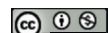




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Applications Perspectives of Emulsomes Drug Delivery System

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ABSTRACT

Oral administration is the most basic, cost-effective, and significant method of pharmaceutical administration. As a consequence, scientists have struggled to improve dose formulations, especially for extended-release applications. Low bioavailability, protection from the harsh stomach environment, and protection from degrading gastric enzymes are all challenges that vesicular drug delivery techniques were devised to solve. Emulsomes are a novel lipoidal vesicular system with an internal solid fat core coated by a phospholipid bilayer that avoids many of the flaws of prior systems. This method is designed to be used as a carrier for poorly soluble medications. Emulsomes enclose the drug, allowing it to remain in the systemic circulation for longer. Also becoming more frequently available are emulsomal-based formulations of genetic medications with evident systemic use, such as antisense oligonucleotides and plasmids for gene therapy. This study analyses the idea of emulsomal drug delivery, describes the effectiveness of emulsomes for the delivery of small molecules, and focuses on formulation design, benefits, biopharmaceutical features, stability issues, and other elements of drug delivery, as well as future considerations.

Key Words: Emulsomes, Vesicular Drug Delivery System, Preparation, Applications, Controlled Oral Drug Delivery, Bioavailability

INTRODUCTION

The active medicine is encapsulated within a vesicular structure in the vesicular drug delivery system (VDDS). Vesicles utilised in drug delivery systems include liposomes, niosomes, archeosomes, transferosomes, sphinosomes, pharmacosomes, ufasomes, and emulsomes. As a consequence, the drug's systemic circulation is boosted, and toxicity is decreased. The adoption of novel vesicular technologies has changed the paradigms of diagnosis and treatment in several fields of biomedicine. Gene delivery, brain tumor targeting, oral formulations, and pharmaceutical stability and permeability concerns are all common uses for these systems. The following are the objectives of VDDS:

1. If selective absorption is possible due to drug administration directly to the site of infection, the medication's life in the systemic circulation is prolonged, and therefore its toxicity is reduced.
2. Improves bioavailability, especially for poorly soluble medications.

3. Drugs that are both hydrophilic and lipophilic might be employed.
4. Acts as a prolonged release mechanism by delaying the clearance of medicines that are rapidly metabolized [1].

EMULSOMES

Emulsomes are a unique kind of lipoidal vesicular system with a solid fat core within and a phospholipid bilayer on the exterior (Figure 1). Emulsomes are more stable than liposomes, which are more unstable. By using emulsomes, you may avoid the aggregation, hydrolysis sensitivity, and oxidation problems that come with traditional liposomes or other vesicular delivery techniques. Emulsomes are a hybrid of liposomes and emulsions. This technique is being tested as a carrier for difficult-to-dissolve medications. Emulsomes encapsulate the active component inside a vesicular structure. As a consequence, the medication's time in the systemic circulation is extended, and toxicity is reduced. The existing medicine distribution mechanism [2] is incompatible with these needs.

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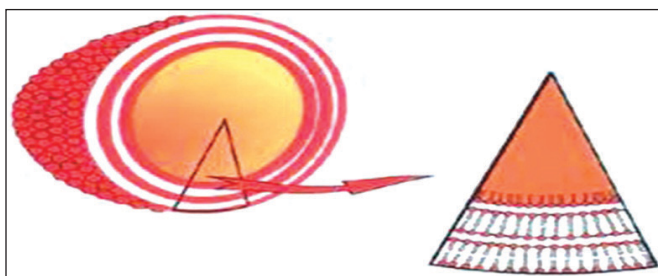


Figure 1: Structure of an Emulsome.

