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Review on Organogel

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ABSTRACT

An Organogel is a type of gel that consists of a liquid organic phase surrounded by a three-dimensional crosslinked network. Organogels can be employed for drug and vaccine delivery via several administration routes in the pharmaceutical area, albeit only a few such formulations have been examined despite the enormous number of organogels under study. Organogels have a number of appealing properties as drug delivery formulations, including ease of preparation and administration. This article will go through the specifics of how organogels are made and how they are used in medication administration.

INTRODUCTION:

Organogels are thermoreversible, viscoelastic materials generated from low-molecular-weight Organogelators. Organogelators are a type of molecule that can self-organize in organic solvents and/or water, and do so at unexpectedly low concentrations. The gel state has been defined in a variety of ways. For example, Hermans defined the gel as a colloid dispersion system with solid-like mechanical properties and at least two components that extend continuously throughout the system. Flory went on to say that a gel needs to have a continuous structure, such as wellordered lamellar structures, disordered physically aggregated polymer networks, covalent polymeric networks, and particulate structures. Depending on the type of the liquid component, the gel is called a hydrogel or an Organogel. If the liquid phase is water, it is referred to as a hydrogel, and if the liquid phase is an organic solvent, it is referred to as an Organogel. Organogels are formed when individual gelator molecules spontaneously self-assemble into three-dimensional networks of randomly entangled fiber-like structures. Liquid microdomains are held in this three-dimensional network. Surface tension is the principal source of resistance in a non-flowing state. Gelators include sterol, sorbitanmonostearate, lecithin, and cholesteryl anthraquinonederivates, to name a few. The Organogels' thermo-reversible feature has sparked a lot of interest in their possible application as a medication delivery mechanism. The Organogels' thermodynamic stability has been attributed to the spontaneous creation of fibrous structure, which keeps the Organogels in a low-energy state. The presence of the gel-to-sol transition above ambient temperature shows that external energy is required to break the three-dimensional structure of the Organogels and cause the gelled state to shift to the sol state. Organogels are sensitive to moisture as well as temperature, which has been investigated in the development of controlled

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delivery systems. Various Organogel-based formulations have been developed for different routes of delivery of bioactive compounds.

GEL: Because of their superb appearance, smoothness, required consistency, fast medication release, ease of manufacture and quality assessment, and admirable stability, gels are the best fit in all of these critical characteristics. Organogels are a type of advanced drug delivery device created by modifying the gel formulation. It was shown that lipid-based formulations function best by enhancing penetration into the skin; however, such formulations have the disadvantage of altering the moisture status of the skin, which can lead to dermatitis. Water-based formulations, on the other hand, are capable of maintaining the bioactive state of the skin but have inadequate penetration. Because of the existence of both phase oil and aqueous phase, a new type of gel called organogel has been developed as a promising vehicle for delivering a wide variety of agents through the skin, and lecithin organogel delivers a bioactive agent in the treatment of skin aging. Physical gels are held together by weaker physical forces of attraction such as van der Walls interactions and hydrogen bonds, whereas chemical gels are held together by covalent bonds. Gels are classed as either organogels or hydrogels, depending on the composition of the liquid component.

GEL TYPES INCLUDE:

A. Hydrogels

Hydrogels are three-dimensional polymeric networks that are hydrophilic in nature and capable of absorbing enormous amounts of water or biological fluids. Insoluble homopolymers or copolymers, which are insoluble due to the existence of cross-links, create networks. Physical cross-links include

tie-points and junctions, which contribute to network creation and physical integrity. Chemical cross-links appear to be entanglement or crystallites. Hydrogels swell in the presence of an aquatic environment because they have thermodynamic compatibility when exposed to water. Their water content and soft texture are similar to natural living tissues, and their high water content contributes to their biocompatibility. As a result, hydrogels are widely employed in contact lenses, biosensor membranes, artificial heart linings, artificial skin materials, and drug delivery systems.

B.,Xerogel

Solid gels with a low solvent concentration are known as Xerogels. These are made by evaporating the solvent or freezing the gel, leaving the gel framework behind, which swells and can be reconstituted when exposed to fresh fluid. Tragacanth ribbons, acacia tear-cyclodextrin, dry cellulose, and polystyrene are only a few examples.

C] Organogels are thermodynamically stable, visco-elastic bi-phasic systems made up of a gelator [any chemical capable of forming gel] and a nonpolar phase, with or without the presence of water molecules in the gelator system's network. When compared to hydrogel, they have a lower hydration level. They have been increasingly important in drug administration in recent years because to their non-irritating properties and biocompatibility. Despite the fact that organogel is made up of a vast number of liquid systems, it has solid-like morphological and rheological qualities.

