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A Review On Novel Drug Delivery System: A Recent Trend

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Abstract: The performance of an existing therapeutic molecule can be greatly enhanced in terms of patient compliance, safety, and efficacy by evolving it from a traditional form to a unique delivery mechanism. An existing medication molecule can be given new life through the use of a Novel medication Delivery System. One significant advancement in addressing issues linked to medication release at a specific site and rate can be an effectively constructed novel drug delivery system. Pharmaceutical companies are developing innovative drug delivery systems in response to the need to provide patients with medication in an efficient and less side effect-prone manner. This article discusses the fundamentals of novel drug delivery systems as well as their various varieties.

Keywords: Phytosome, Liposome, Noisome, Nanoparticles, NDDS.

INTRODUCTION

A novel drug delivery system is one that takes advantage of recent developments in the knowledge of the pharmacokinetic and pharmacodynamic behavior of the drug to provide a more logical method to creating the best possible drug delivering system. innovative methods for delivering drugs. Many drug delivery systems have been created, and some are currently being developed, with the goal of reducing medication loss, preventing negative side effects, increasing drug bioavailability, and promoting and facilitating the drug's accumulation in the necessary bio-zone (site). Several novel carriers have been proven and recorded as effective for sustained and regulated medication delivery. Examining the many terminologies utilized under the several overarching categories of novel drug delivery systems is crucial. Drug action is provided at a predetermined rate by sustained- or controlled-drug delivery systems, which offer a prolonged or constant (zero-order) release at the therapeutically efficacious levels in the bloodstream. By rate-limiting drug release in the immediate neighborhood of the target, localized drug delivery systems deliver medication activity. Drug action is provided by the pre-deternine rate of drug delivery, which modifies the release of drug molecules through system design, hence regulating the molecular diffusion of drug molecules in systemic circulation. Targeted drug delivery works by using carriers for passive or active diffusion, a one-base or self-programmed approach, or carries that recognize their receptor at the targeted site with the help of appropriate sensory devices.

Trending developments in novel drug delivery system

1. Phytosome
2. Liposome
3. Nanoparticles
4. Nanoemulsions
5. Microsphere
6. Ethosome
7. Niosomes

8. Proniosomes
9. Dendrimers
10. Hydrogels

1. **Phytosome:**

Phytosomes are a lipid-compatible molecular complex made up of "phyto," which refers to a plant, and "some," which refers to a cell-like structure. A novel herbal drug delivery system known as the "Phytosome" is produced by complexing the polyphenolic phytoconstituents with phosphatidyl choline in the molar ratio. Phytosomes are new kinds of herbal products that work better than traditional herbal extracts because they are more easily absorbed. Phytosomes have superior therapeutic and pharmacokinetic profiles to traditional herbal extracts.

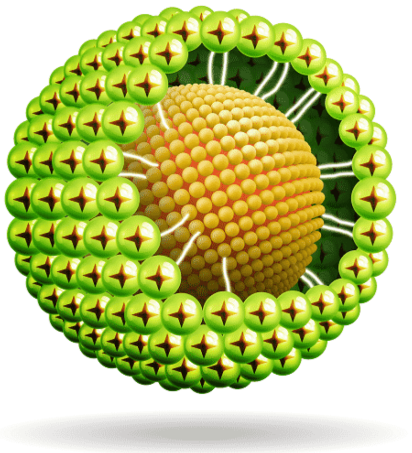

Fig: Structure of Phytosome

The benefits of phytosome:

1. Because Phytosome increases the absorption of active ingredients, its dosage is minimal.
2. Bile's solubility in herbal compounds has improved, and it can target the liver. There is significant drug entrapment.
3. Chemical bonds between phosphatidylcholine molecules in Phytosome ensure its stability.
4. The herbal phytoconstituents' percutaneous absorption is enhanced by phytosome.

2. **Liposomes:**

Tiny pouches which are made up of lipids and fat molecules surrounding with the water core widely used for clinical cancer treatment. Several different k A water cores is surrounded by tiny pouches made of lipids, or fat molecules, that are frequently utilized in clinical cancer treatment. Liposomes of various kinds are frequently used to combat infectious diseases and can deliver certain vaccines. They encapsulate drugs during cancer treatment, protecting healthy cells from their toxicity and preventing their concentration in delicate tissues like the patient's kidneys and liver. Additionally, liposomes have the potential to lessen or completely eliminate common cancer treatment side effects like hair loss and nausea.

