



IJPPR

INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH  
An official Publication of Human Journals

ISSN 2349-7203




Human Journals

Review Article


March 2020 Vol.:17, Issue:4

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## A Review on Novasome Technology



IJPPR  
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH  
An official Publication of Human Journals



ISSN 2349-7203

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**Submission:** 22 February 2020  
**Accepted:** 29 February 2020  
**Published:** 30 March 2020



HUMAN JOURNALS

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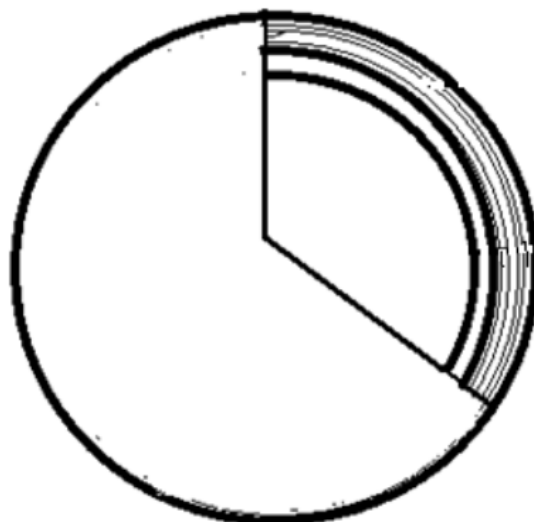
**Keywords:** Novasome, Non-phospholipids, Paucilamellar, Innovation, Pharmaceutical technology

### ABSTRACT

Various new modes of novel drug delivery are developed in pharmaceuticals. Earlier existing drug delivery methods are modified have led to develop various newly innovated technologies serving safe and effective formulations over the existing ones. Novasomes technology is one of the modified form of liposomes which have solved many of the difficulties related to liposomal drug delivery system. It offers a seven-bilayer membrane which can incorporate both water soluble and insoluble drugs. It has an excellent entrapment efficiency which provides better medication. Formulation of novasomes is achieved during a high shear device. Novasomes have found their applications in several fields like cosmetics, chemical, personal care, foods, pharmacy field and agrochemicals. Many products have already been introduced in the market using this technology with a proposal of furthermore launches. Novasomes has become one of the most advanced derma cosmetics because of its penetration depth. Novasomes are continuously being researched upon to obtain enhanced release characteristics.

## INTRODUCTION

Novasome micro-vesicles are the paucilamellar vesicles that are designed from many biocompatible phospholipids and single tailed amphiphiles. Novasome is an effective drug delivery system for a variety of drugs. Novasome is a patented technology developed by the IGI laboratories Novavax. Novasomes are an innovation of the liposomal drug delivery system or a variation of other similar drug delivery systems<sup>[1]</sup>. Novasome can be defined as paucilamellar vesicles of 200 to 700 nanometres in diameter consisting of 2 to 7 bilayered membrane each composed of amorphous core and amphiphilic molecule. The core accounts for most of the Novasome vesicular volume thus accommodating a high capacity of water immiscible and water-soluble drugs. The Novasome micro vesicles are inherently stable and are tailored to be stable at pH range of 2-13 and the temperature ranges from the liquid nitrogen to the temperature above the boiling point of water<sup>[2]</sup>. Novasome offers sustained release action. There is no proper array arrangement of the Novasome bilayers. Novasomes will bear any charge and so operate consequently. For example, if the charge on the Novasome micro-vesicles is positive, it can combine with the skin, hair or mucous membrane of negative charge. They can also adhere to the hair shafts. Incompatibility problems can be avoided with the use Novasome technology by incorporating the incompatible drugs between the bilayers. Novasome increase the efficacy and efficiency of the treatment with almost no side effects. They are natural and do not cause any kind of cytotoxicity. Because of the wide range of pH offered by Novasomes, they can be used for a wide range of applications. Novasomes can be formulated to the desired release action and absorption level. Novasome can be considered as one of the most effective method to treat skin disorders. Novasome molecules have a hydrophobic tail group attached to a hydrophilic head group. These molecules embody long chain acids, long chain fatty alcohol derivatives and long chain amino and glycerolipids. They are ready from a mix of sterol, free fatty acids and monoester of polyoxyethylene fatty acids. They have a uniform size distribution that depends upon a wide variety of membrane constituents that are chosen individually for each purpose with encapsulation efficiency of 99-100% for lipid materials and 78-88% for aqueous materials. The water-soluble ingredients get incorporated into the liquid areas and the lipid soluble materials gets incorporated within the central of the vesicle. The greater part of the vesicle is occupied by the amorphous core that incorporates finely divided insoluble particles like diamonds and titanium dioxide, water soluble particles<sup>[3]</sup>.



