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A REVIEW ON LIPOSOMAL DELIVERY OF COSMETICS

Magic Bullets as A Carrier For Delivering Cosmetics

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Abstract:

A vesicle made of phospholipid layers with an aqueous core known as liposomes was employed in moisturizing creams, sunscreen lotions to introduce nanotechnology to the cosmetics and health product industries about 40 years ago. Liposomes as potential medication carriers were first substantially investigated by the pharmaceutical sector, these preparations were said to be “MAGIC BULLETS”. Nano cosmeceuticals were frequently used to treat disorders like Wrinkles, Photography, Hyperpigmentation, Pimples and Hair damage on the skin, hair, nails and lips. The use of liposomes we are able to overcome some limitations including low penetration, solubility, stability, duration of impact and excessive side effects.

This Review discusses numerous kinds of Cosmetic liposomes that can be used in various cosmetic formulations based on their unique qualities and finally it considers the applications of using liposomes in cosmetics.

keywords: Liposomes, Nano cosmeceuticals, Types of liposomes, Applications.

I.INTRODUCTION:

HISTORY OF COSMETICS:

Since the dawn of civilization, people have used cosmetics, which were made from natural ingredients including Milk, Flowers, Fruits, Seeds and vegetables as well as minerals (clay, ash, etc.) for improve elegance in their appearance. The purpose of utilizing cosmetics is to preserve the human body from the damaging effects of the environment, the ageing process, and to maintain or alter the body's odour and appearance.[1]

In Egypt, cosmetics originally appeared 5,000 years ago (about 3100 BCE), Egyptians of all social levels have worn Kahl customarily from the Protodynistic Period of Egypt (about 3100 BCE), initially as eye health protection. In the Early Common Era (CE) People in Rome used barley flour and butter to treat their acne and sheep fat and blood to paint their fingernails.

The anti-aging cream "Capture," introduced by Dior in 1986, was the first liposomal cosmetic product to hit the market. Due to its softening and conditioning qualities Phosphotidylcholine was one of the primary components of liposomes, has been used extensively in shampoo products. Industry of skin care Additionally, in 1987 and 1990, Laboratories RoC introduced two products, Myosphere and the first liposomal facial cream for men. Myosphere was the first emulsion to contain liposomes. A powder manufactured in 1988 was the first cosmetics item that incorporate liposomes, and it was followed by mascara and several foundations.[2]

GLOBAL SCENARIO:

Fortune Business Insights claims that during the projection period of 2021-2028, the global market for cosmetics is anticipated to increase at a CAGR of 5.0%, from $287.94 billion in 2021 to 5415.29 billion in 2028.In the past 30 years, liposomes have been used for more than only medicine administration, they are now the most popular method for delivering cosmetics. Due to their distinctive structure, liposomes can be used as a delivery mechanism, transporting lipophilic compounds via the nonpolar tails of the bilayer region and hydrophilic chemicals through their enclosing aqueous part.[3]

Size is a crucial factor in pharmaceutical science and cosmetics because it affects the bioavailability, toxicity, shelf life, and efficacy of medications. Drug performance can be considerably improved by nanotechnology and it offers novel methods for effective pharmaceutical applications.[4]

LIPOSOMES: DEFINITION

A spherical vesicle called a liposome has a membrane made of a bilayer of phospholipid and cholesterol. Liposomes are straightforward tiny vesicles with a lipid-based membrane that completely encloses an aqueous volume.[5] and their size can range from 15 nm to several micrometres.[6] Lecithin's are phospholipids that are frequently employed in liposomes and are mostly obtained naturally from sources like soya beans and eggs or artificially. Cholesterol by itself does not result in a double-layered structure, when added to the chemical, it allows the liposome to hold the entrapped substance inside for an extended period of time. [7]