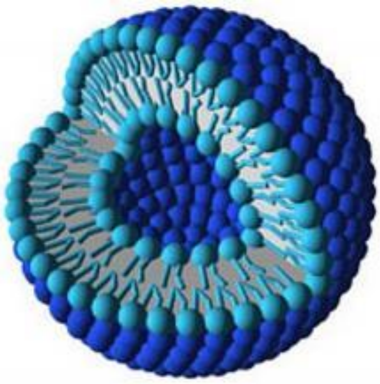

Fig: Structure of Liposome

They are a type of vesicle with one, a few, or a lot of phospholipid bilayers. Encapsulating polar drug molecules is made possible by the polar nature of the liposomal core. Depending on their affinity for phospholipids, molecules that are lipophilic or amphiphilic are solubilized within the phospholipid bilayer.

The benefits of liposomes:

1. the high degree of biocompatibility
2. the simplicity of preparation.
3. the chemical adaptability that makes it possible to load compounds that are hydrophilic, amphiphilic, and lipophilic.
4. simply altering the chemical composition of the bilayer components can alter their pharmacokinetic properties.

Utilizing Liposomes:

The use of liposomes to transport drugs to the site of action is yet another significant development in novel drug delivery systems. Both modified and unmodified liposomes can alter the drug's pharmacokinetic parameters over time. Delivery of cytotoxic agents to the tumor tissue and prevention of side effects like myelosuppression are common uses for these. Through receptor-mediated endocytosis, these are also utilized for targeting. Additionally, modified liposomes have significant potential for drug delivery to a variety of organs, including the heart, kidneys, lungs, and bones.

3. **Nanoparticles:**

Amorphous or crystalline nanoparticles, which include nanospheres and nanocapsules of sizes between 10 and 200 nm, are in the solid state. They can protect a drug from chemical and enzymatic degradation by adsorbing it and/or encapsulating it. Due to their capabilities to deliver proteins, peptides, and genes through the oral route, biodegradable polymeric nanoparticles have garnered a lot of attention as potential drug delivery devices in recent years. These applications include the controlled release of drugs, the targeting of specific organs and tissues, the role they play as carriers of DNA in gene therapy, and the targeting of specific organs and tissues.

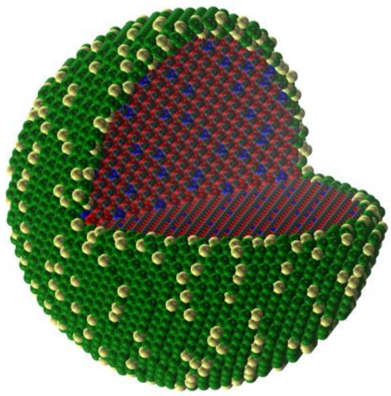

Fig: Structure of Nanoparticles

Herbal nanoparticle delivery system's advantages

1. The herbal formulation is delivered directly to the site of action by the nanoparticulate system.
2. increased therapeutic index and efficacy.
3. encapsulation improved stability.
4. enhanced pharmacokinetic action.
5.able to be produced in a variety of sizes, compound surface properties

4. **Nanoemulsions:**

A nanoemulsion is a biphasic system in which tiny droplets with diameters ranging from 0.1 m to 100 m are intimately dispersed in the other phase. One phase of an emulsion is always water, or the aqueous phase, and the other is an oily liquid, or the non-aqueous phase. The sub-microemulsion is known as liquid emulsion, and the microemulsion is also known as a nanoemulsion. Microemulsion is a transparent substance that is thermodynamically stable and frequently contains a co-surfactant.