Cholesterol and soy lecithin aid in the stability of emulsomal formulations. Water-soluble drugs may be encased in the outer phospholipid layers' aqueous compartments, whereas hydrophobic pharmaceuticals can be put in the cores. Emulsomes make lipophilic drugs more soluble and bioavailable, allowing for more consistent and regulated release. After intravenous delivery, the colloidal structure of emulsomes allows for passive absorption from the blood by liver and spleen macrophages. Emulsomal drug delivery is a liquid-based medicine delivery technology. Parenteral drug administration, which is totally water-soluble, may be used for a wide range of therapeutic purposes. Lipophilic drugs need a large number of surfactants and co-solvents due to their poor water solubility, which might be harmful. Emulsomes are a kind of oil that is utilized in water emulsions but is not the same as ordinary oil. The high phospholipid concentration of the phospholipid monolayer that covers the lipid core present at the interface helps to stabilize the emulsions. Emulsomes are appropriate for intravenous administration since their particle size distribution ranges from 10-250 nanometers. The emulsomal formulation's drug release profile is 12-15 percent after 24 hours, which is a good pace. Emulsomes may be useful drug delivery methods due to their biocompatibility, stability, high entrapment efficiency, and long-term release [3].

ADVANTAGES

- Alternative to conventional lipoidal formulations that is less expensive.
- Increased drug concentrations in damaged tissues.
- Ensure that the medicine is protected from the gastrointestinal environment.
- Increase the solubility and bioavailability of medicines that are weakly water soluble.
- A cytotoxicity profile that is both safe and effective.
- Defend against the emergence of multi-drug resistance.
- Modify the drug's pharmacokinetics.
- Improve pharmacological efficacy while lowering toxicity.

- Drug effectiveness is extended due to a slow drug release profile.
- Surface changes, such as for cellular targeting, may be conceivable.
- Drugs that are poorly water-soluble have a high load capacity.
- Exceptional stability.
- Low manufacturing costs and large-scale production simplicity [4].

DISADVANTAGES

- Drug loading capacity is limited.
- During parenteral administration, it causes adverse effects.
- Surfactants are used sparingly in parenteral administration due to their detergent effects.
- The formulation's stability is harmed by high oil content [5].

EMULSOMAL FORMULATIONS

Lipid core

At normal temperature (25°C), the internal hydrophobic core or lipid core of emulsomes is made up of lipid, which has a solid or lipid crystal phase, or a mixed solid and liquid crystal phase. Lipids and lipid-like excipients may be found in abundance on the market. All of these compounds are referred to as lipids in the pharmaceutical sector. It is possible to use a single lipid or a mixture of lipids. They are fatty acids and their derivatives, as well as compounds that are biosynthetically and functionally connected to these substances. Lipids are insoluble in water and are distinguished by their fatty acid concentration, melting point, and hydrophilic-lipophilic balance (HLB). Instant release and bioavailability enhancement excipients have a high HLB and a semi-solid form, while sustained-release lipids have a low HLB and a high melting point. Because o/w emulsions have a limited storage life, solid triglycerides at 25°C have been proven to be an appropriate core material. Emulsomes, which are made up of unbranched fatty acids with chain lengths ranging from C-10 to C-18, are formed using triglycerides.

Antioxidant

The lipid core of the emulsome particles in this invention may include one or more antioxidants. The antioxidants of choice are alpha-tocopherol or its derivatives, which are members of

the vitamin E family. An additional antioxidant is butylated hydroxytoluene (BHT). Unsaturated lipids are prevented from forming oxidative breakdown products such as peroxides by antioxidants. The demand for antioxidants may be satisfied by generating the lipid core from saturated fatty acids [6].

Negatively charged particles

To raise the composition's zeta potential and so stabilise the particles, negatively charged lipid particles, such as oleic acid, and negatively charged phospholipids, such as phosphatidic acid, phosphatidylinositol, and phosphatidylserine, may be added to emulsomes. When these negatively charged lipid molecules are incorporated into emulsomes, they form phospholipid bilayers with opposing charges. The phospholipid bilayers surround the lipid core as a consequence, increasing the loading aqueous compartment. The layers of aqueous space between the bilayers produce the electrical repulsion between them. By lowering particle aggregation, negative charge reduces coalescence, flocculation, and fusion.