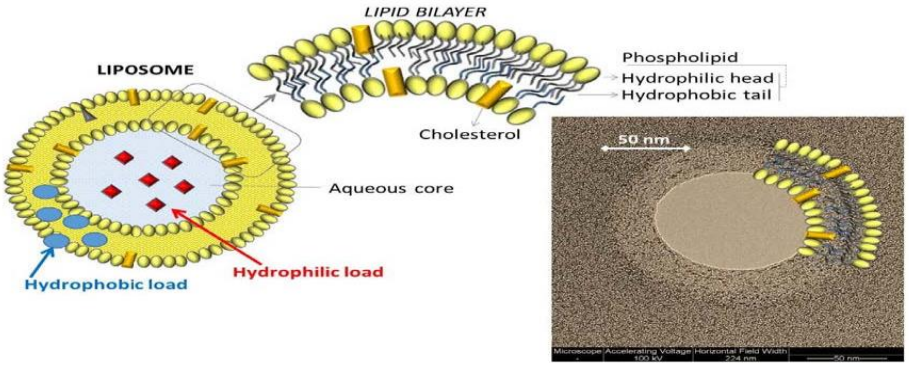

Figure :1 Structure of liposome

II.TYPES OF LIPOSOMAL COSMETICS:

1.NIOSOMES:

By hydrating liposomes, when cholesterol is combined with a non-ionic ether family, microscopic lamellar structures surfactant of the alkyl or dialkyl polyglycerol and formation of non-ionic surfactant- based liposomes called as Niosomes [8].

- Niosome size ranges from 10-100 nm. [9]
- In 1970, L'Oreal began researching and creating synthetic liposomes, which led to the first niosome creation. L'Oreal obtained a patent on niosome in 1987; they were created under the trade name Lancome.[10]

2.ETHOSOMES:

- These are lipid vesicles that are heavily ethanol- contained. Both the stratum corneum and intercellular lipid bilayers are fluidized by ethanol. This system consists of phospholipid, ethanol and water.[11].
- Marketed medications using ethosomal formulations include topical creams for the treatment of herpes simplex virus. anticelulite (Cellulite, Noicellex, Skin Genuity Osmotics Liposuction), and antiaging (Decorin) agents, as well as hair growth stimulants like Minoxidil, (Nanomax) and Acyclovir (Supravir).[12]

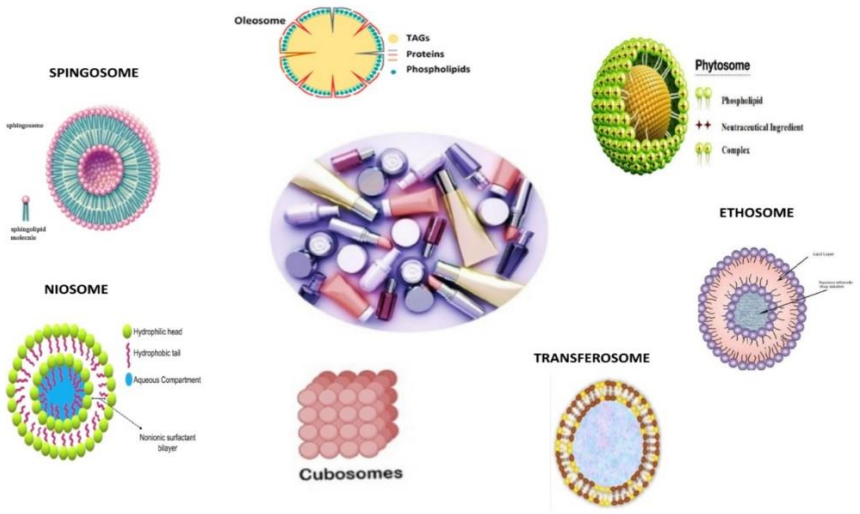

Figure 2: Various types of liposomes

3.CUBUSOMES:

Cubosomes are isolated, sub-micron-sized nanostructured components of the bi-continuous cubic liquid crystalline phase. It is created when certain liquid crystalline surfactant particles are combined with water and a specific microstructure in a specific ratio.[13]

4.PHYTOSOMES or HERBOSOMES:

Anacystis nidulans, a marine plant, provided the photolysis enzymes that are released by photosomes. They are widely utilised in sunscreens, which guard against light-induced DNA damage to cells, preventing the inhibition of the immune system and lowering the danger of cancer induction.[14]

5.NOVASOMES:

The non-phospholipid oligolamellar lipid vesicles known as novasomes are a kind of liposomes or modified Niosomes that are produced by mixing the monoester of polyoxyethylene fatty acids, cholesterol, and free fatty acids at a ratio of 74:22:4. Their capacity to adhere to skin or hair shafts gives them further superiority for use in cosmetic preparations. Additionally, this permits a sustained release and improves the efficiency and texture of these cosmetics.[15]

6.TRANSFEROSOMES:

Cevc and colleagues introduced transferosomes in the 1990s, which are lipid vesicles that contain significant amounts of fatty acids, Phospholipids make up the majority of the vesicles of transferosomes, which also contain 3-10% ethanol and 10-25% surfactant. Therefore, compared to liposomes, their bilayers are far more elastic and are therefore better suited for skin penetration. Since undamaged skin can be penetrated by 200 to 300 nm sized transferosomes.[16]

7.INVASOMES:

Invasomes are liposomal vesicles with high skin penetration capabilities that contain terpenes or terpene combinations together with modest amounts of ethanol to serve as powerful transporters. Soft liposomal vesicles with a highly fluid membrane are Invasomes. Due to the presence of ethanol and terpenes, the Invasome has unique properties that allow it to simultaneously benefit from liposomes as possible transporters, which increase skin permeability and cutaneous distribution by changing the packing order of the stratum corneum.]17]

8.MARINOSOMES:

Liposomes called Marinosomes, developed in Bordeaux, France, are based on a naturally occurring marine lipid extract that contains high concentrations of polyunsaturated fatty acids including eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA,22:5n-3).[18]

9.MENTHOSOMES:

Liposomes made with phospholipids, ethyl acetate, and menthol are known as Menthosomes. The organization of the vesicle is impacted by menthol, which enhances penetration. Thin film hydration is a technique that can be used to make this kind of liposome.[19]

10.YEAST BASED LIPOSOMES:

These are made from yeast cells and contain vitamin C, which helps the skin by healing, calming, and oxygenating it. They activate skin fibroblasts in liposomal form, giving the skin a healthier appearance. The amount of vitamin C absorbed by cells dramatically rises when the liposome is utilised as a carrier.[20]

11.OLEOSOMES:

Natural liposomes that serve as a storage space for oils, vitamins, and colours are called oleosomes. They have been shown to be effective delivery methods in personal care and can be found in a range of oil containing plant seeds or fruits. Oleosomes made up of sea buckthorn fruit flesh demonstrated high stability and antioxidant properties.[21]

12.CATEZOMES:

Catezomes are new amphipathic molecules made of fatty acid salts of quaternary amines that have a cationic surface charge. They are non-phospholipid vesicles. These liposomes with hydrophilic or hydrophobic cosmeceutical payloads can be retained by hair and skin, making them excellent delivery vehicles, particularly when penetration is undesirable or when we anticipate managed penetration.[22]

13.GLYCEROSOMES:

Glycerosomes are reformulated liposomes that additionally include glycerol and phospholipids. Unilamellar Glycerosomes with quercetin were recently developed, and tests revealed that they enhanced skin defence activity. The prospect of using them in the future is the production of antioxidant skin lotions.[23]

III.NOVEL METHODS FOR PREPARATION OF LIPOSOMAL COSMETICS:

1.) Novel techniques have been developed based on the advancement of traditional techniques, such as the Wagner method and membrane contactor technology, which improved the ethanol injection technique.[24]

2.) The cross-flow filtering technique is created using the enhanced detergent removal technology.[25] Following the sonication procedure, the immediate hydration of lipid components is a simple method that prevents dissipative stages.[26]

3.) Additionally, the supercritical fluid (SCF) method uses a supercritical fluid, like carbon dioxide (CO2), kept under supercritical conditions of pressure and temperature.[27]