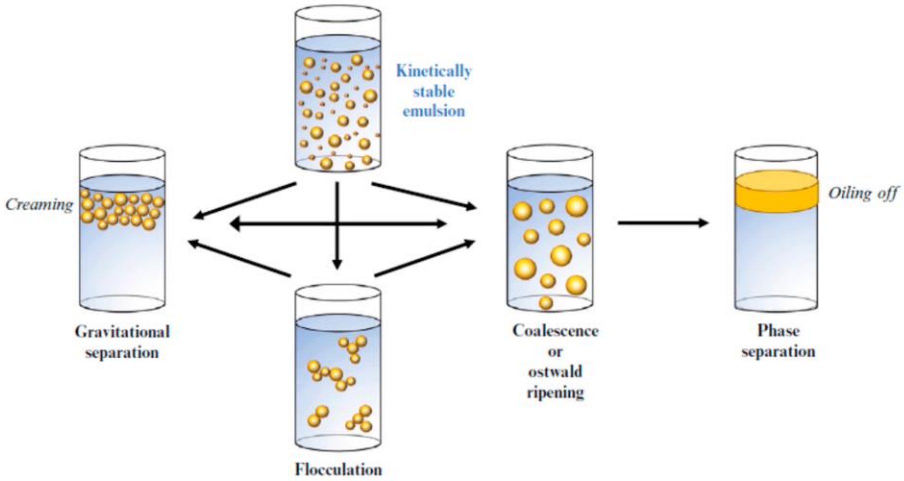

Fig: Structure of Nanoemulsions

Benefits of formulations based on emulsions:

1. Because it is packed in the inner phase and makes direct, it can release the drug for a prolonged period of time.
2. contact with other tissues and the body.
3. The oil drops are phagocytosed by macrophages and increased in concentration in the liver, spleen, and kidney as a result of the lipophilic drugs being transformed into an o/w/o emulsion.
4. The herbal formulation in the emulsion will improve the drug's penetration into skin and mucous and increase the stability of the hydrolyzed formulation.
5. The new type, Elemenum emulsion, is safe for the heart and liver and is used to treat cancer.

5. **Microsphere:**

A microsphere is made up of tiny, spherical particles with diameters ranging from one micrometer (m) to one thousand micrometers (m). Micro-particles are another name for microspheres. Natural and synthetic materials can be used to make microspheres. Ceramic, polymer, and glass microspheres can all be purchased commercially. There are two types of microspheres: biodegradable and non-biodegradable. Albumin microspheres, modified starch microspheres, gelatin microspheres, polypropylene dextran microspheres, polylactic acid microspheres, and others are examples of biodegradable microspheres. The current literature on non-biodegradable microspheres states that polylactic acid, which is used as a controlled-release agent, is the only polymer that can be used by humans. The numerous density variations between solid and hollow microspheres make them suitable for a variety of applications.

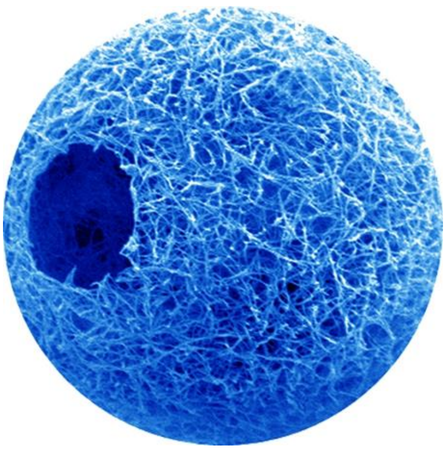

Fig: Structure of Microsphere

6. Ethosomes:

Phospholipids and a high concentration of ethanol create ethososomes. This carrier has the ability to penetrate the skin deeply, enhancing drug delivery into the skin's deeper layers and blood circulation. For the comfort of patients, these formulations are useful for topical delivery of alkaloids in the form of gel and cream. By fluidizing the skin's lipid domain, they demonstrate an increase in their permeability through the skin. Ethanosomes' tropical delivery is limited by their unstable nature and poor skin penetration. The Ethosomes were made and looked at to see if they could deliver Tetrandine to the skin for topical absorption. They also looked at how formulations related to the pharmacological activity of Tetrandrine in the formulation. Ethosomes were demonstrated to be a promising carrier for improving topical delivery of Tentrandrine via skin. The results of the drug levels in rat plasma indicated that when Tetrandrineloded Ethosomes were applied topically to rats, the drug level was too low to be detected in rat plasma.