Surfactants

To choose a surfactant, the Hydrophilic Lipophilic Balance (HLB) value should be employed. HLB levels between 4 and 8 were found to be compatible with vesicle generation since HLB is a strong indicator of a surfactant's potential to create vesicles. The transition temperature of surfactants has an impact on drug entrapment in vesicles. The spans with the highest phase transition temperature have the most entrapment for the drug, and vice versa. Drug leakage from the vesicles is limited due to the high phase transition temperature and low permeability. The production of larger vesicles with a wider surface area exposed to the dissolving fluid is enabled by high HLB values of Span 40 and 60, which result in a reduction in surface free energy.

Phosphatidylcholine

Phosphatidylcholine is the primary component of lecithin. Phosphatidylcholine has low water solubility. Phospholipids in an aqueous solution may form bilayer sheets, micelles, or lamellar structures depending on their hydration and temperature. Amphipathic surfactants are produced as a result of this process. They are an important component of biological membranes and may be made readily from a variety of sources, including egg yolk and soy beans. Depending on the source, they are termed egg lecithin or soya lecithin. Due to an increase in hydrophobicity, the addition of lecithin boosted drug entrapment to 96.1 percent, resulting in smaller vesicles.

Cholesterol

In emulsomes, cholesterol is essential for the production of vesicles. Cholesterol has an influence on vesicle stability. The

amount of cholesterol in the blood influences drug trapping in vesicles. Increasing cholesterol content, according to certain research, enhances entrapment efficiency. When cholesterol levels were very high, drug trapping in the vesicles was shown to be decreased. This might be because cholesterol beyond a certain level affects the usual bilayer structure, allowing medicine to escape [7]. The components used to make emulsomes are listed in Table 1.

Table 1: Materials for emulsomes preparation.

Materials	Uses
Antioxidants	Protect the lipids from oxidation or rancidity
Charged particles	Zeta potential of the composition, stabilizing the particles and reduce the particles aggregation
Cholesterol	Incorporation of cholesterol influence vesicles stability, excessive cholesterol leads to instability of the formulation
Soya lecithin	Bilayer sheets, micelles, or lamellar structures and also increases the entrapment efficiency
Stearyl amine	Impart positive charge for target delivery and raised the zeta potential of the formulation
Surfactants	Provide the highest entrapment for the drug
Triglycerides	Used as hydrophobic lipid core, Lipids with low HLB value provides sustain released formulation

METHODS OF PREPARATION

Lipid film formation (Handshaking method)

Surfactants/lipids are dispersed in an aqueous environment after being cast as layers of film from their organic solution in a flask rotary evaporator at low pressure (or by manual shaking). The lipids expand and peel off the wall of the round bottom flask at a temperature slightly above the phase transition temperature of the surfactants used for a set amount of time (time of hydration) with continuous mild shaking. Manual handshaking or exposing the film to steam of water-saturated nitrogen for 15 minutes followed by swelling in an aqueous solution without shaking provides the mechanical energy required for lipid swelling and dispersion in a cast lipid film. Handshaking produces multi lamellar vesicles (MLVs), while non-shaking produces massive unilamellar vesicles (LUVs) [8].

Reverse phase evaporation

The reverse-phase evaporation (REV) technique is a two-step procedure. Make a phospholipid water-in-oil emulsion using

a buffer and an additional organic phase. Remove the organic phase at low pressure. The two phases (phospholipids and water) are generally emulsified mechanically or acoustically. When the organic solvent is removed under vacuum, the phospholipid-coated water droplets link together to form a gel-like matrix. When the organic solvent is withdrawn further under reduced pressure, the gel-like matrix turns into a smooth paste. In this paste, LUV is dissolved. Drug entrapment efficiencies of 60-65 percent are possible using this approach. Both tiny and big molecules were encapsulated using this approach. The medication is exposed to organic solvents and mechanical agitation, which is the principal downside of this approach. Phospholipids are dissolved in organic solvents such as chloroform, isopropylether, or freon during this procedure. It may be necessary to combine two organic solvents to get a density that is closer to that of the aqueous phase in order to support proper emulsification conditions. Biologically active molecules such as enzymes, protein therapeutics, and RNA-type molecules may undergo conformational changes, protein denaturation, or DNA strand breakage as a result of significant organic solvent exposure and mechanical agitation.