**Fig. no. 1 Schematic diagram of Novasome**

### **Characteristics of Novasomes:**

Novasomes are found to possess many characteristics, several that mentioned below includes

- It could be a multi bilayered cyst with a high capability central core.
- Its surface will be negative, positive or neutral charged.
- The inner amorphous core will be loaded up to 80-85% with a medicated product.
- They will be made of a size vary.
- They can adhere to the skin or hair shaft depending on varying conditions of the vesicle surface charge as well as skin surface.
- They have the advantage of containing additional active ingredient in an exceedingly tiny volume.
- They show a certain unleash of active ingredients therefore reducing the frequency of applications.
- They have the power to hold and unleash an oversized volume of water-soluble ingredients <sup>[4]</sup>.

### Advantages of Novasomes:

It offers many benefits to the house owners of the merchandise like

- Both hydrophilic additionally as hydrophobic merchandise is incorporated within the same formulation.
- Drugs showing interactions is incorporated in between bilayers to stop incompatibility.
- Due to surface charge characteristics, it is created website specific.
- It will deliver an oversized volume of active ingredient since it possesses a loading potency of eightieth, so conjointly reducing frequency of administration.
- Having the flexibility to stick at skin or hair shafts, it offers further advantage of being employed in numerous cosmetic formulations <sup>[5]</sup>.

### MECHANISM OF DRUG RELEASE

The Novasome bilayers do not show perfect array arrangement. They contain channels (vacancies) that act as a pathway for travel of encapsulated components. Encapsulated components such as active ingredients in the core travel at intervals and between every bilayer via a series of random jumps that causes lateral movement of the vacancies within the bilayer. This causes the continual unleash of active moieties from the bilayers through the liquid suspension separating the bilayers. The charge on the surface of micro vesicles can be net negative, net positive or no net charge which determine their activity. For example, the positively charged micro vesicles can combine with the negatively charged skin, mucous membrane or hair. Similarly, a sustained release mechanism is provided by the structure of the Novasome vesicles so a controlled release of the active ingredient <sup>[6]</sup>.