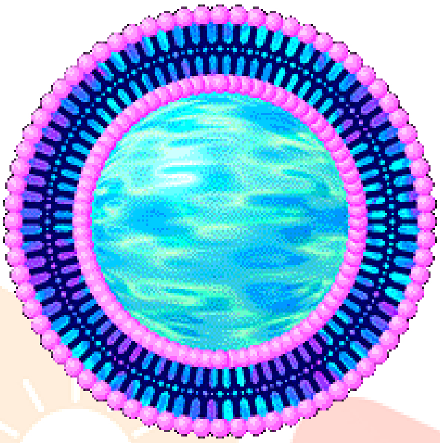

Fig: Structure of Ethosomes

Advantages of ethosomal drug delivery:

1. The drug's transdermal penetration through the skin is enhanced by ethosomes.
2. Ethosomes serve as a platform for the large-scale administration of numerous drug classes.
3. Since Ethosomaldrud is given as a semisolid, patients are more likely to comply.

7. Niosomes:

Cholesterol and non-ionic surfactants of the alkyl or dialkyl polyglycerol ether class form niosomes, which are multilamellar vesicles. In the past, studies conducted in collaboration with L'Oreal have demonstrated that, in general, niosomes share characteristics with liposomes as potential drug carriers. In comparison to liposomes, niosomes offer a number of advantages.

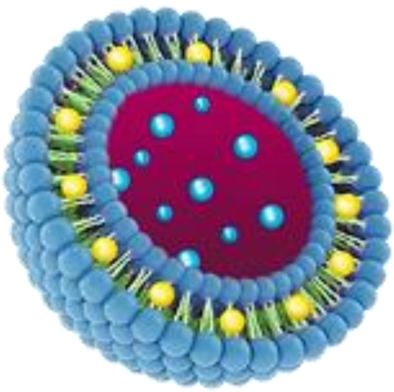

Fig: Structure of Niosomes

8. Proniosomes:

The Proniosome Gel System is a step forward from the Niosome and can be used for a variety of purposes, including the delivery of actives to the desired site. Formulations that transform into niosomes upon in situ hydration with skin-derived water are known as proniosomal gels.

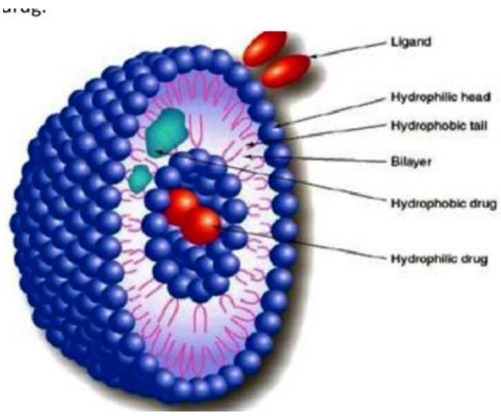

Fig: Structure of Proniosomes

9. **Dendrimers:**

Dendrimers are synthetic nanoparticles with precise definitions of 5–10 nm in diameter. They have a control core surrounded by polymer layers. Drugs and materials like PEG can attach to a variety of different sites on the surface of a dendrimer, which can be used to alter the way the dendrimer interacts with the body. PEG were attached to dendrimer as "disguise" it and prevent the body's defenses in detecting. This slows down the breakdown process. The treatment of cancer is very likely to benefit greatly from this fascinating particle. Its numerous branches make it simple for other molecules to attach to its surface. Dendrimers have been transformed by researchers into sophisticated anticancer devices that carry five chemical tools: a molecule that binds to cancer cells, another that fluoresces upon finding genetic mutations, a third that aids in x-ray imaging of tumor shape, a fourth that carries drugs that are released on demand, and a fifth that would signal when cancerous cells have finally died. The creators of these dendrimers intend to test them soon on living animals after conducting successful tests with cultured cancer cells.

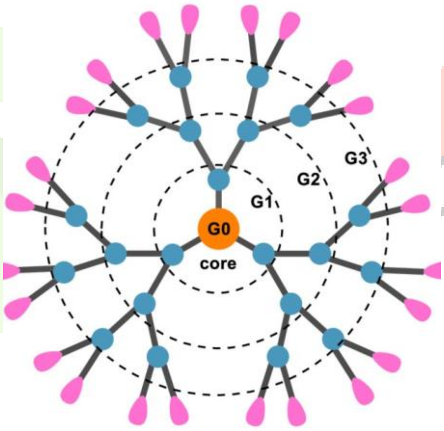

Fig: Structure of Dendrimers

10. **Hydrogels:**

These are three-dimensional polymeric networks. Which are hydrophilic and able to absorb so much of water or biological fluids. In reservoir-based, controlled release systems or as carriers in swellable and swelling-controlled release devices, they are utilized to regulate drug release.