The opposing forces that operate and are associated with the organogelator's partial solubility in the continuous phase are responsible for the thermodynamic and kinetic stability of these systems. The interaction and physicochemical qualities of gel components are governed by the Gelling matrix. Gels are classed based on the properties of the gelators, solvents, and intermolecular interactions that result in gel formation. Because organogelators are largely tiny molecules while hydrogel gelators are polymeric, the organogelators are referred to as Low Molecular Weight [LMW] Organogelators. Organogel required a change in its formula depending on the method of administration for the medications to be administered. Non-aqueous liquids, which are beneficial for topical distribution of lipophilic drugs, and aqueous liquids, which are useful for hydrophilic drugs indicated in various pharmacopoeias as well as skin hydration, are the solvent systems in organogels. Organogel achieved a local as well as systemic effect through percutaneous absorption due to the presence of penetration enhancers: its lipophilic nature and occlusive effect are potentiated.

Organogels' Structure:

Gels are a type of substance that contains both solid and liquid components. A three-dimensional network of interconnected molecules makes up the solid component, which immobilizes the liquid continuous phase. Organogels have an organic solvent as the liquid continuous medium, while hydrogels have an aqueous continuous phase. Organogels have unique capabilities, including the capacity to solubilize guest molecules, purification and separation applications, and use as transdermal delivery vehicles.

Release of Drugs from Organogel:

Depending on the organogel system used, the specific mechanism of drug release differs. However, drug release happens by simple diffusion in the majority of organogel systems. The presence of a three-dimensional network of gelator molecules regulates this diffusion. The pace of medication release is determined by the degree of cross-linking. The slower the rate of drug release, the more crosslinking [greater gelator concentration]. However, [surface erosion] in the case of Eudragit-L based organogels and [diffusion process] in the case of Eudragit-S based organogels. In the case of transdermal and ophthalmic drug delivery via organogels, efforts have been undertaken to improve drug penetration rather than control drug release, which happens via diffusion. When organogel is utilized as a vaccine delivery vehicle, interstitial fluid percolates into the gel's three-dimensional network.

ORGANOGEL FORMULATION:

The majority of organogels are made by heating a mixture of the gelator and the liquid component to generate an organic solution/dispersion, which is then cooled to form a gel. The gelator dissolves in the liquid when heated. The gelator's solubility in the liquid phase reduces as it cools, and gelator-solvent interactions weaken, causing the gelator molecules to come out of solution. Gelator-gelator interactions cause self-assembly of gelators into well-defined aggregates such tubules, rods, and fibres. The creation of a three-dimensional network, which immobilizes and resists the gel, is caused by the entanglement of the aggregates and connections between them. Gel creation requires connections between gelators; without these, the gel state may be lost, even if many gelator aggregates are present.

Formulation Method For Organogels:

1) Solid fiber mechanism: 2) Fluid-filled fiber mechanism:

3) Hydration Technique:

4) New technique:

ORGANOGEL FORMATION PROCEDURE:

1) Fluid-filled fiber mechanism: A non-polar solvent is combined with a surfactant combination, and reverse micelles are formed. Tubular reverse micelles were generated by adding water. With the addition of more water, a 3D network was established.

2) Solid fiber mechanism: Add solid organogelator to organic solvent. A hot solution of organogelator was generated after heating at 60-70 degrees Celsius. Following the addition of the aqueous phase, the heating process continues, resulting in the creation of solid fibres that entangle to form a 3D network.

3) Hydration Method: A gel can be made by directly hydrating an inorganic chemical, resulting in the dispersed phase of the dispersion. Other substances, such as propylene glycol, propyl gallate, and hydroxyl propyl cellulose, can be employed to increase gel formation in addition to water. 4) New technique:

1. Homogenisation

Microirradiation is a type of irradiation that uses a very small amount of energy.

ORGANOGELATOR

3. The above discussion demonstrates the importance of organogelators in the design of organogels. Based on their ability to generate hydrogen, theorganogelators can be divided into two classes.

bonding. Anthracene, 5. anthraquinone, and steroid-based molecules are examples of organogelators that do not generate hydrogen bonds, whereas hydrogen-bond-forming organogelators include anthracene, 5. anthraquinone, and steroid-based molecules.

. Amino acids, amide and urea moieties, and carbohydrates are all included [10]. Before we address the numerous forms of organogels, we should have a 7. talk on the different organogelators. and how they're used in regulated distribution

ORGANOGELS TYPES

Organogels of Lecithin:

Apart from the egg yolk, lecithin is a phospholipid derived from numerous plants and animal tissues.

Scartazzini and Luisi documented the use of lecithin in the design of organogels for the first time in 1988.