High-pressure extrusion technique

According to several studies, MLV is repeatedly passed through extremely tiny pore polycarbonate membranes (0.8 to 1.0 μm) under high pressure, and the average diameter of the vesicles decreases to 60-80 nm after 5-10 passes. When the average size of vesicles is reduced, they tend to become unilamellar. Other studies have seen similar results when MLV is passed through a Microfluidizer. A microfluidizer is a device that forces material through a tiny hole with high pressure. Layers of bilayers seem to be peeled off the vesicular structure when MLV is forced through the tiny hole, similar to how onion skin layers are peeled. The layer separation procedure was also recommended to only apply to vesicles made with positively charged phospholipids and vesicles bigger than 70 μm .

Sonication method

Solid lipids, cholesterol, and phosphatidylcholine were dissolved in chloroform with 3 or 4 drops of methanol in a round-bottom flask in varied molar ratios. In this solution, a specific quantity of drug was dissolved. The organic solvent was evaporated until fully dry using a rotary evaporator at reduced pressure to form a thin lipid layer on the walls of the round bottom flask. The dry film was hydrated with phosphate-buffered saline pH 7.4 (10 mL) and homogenised by ultrasonication for 15 minutes at 40% frequency to form nano-sized emulsomes.

Cast film method

Emulsomes may be created by mixing phospholipids and

triglycerides in a 0.5:1.0 weight ratio, with the triglycerides having a solid-liquid phase transition temperature greater than 25°C. Reduce the suspension of the combination by suspending it in an aqueous solution at a temperature below the solid-liquid transition point to generate emulsomes. These emulsomes are typically made up of a nanoemulsion of liquid particles with a mean particle diameter of 10 to 250 nm, a frequency of 50 to 150 nm, and a mean particle diameter of 20 to 180 nm. Instead of using a particle number, the size range should be calculated using a weight %. The lipid component has traditionally been made using volatile and chemically unreactive volatile organic solvents such as dichloromethane or diethylether. The solvent is commonly evaporated at reduced pressure in a spinning evaporator or under a stream of inert gas. The lipid film is hydrated and dispersed by covering it with an aqueous solution and shaking it. If the medicine component was not present in the organic solution, it might be added to the aqueous hydration solution. Following that, the lipid suspension or dispersion is sized, which is commonly done using a high shear homogenizer at pressures of up to 800 bar.

Ethanol injection method

A technique for making small unilamellar vesicles has been disclosed (SUVs). Using a small needle, an ethanol surfactant solution is swiftly injected into excess saline or other aqueous environments. Vesicles develop when ethanol is evaporated. A tight distribution of small liposomes (sub 100 nm) may be created by infusing an ethanolic lipid solution into water in one step, without extrusion or sonication. The ethanol injection technique is an effective approach to create emulsomes that form spontaneously and have a small average radius. Alternatively, the lipid or lipid mixture is dissolved in an alcoholic solvent, and an aliquot of 200, 500, or 600 μL is fast injected with a 1 mL syringe into the dispersant solution, which contains water or saline solution, of 9.8 mL diluted to 1:50, 9.5 mL diluted to 1:20, or 9.8 mL diluted to 1:17, respectively. The solution was then vigorously stirred by hand for 20 to 30 seconds. The ethanol solution is then swiftly pumped into a 5 percent glucose solution. The vesicles were 60 nm in diameter on average and were predicted to last at least one week [9].