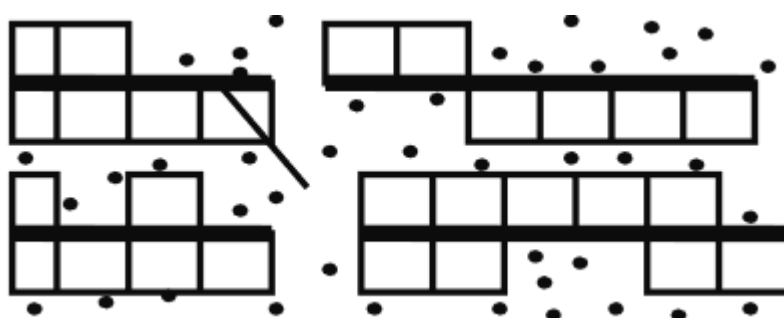


Fig. no. 2 Frequently release of active drug mechanism of action

## FORMULATION OF NOVASOME

A high shear device that produces high shear rates is needed for the formulation of Novasomes. The devices that can be used for the formulation of Novasomes are French pressure cell and Micro fluidizer. Other devices should also be used that produces high shear rates and have the power of handling semi viscous and heated lipids. An advanced device is employed currently every day to manufacture Novasomes. It takes in a mixing chamber that is cylindrical with an inlet orifice positioned tangentially. The other orifices lead to a reservoir that contains the different phases. The phases include the aqueous phase and the lipophilic phase. A turbulent flow is produced inside the chamber when the reservoir is connected to the pumps. The mixture taken is usually a charge producing agent, a non-phospholipid surfactant a target molecule and an antioxidant. This mixture is first heated and then blended. This mixture is yet again intermingled with the solvent phase containing an aqueous soluble collagen and an aqueous buffer. The micro vesicles are moulded in less than a second and can be removed from the axially located discharge orifice of the chamber. Now an innovative technology has been proposed to formulate the Novasomes using N-acyl sarcosinates. This technology has been used for the preparation of controlled and sustained delivery of emollients or fragrant oils <sup>[7]</sup>.

## APPLICATIONS OF NOVASOMES

Novasomes have widespread utilization in foods, cosmetics, personal care, chemicals, agrochemicals and pharma sector. The technology improves absorption rate via topical delivery of pharmaceuticals and cosmetics by applying non-phospholipid structures. It offers several advantages such as it aids in formulation, increase delivery to site of action, offers high stability to chemical ingredients in the formulation, low cost and availability in large amounts to all these products. Due to its capability to protect, transport and deliver flavour oils, nutrients and other active ingredients, Novasome vesicles can be used for various functions in foods and beverages. It can provide sustained release of ingredients and to enhance texture, flavour, fragrance, efficacy, safety, stability and various other desirable properties of various materials. Various FDA-regulated products such as human pharmaceuticals and vaccines can be manufactured using this technology <sup>[8]</sup>. Various vaccines based on Novasomes have been licensed for the immunization of fowl against Newcastle disease virus and avian reovirus is an ortho reovirus <sup>[9]</sup>.

## ADVANCES IN NOVASOME TECHNOLOGY

Novasome technology is the most innovative derma cosmetics technology that inflates the boundary of dermatology science. The penetration of the novasomes vesicles is not good into the deepest layers of the skin easily but they also penetrate the targeted cell as pre-programmed. Novasome based dermatological products were studied at Cornell University in two common clinical situations. The first study evaluated the effectiveness of Novasomes based versus non encapsulated emollients in the management of wintertime dry skin in dogs, in which 20 affected dogs were treated with both type of products. The results showed that the Novasome based emollient was the superior agent in 80 percent of the Dogs. This study showed that Novasome can aid as potent Humectants. The second study evaluated Novasome and Non- Novasome based shampoos that contained Benzoyl peroxide. The test results showed that Novasome based shampoos decreased scaling in 70 percent of the subjects while the Non-Novasome based shampoos showed decreased scaling in only 20 percent <sup>[10]</sup>. Studies showed that Novasome technology has improved localized delivery of H<sub>2</sub> antagonists for the treatment of periodontal diseases due to increased local absorption of the H<sub>2</sub> antagonist and enhanced drug action. It also finds applications in the management of inflammatory skin and other disorders <sup>[11]</sup>. Recent advances in veterinary topical agents have followed the human field and Novasome based sustained release veterinary products are now available to pets for long lasting skin hydration and delivery of antipyretic agents. Sustained release technology is one such breakthrough that uses Novasome micro vesicles to encapsulate moisture within skin treatments, shampoos and sprays to achieve a hydrating effect These non-ionic vesicles of glyceryl dilaurate with cholesterol and polyoxyethylene-10-stearyl ether have been known to deliver greater amounts of cyclosporine into and through the mouse skin than phosphatidylcholine or ceramide based vesicles<sup>[12]</sup>. Novasome technology has been extensively used for the preparation of vaccines. Smallpox vaccine has been developed based on Novasome. The other Novasome based vaccine is still under development. The Novasome based vaccines have been used for the immunization of fowl against Avian Rheovirus and New castle disease virus <sup>[13]</sup>. The topical delivery of Minoxidil was increased by making it more hydrophilic using Novasome micro vesicle and an organic acid or a base such as lactic acid. Fuels enhanced with patented lipid vesicles (Novasome®) and dispersion assistant molecules to deliver water- and water-soluble fuel additives in fuels has been used that gives enhanced performance characteristics compared to conventional fuels. Novasome is marketed as skin cleansers, skin- protective agents, oil. Novasome offers greater resistance to acidity,

