to the two aspects most important to drug delivery is as follows:

2.1.1 Spatial drug delivery

Targeting drug to a particular site (usually organ or tissue).

2.1.2 Temporal drug delivery

The drug delivery rate to the target tissue is controlled

In India the prime areas for research and development for NDDS are:

- Liposomes
- Micro sponges
- Noisome
- Nanoparticles
- Transdermal drug delivery
- Implants
- Oral system
- Microencapsulation
- Polymer in drug delivery

2.2 CHARACTERISTICS OF NDDS

- Increase the bioavailability
- Safe and reliable
- Stability
- Provide controlled delivery of drug
- Easy to administer
- Approachable cost

2.3 APPLICATIONS OF NDDS

- In drug monitoring
- Studying immune response through different kind of administration
- Delivery of nano, micro particle drugs
- Genetic engineering
- In malignancies
- Anti-microbial activity by monitoring (antimicrobial steward ship program

2.4 BENEFITS OF NDDS

- Medical: Accurate dose at right duration and location.
- Industrial: Significant use of excellent ingredient.
- Social: Advantageous to patients by providing excellent treatment, better compliance and enhanced standard of living.

2.5 NOVEL DRUG DELIVERY SYSTEM APPROACHES

- To suppress drug degradation
- Enhanced bioavailability
- To reduce ADR
- Targeted drug delivery
- Decreased dosing frequency
- Improved patient compliance
- Loading of variety of drugs.

3 LIPOSOMES

Liposomes derived from two Greek words LIPO – fat and SOMA – body.[2] This name occurs due to its composition majorly consist of phospholipids. Liposomes are artificial microscopic vesicles consists of aqueous compartment and surrounded by one or more layer of phospholipids. The sphere like encapsulated a liquid contains more substance like protein, peptide, hormones, enzymes, antibiotics, antifungal, and anticancer agents.it is a spherical vesicle having at least one lipid bilayer.[3].

3.1 STRUCTURE OF LIPOSOMES

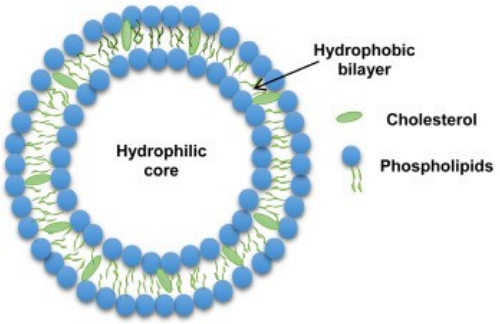

Fig. 2. Structure of Liposomes

3.2 COMPONENTS OF LIPOSOMES

- Phospholipids especially phosphatidylcholine.
- Cholesterol.
- Drug molecule.

3.3 MECHANISM

Encapsulation technique has been employed for the incorporation of hydrophilic aqueous solution by lipophilic aqueous solution by lipophilic membrane in which the liposomes reach the target site and the lipid bilayer fuse with the cell membrane to release the drug.

3.4 LIST OF SOME CLINICALLY APPROVED LIPOSOMAL DRUGS

Therapeutic Agent	Disease Treated	Liposomal Product Name	Company Name	FDA approval year
Amphotericin-B	Systemic Fungal Infections	Ambelcet	Enzon	1995/1996
Amphotericin-B	Systemic Fungal Infections	Ambiosome	Gilead Sciences	1997

Amphoteric-B	Systemic Fungal Infections	Amphotec	Alza Corp.	1997
Daunorubicin	AIDS-related Kaposi's Sarcoma	DaunoSome	Gilead Sciences	1996
Cytarabine	Lymphomatous Meningitis	DepoCyt	SkyePharma/ Enzon	1999
Doxorubicin	Ovarian and Breast Cancer	Caelyx	Schering-Plough	1999
Doxorubicin	Ovarian and Breast Cancer	Doxil	Alza Corp	1999

3.5 WHY LIPOSOMES?

- To increase efficacy and therapeutic index
- Biocompatibility
- Versatility for drug encapsulation
- Ability to modify surface
- Enhanced permeability

3.6 APPLICATIONS OF LIPOSOMES

- specific targeting.
- Gene therapy.
- Site avoidance delivery.
- continuous release drug and formulation aid
- Mental storage disease [4].

Fig. 3. A typical application of liposomes

4 MICROSPONGES

Microsponges are porous microsphere-based polymeric drug delivery devices. They're round sponge-like particles with a massive porous surface. Microsponge Systems are made up of microscopic polymer-based usually suspend or entrap a wide range of compounds . The Microsponge Delivery System (Microsponge drug delivery technology) is a patented porous microsphere-based polymeric system. They are tiny sponge-like spherical particles having a broad porous surface through which active ingredients are delivered in a regulated manner.

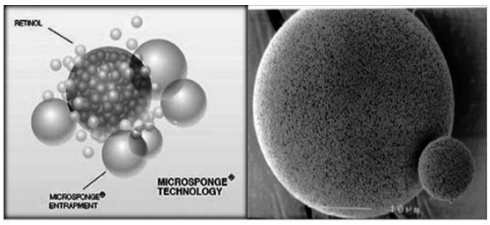

Fig. 4. Structure of Microsponges

4.1 COMPONENTS OF MICROSPONGES:

- Microspheres

4.2 MECHANISM

Monomer and monomer combination to be chosen. chain polymers will be formed by polymerization. During the formation of chain polymers, a ladder-like link will be produced which results in the formation of spherical particles by momomer ladder. Hence the bunches of microspore results by agglomeration creating microsponges.