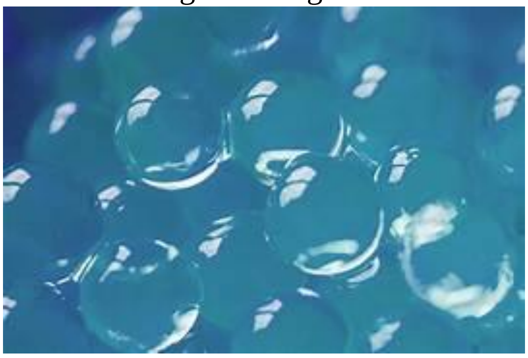

Fig: Hydrogels

NDDS Applications

In the medical and pharmaceutical industries, there are numerous potential applications for novel drug delivery strategies. Patients' compliance is improved, treatment efficacy is increased, and adverse effects are reduced by these systems. The following are some important applications for novel medication delivery systems:

1. Drug Delivery with Specificity:

Targeted drug delivery is one of the primary uses for novel drug delivery systems. Drugs can be delivered specifically to specific organs or tumors in the body by these systems. This makes it possible to treat a specific area, reduce exposure to the system, and minimize side effects.

2. Controlled Extraction:

Controlled drug release over an extended period of time is made possible by novel drug delivery systems. The drug's effectiveness is enhanced because this ensures a consistent and optimal concentration at the target site. Additionally, controlled release has the potential to decrease the number of times a drug is administered and increase patient compliance.

3. Medical Personalized Care:

Drug delivery systems can be made to fit the needs and conditions of each individual patient. This paves the way for personalized medicine, in which medications are administered in a manner that minimizes side effects and maximizes their therapeutic effects.

4. Care for Chronic Diseases:

For the treatment of chronic diseases, numerous novel drug delivery systems have been developed. Long-acting formulations that deliver the drug over a longer period of time are possible with these systems, reducing the need for frequent dosing. This simplifies the treatment plan for chronic conditions and increases patient compliance.

5. Medications in Combination:

Multiple drugs can be delivered simultaneously or sequentially through novel drug delivery systems. This makes it possible to use combination therapies, in which two or more drugs with different mechanisms of action that complement one another are given together to improve treatment results. Complex diseases and drug-resistant infections respond particularly well to combination therapies.

6. Cellular and Gene Therapies:

Gene and cell therapies rely heavily on drug delivery systems. Targeted and effective treatment is made possible by these systems, which can deliver therapeutic cells or genetic material to specific organs. They have the ability to enhance the uptake of genetic material or cells by the target cells and prevent their degradation.

7. Vaccines:

The creation and administration of vaccines can also make use of novel drug delivery systems. These systems have the potential to enhance antigen presentation, sustain the release of vaccine components, and enhance vaccine stability and efficacy, all of which can enhance immune responses and provide protection against infectious diseases.

8. Delivery through the skin:

For the systemic delivery of drugs, transdermal drug delivery systems like patches are frequently utilized. They can deliver the medication in a controlled manner through the skin, avoiding the digestive system and first-pass metabolism. Drugs with low oral bioavailability benefit most from transdermal delivery.

CONCLUSION

The development of nanotechnology would undoubtedly have significant effects on the drug supply industry, affecting virtually every route, from oral to injectable, and nanoparticles are a promising controlled and selective drug delivery method. Physicians and patients are expected to benefit from reduced drug toxicity, increased bioavailability, and an extended economic life for patented medicines. This will make drug therapies work better and reduce side effects before and after treatment and diagnosis. Nanoparticles are likewise a promising stage for the blend of sub-atomic differentiation specialists. Significantly capable of transforming biologically active material that is poorly soluble, poorly absorbed, and labile into promising nanoparticulate systems that can be administered to drugs. Due to their small size and relative mobility, nanoparticles are accessible to a wide range of biological objectives and typically have a comparatively higher intracellular absorption rate than microparticles.

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