alkalinity and temperature. Hence products can be easily incorporated using this technology [14].

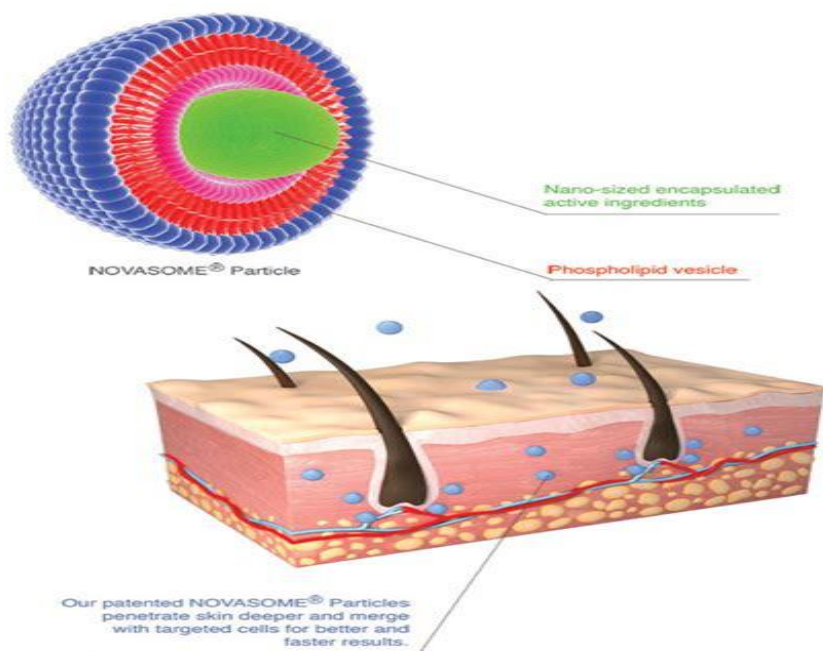


Figure No. 3 Penetration of Novasomes into tissues

Table no. 1 Novasome® products in the market currently include

Manufacturer	Marketed formulation	Uses
Estee Lauder, Pierre Fab, Neutrogena	Novasomes®	Cosmetics
Chattem Pharmaceuticals	Icy Hot creams, lotions and patches	a line of over the counter pain therapy
Apollo Pharmaceuticals	Relieva cream, lotion, and shampoo	for the treatment of psoriasis
Amore Pacific	Moisturizing cream and gel in its popular Water Bank products line.	for body skin
Vetoquinol USA	Vaccines, pharmaceuticals and grooming.	for animal care
Dermworx	Acne-worx	adult acne product
Dermatology Associates of Georgia	Skincare products	for skin
Johnson and Johnson	Retinoid products	for skin care
IGI	MIAJ anti-wrinkle cosmetics	for cosmetics



## CONCLUSION

It was found that Novasomes increase product stability, extend shelf life from weeks to typically years, prevent oxidation and emulsification, and permits separate out antagonistic ingredients inside the formulation till use. Novasomes also permits the control release of active ingredients through heat, pressure and time. The incremental price of formulating products using novasomes is minimal. It has wide applications in the fields of foods, cosmetics, pharmaceuticals, chemical, agrochemical, personal care and others. Continuous advances are being made in novasomes technology. Many novasomes based products are underneath development to be marketed into the market. Continuous developments are being made in Novasome technology. Many Novasome based products are under development to be marketed into the market.

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