4.) The most popular SCF techniques include

A) injection and decompression

B) rapid expansion of supercritical reverse-phase evaporation (SCRPE)

C) supercritical solutions (RESS)

D) processes using supercritical CO2 as an anti-solvent

E) gas antisolvent (GAS)

F) supercritical anti-solvent (SAS), and aerosol solvent extraction systems (ASES).[28]

IV.Cosmetic applications of liposomes:

- Liposomes have the potential function as both active ingredients in cosmeceuticals and as carriers for such ingredients. Empty liposomes can interact strongly with skin lipids, proteins, and carbohydrates when eczema- affected skin is dry or damaged owing to lack of moisture. This helps the skin return to its natural state and allows the stratum corneum to effectively carry out its protective job. They may improve the product's penetration, solubility, stability, length of effect, and isolation from environment. [29]

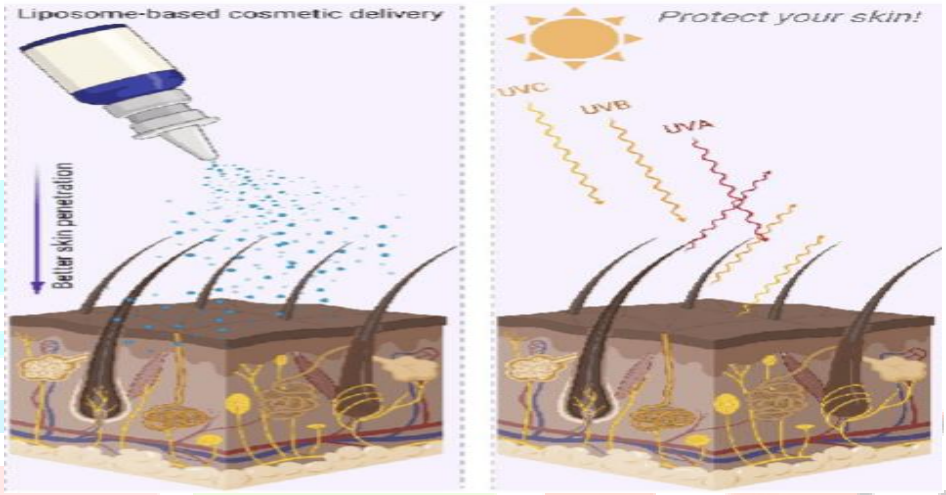

Figure 3: liposomal cosmetic delivery

1.To overcome solubility:

- Because of their biphasic nature, liposomes can retain hydrophilic, amphiphilic, and lipophilic molecules in their structure, depends on its solubility. Generally lipophilic, and amphiphilic substances are settled in the lipid bilayer of the liposome and hydrophilic agents are embedded in the aqueous centre or in the external aquatic phase. This positioning minimizes the loss of materials when stored.[30]
- Since aqueous environments are where liposomes are most frequently used, we take advantage of this property to transport hydrophobic materials in aqueous formulations. The four fat-soluble vitamins that we have- Vitamin A, D, E, Vitamin E is frequently utilised in cosmeceuticals for its skin protection capabilities, such as anti-aging, improved skin moisturization, and prevention of skin illness.[31].
- Vitamin K is a very lipophilic and photosensitive molecule that has recently been proposed for a variety of cosmeceutical applications, such as antioxidant effect, reducing skin pigmentation, preventing vascular events associated with ageing, and resolving bruising, which includes addressing issues brought on by laser beam irradiation.[32]
- An ingredient with limited water solubility, such as linoleic acid (LA), is recommended to accomplish skin lightening effects on hyperpigmented skin. The skin-whitening action of linoleic acid is boosted by liposomal preparations. Liposomes containing vitamin E or retinoic acid, which may slow ascorbic acid
- oxidation, may be used in skin-whitening compositions.[33].