Product Name	Pharmaceutical Uses	Manufacturer
Glycolic Acid Moisturizer w/SPF 15	Anti-Wrinkles, soothing	AMCOL Health & Beauty Solution
Retin A Micro	Acne vulgaris	Ortho-McNeil Pharmaceutical, Inc.
Line Eliminator Dual Retinol Facial Treatment	Anti-wrinkle	Avon
Retinol 15 Night cream	Anti-wrinkles	Sothys
Retinol cream	Helps maintain healthy skin	Biomedic
EpiQuin Micro	Hyper pigmentation	SkinMedica Inc
Sports cream RS and XS	Anti-inflammatory	Embil Pharmaceutical Co. Ltd.
Salicylic Peel 20	Excellent exfoliation	Biophora
Oil free matte block SPF 20	Sunscreen	Dermalogica
Lactrex™12% Moisturizing Cream	Moisturizer	SDR Pharmaceuticals, Inc
Dermalogica Oil Control Lotion	Skin protectant	John and Ginger Dermalogica Skin Care Products
Ultra Guard	Protects baby's skin	Scott Paper Company

Fig. 5. Clinically approved Microsponges drug list

4.3 WHY MICROSPONGES?

- Non-mutagenic [5]
- Non-irritant
- Improved Flexibility
- Improved bioavailability
- Improved product elegance
- Easy formulation process
- Extended release.

4.4 APPLICATION OF MICROSPONGES

Sr.no	Active agent	Application
1	Sunscreens	Long lasting product efficacy,with improved protection against sunburns & with reduced irritancy & sensitization.
2	Anti-acne eg.Benzoyl peroxide	Maintained efficacy with decerased skin irritation & sensitization.
3	Anti-inflammatory eg. Hydrocortisone	Long lasting activity with reduction of skin allergic response &dermatoses.
4	Anti-fungal	Sustained release of actives.
5	Anti-dandruffs eg. zincpyrithione, selenium sulfide	Reduced unpleasant odour with lowered irritation with extened safety & efficacy.
6	Antipruritics	Extended & improved activity.
7	Rubefacients	Prolonged activity with reduced irritancy greasiness &odour.

Fig. 6. A typical applications of microsponges

4.5 LIPOSOMES WITH MICROSPONGES

Liposomes with Microsponges acts as a potent system and effective against various environmental variations such as temperature, humidity, rainfall, altitude etc., Our current study is to aiming the system against resistant delivery system. thereby, we can achieve a potent NDDS.

4.5.1 METHOD- 1

- Outer layer- Microsponges.
- Inner layer- liposomes.

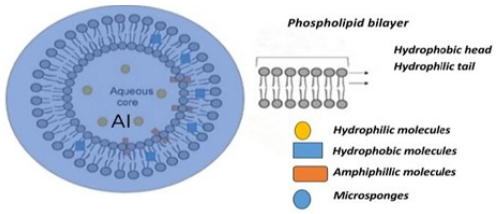

Fig. 7. Microsponges with liposomes

4.5.2 METHOD-2

Outer layer - liposomes Inner layer - Microsponges

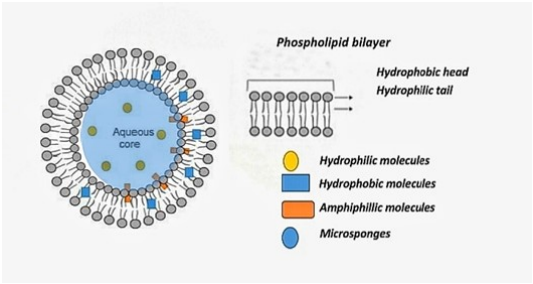

Fig. 8. Liposomes with microsponges

Table 2: Current formulations vs Possible formulations

CURRENT FORMULATIONS	POSSIBLE FORMULATIONS
Tablets	Peel off mask
Capsules	Wipes
Syrups	Wet spraying
Injections	Inhalants
Drops	Lozenges
Sunscreen	Transdermal patches
Cream	Plasters
Soaps	Pills
Powders	Enemas
Gels	Suppositories
Drops	Aerosols
Lotion	Oil

These formulations are included in order to promote a best formulation and effective against various ecological conditions.

1. Inhalants- By using this method thereby we can achieve a maximum therapeutic effect even in high altitude by decreasing plasma half-life and it promotes the drug concentration in blood This kind of preparation is mainly targeted for asthmatic patients

2. Wet spraying- This technique is employed in sequence to discourage an environmental factors like temperature, humidity, rainfall etc., Thereby it acts as a water resistant. so, longer the duration and shorter the action gets achieved.

5 CONCLUSION

Environmental factors such as climate change, air pollution, water pollution, chemical pollution, land pollution, deadliest disease producing microorganisms makes the NDDS less effective to overcome this hypothetical situation we are aiming a different system. This paper focuses on the systematic approach on liposomes with Microsponges acts as an excellent delivery system with regards to ecosystem. Hope this system plays an immense role in ecosystem.

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