Lecithin-based organogels have been the subject of a lot of research since then. The existence of 14. unsaturated chemistry within the structure of lecithin obtained from 13. natural sources allows it to form gelled structures, which has been attributed to the presence of 14. unsaturated chemistry within its structure. Organogels were not developed using synthetic lecithin or hydrogenated soy lecithin 15. The purity of the extracted lecithin 16. plays a crucial role in the creation of organogels, in addition to the chemical structure. Experimental results show that if the lecithin contains less than 18. 95 percent phosphatidyl, the process of gellification of the apolar solvent is not initiated. The thermodynamic properties of lecithin-based organogels were discovered to be 19. stable, thermoreversible (solto-gel transition temperature at 40°C), transparent, viscoelastic, 20. biocompatible, and non-irritant. Organogels made with lecithin were discovered to have a 21. isotropic structure. Lecithin organogels aid in the solubilization or accommodation of 22 different guest molecules inside their structure. These characteristics of lecithin organogels have aroused a lot of interest in their application as a controlled delivery vehicle. The molar ratio of water to lecithin in 24. lecithin organogels can range from 1 to. The production of the 25. organogel in the presence of lecithin can be attributed to fluid-fiber reverse entanglement.

Micellar tubular structures number 26. The lecithin-based organogels 27. have three separate components, namely an apolar phase, a polar phase, and a surfactant, as shown in the preceding discussion (lecithin).

Organogel: 28. 2) Pluronic Lecithin: 29. (PLO) Isopropyl palmitate or 30. isopropyl myristate, water, and Pluronic F127 make up PLO, a soy lecithin-based organogel (also known as Poloxamer 407). In both phases, PLO may or may not contain sorbic acid, which functions as a preservative. It comes in the form of a yellow-colored, odorless, opaque gel that is swiftly absorbed by the skin. PLO is made up of entangled tubular reverse-micelle structures that produce temporal three-dimensional structures, similar to lecithin organogels.

3) PrLOs (Premium Lecithin Organogels):

The PrLO is a second universal lecithin organogel that has a higher thermostability as well as a nongreasy and non-tacky character that makes it cosmetically acceptable. Because this gel does not contain a Pluronic derivative, it does not cause skin irritation or local skin intolerance reactions. PrLOs are frequently referred to as PrLO premixed gels because they are sold as ready-to-use intradermal bases. The use of PrLO as a medication delivery carrier has shown that the gel aids in boosting bioavailability in the tissues by increasing bioactive agent penetration [39–41]. This gel has been effectively utilized to accept a variety of bioactive compounds, including diclofenac, ibuprofen, ketoprofen, and progesterone, and is considered the preferred vehicle for intradermal medication delivery.

4) Organogel Limonene GP1/PG:

Limonene, a terpene, has been discovered to be an effective penetration enhancer and has thus been included into many transdermal formulations for boosting bioactive chemical penetration through the transdermal layer, thereby improving bioavailability inside the dermal tissue. Limonene integrated in dibutyllauroylglutamide (GP1) in biocompatible propylene glycol (PG) organogels has been widely researched. GP1 is an amino-acid-type gelator that belongs to the class of organogelators. Apart from the hydrophobic interactions among the lengthy alkyl chains, it has been postulated that the GP1 organogelators undergo substantial intermolecular hydrogen bonding among the amide groups contained within their structure. GP1 generates a solid-fiber based matrix, just like any other amino-acid-type organogelator. The GP1/PG organogels are made by combining the proper amounts of GP1, limonene, and PG and incubating them at 120°C. When the mixture cools, it solidifies into a white gel. The addition of limonene in the GP1/PG organogels was discovered to modify the rheological properties of the organogels, but there was no substantial change in the chemical stability of the organogels. Apart from limonene, other terpene-based penetration enhancers (such as linalool, farnesol, and cineole) have been successfully integrated into GP1/PGorganogels. The inclusion of penetration enhancers within the organogels leads to an increase in the rate of bioactive agent permeation.

CONCLUSION

Organogels are systems whose existence is constrained by the thin line between uncontrollable gelator aggregation and perfect solvent solubility. Many key topics remain unresolved, given the stringent conditions for creation and the comparatively recent interest in these systems. For one thing, the precise thermodynamic and kinetic variables influencing gelatorfibre stability in organic solvents have yet to be investigated. This knowledge could be used to develop a system for designing gelators that produce stable organogel systems. Gel components could also be chosen based on compatibility with the desired applications, such as nontoxic solvents for medicinal formulations. Organogels have a number of appealing properties as drug delivery formulations, including ease of preparation and administration. Fast diffusion of LMW drug molecules out of the matrix and/or water infiltration into the matrix are currently limiting several organogels. Nonetheless, fine-tuning the organogelator structure and maybe the composition of the organic phase is regarded to be a possibility for optimizing sustained drug release duration.

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