2. To Enhance stability:

- Many materials are vulnerable to oxidation, deterioration, or loss of effectiveness when exposed to environmental hazards. Liposomes allow us to protect the contained component from harmful elements. The skin is shielded from free radical damage by an endogenous antioxidant mechanism. However, when skin is exposed to UV rays, the number of pro-oxidants increases and outweighs the number of antioxidants, which causes oxidative stress and photoaging of the skin and also alter the activity of many bioactive compounds. In order to quench free radicals, the cosmetic industry has embraced the strategy of topical antioxidant supplementation. Making liposomes that enable the encapsulation of antioxidant compounds is one strategy for counteracting this effect on the skin.[34]
- After 60 days of storage, vitamin C nanoliposomes had greater stability and antioxidant activity than regular liposomes.[23]

3. To facilitate penetration:

- A molecule needs to have specific physicochemical characteristics in order to easily permeate the stratum corneum, such as being intermediate distribution coefficient, and having a light in weight, water and oil soluble with a low melting point. In comparison to conventional dosage forms, liposomes significantly ease the penetration inside the horny layer due to their small size and structural resemblance to skin in terms of their lipid makeup.[35]

4. Separating the Component from External Milieu:

- Most materials can perform a distinct function after reacting with other compounds. The variation in our skin colour is caused by the pigment melanin. Tyrosine is converted into melanin by the tyrosinase enzyme in the melanocyte, a type of cell found deep under the skin. These pigments are subsequently transported to the skin's deeper layers, where they are deposited. The skin becomes darker as more melanin is generated. Tyrosinase, an enzyme necessary for the production of melanin, is inhibited by liposomal Vitamin C as a result, less melanin pigments are created.[36]

5. Reduce toxicity:

- A toxin is any substance that enters the body in excess of what is required. We prevent this by using liposomes with the least amount of active ingredient possible. Additionally, the controlled release of active ingredients from liposomes keeps it from rising to toxic levels. Utilizing liposomes lowers the required dosage and the chance of overdosing on the product, which could result in intoxication. Liposomes offer high efficacy and targeted delivery of ingredients.[14]

Table 1-marketed liposomal cosmetic formulations [37,38,39,40,41,42,43,44]

S.NO	COSMETIC PRODUCT	MANUFACTURE	INGREDIENTS
1.	Capture	Christian Dior	Thymus extract, Collagen & Elastic peptides
2.	Revitalift	L'Oreal	Pro – Retinol A
3.	Aquasome LA	Nikko Chemical Co	Liposomes with humectants like Glycerine, Sorbitol.
4.	Inovita	Apotheke /Pharm	Thymus extract, Hyaluronic acid, Vitamin E
5.	Symphatic 2000	Biopharm Gubh	Thymus extract, Vitamin A Palmitate
6.	Eye Perfector	Avon	Soothing cream to reduce Eye irritation.
8.	Future perfect Skin gel	Estee Lauder	TMF. Vitamin E, A Palmitate cerebroside ceramide phospholipid
9.	Natipide II	Nattermann PL	Liposomal gel for do it -yourself cosmetics.
10.	Effect du Soleil	L'Oreal	Tanning agents in liposomes
11.	Royal gelly lift concentrate	Jafra cosmetics	Larrea Divaricata Extract, Winter cherry &Lotus flowers, Sunflower sprout Extract
12.	Formulae liposome Gel	Payot (Ferdinand Muehlens)	Thymoxin, Hyaluronic acid

CONCLUSION:

The cosmeceutical market is incredibly diversified with products originating from major and small manufacturers as well as local businesses all over the world. As a result, the cosmeceutical sector is growing more rapidly every day. Reported literature indicates that Liposomes are efficient colloidal carriers for the delivery of therapeutics into skin. Liposome components and skin lipids are quite similar, which explains why they are both safe and efficient. Liposomal cosmetics based on nanotechnology should be designed and sold in a way that fully respects the health of consumers and the environment. Modified liposomes such as Niosomes, Yeast based liposomes, Ethosomes, Transferosomes, Invasomes, Novasomes etc hold a promising approach in cosmetic industry.

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