Detergent removal technique

Micellar mixtures are made by combining phospholipids and a detergent. The micelles grow increasingly phospholipid-rich once the detergent is removed, eventually generating single bilayer vesicles. Dialysis, column chromatography, or adsorption onto bio beads may all be used to remove the detergent from the formulation. Biological membranes that had been dissolved by detergents were originally reassembled using the dialysis procedure. This method may also be used to make emulsomes. Detergents with high critical micelle

concentrations are widely used for this purpose (CMC). This job is suitable for detergents with a high CMC (in the range of 10- 20 mM), such as sodium cholate, sodium deoxycholate, and octylglycoside, among others. A flow-through dialysis cell was used to remove detergent from the phospholipid detergent mixture. According to the researchers, this approach generated a homogeneous population of single-layered emulsomes with mean diameters of 50-100 nm (Figure 2).

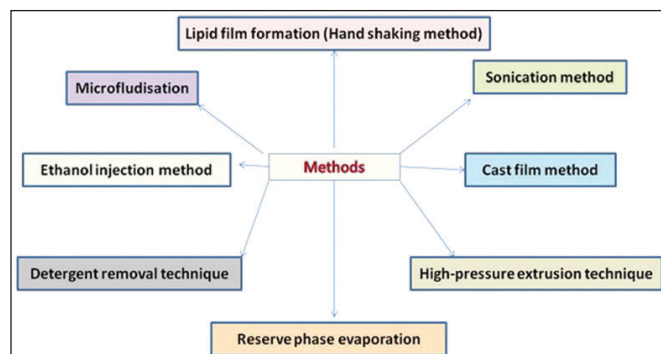


Figure 2: Methods for formulating emulsomes.

BIOPHARMACEUTICAL ASPECTS

Emulsomes help to improve the solubility of luminal medications, which is presently ineffective. When lipids are present in the gastrointestinal tract, they stimulate the secretion of bile salts and endogenous biliary lipids like phospholipid and cholesterol, resulting in the formation of bile salts/phospholipid/cholesterol intestinal mixed micelles and an increase in the GI tract's solubilization capacity. When exogenous lipids are introduced into these bile salt structures, either directly or indirectly via digestion, the micellar structures expand, enhancing their solubilization capacity even more. Lipids may increase bioavailability either directly or indirectly by lowering first-pass metabolism as a consequence of stimulating intestinal lymphatic transit. Emulsomes may increase bioavailability by modifying the biochemical barrier function of the GI tract. As revealed by the p-glycoprotein efflux pump, fats and triglycerides in emulsomal preparations may reduce the quantity of enterocyte-based metabolism by lowering the activity of intestinal efflux transporters. Emulsomes may interfere with the GI tract's physical barrier function. A number of lipid and triglyceride combinations have been proven to improve permeability. Passive intestinal permeability is not thought to influence the majority of weakly water-soluble and lipophilic medications.

STABILITY ASPECTS OF EMULSOMES

Emulsomes combine the advantages of liposomes and emulsions by allowing water-soluble medications or antigens to be encapsulated in the aqueous compartments

of surrounding phospholipid layers. Pharmaceutically stable emulsomes may be made in the absence of ionic or non-ionic non-natural synthetic surfactants or co-surfactants such polyoxamers, deoxycholate, polysorbates, and so on. The utilization of solid lipid compositions as the core and a high lecithin concentration help to keep them stable. Emulsomes have a particle size distribution in the range of 10-250 nm based on differential weight percents, making them suitable for parenteral administration by injecting them with water, whereas oral vesicular formulations are generally unstable due to leakage and possible destruction in gastric fluids. When you add water to emulsomes, they become a dry, free-flowing powder. Traditional liposomes or other vesicular delivery systems have concerns with aggregation, hydrolysis susceptibility, and oxidation. These problems may be prevented by using emulsomes. Emulsomes, which start off as a dry powder and subsequently become hydrated, are superior for developing sustained release formulations for oral administration. The measurement of zeta-potential in electrostatically stabilized vesicles is an essential criterion for assessing the storage stability of these vesicles and is a vital aspect in understanding the applicability of dispersion and aggregation processes. Particle size and zeta potential decrease as a consequence of the high input energy during sonication, resulting in stable and dense emulsomes.

APPLICATIONS IN DRUG DELIVERY

Emulsomes' solid lipid core and phospholipid (PL) multilayer around the core enable encapsulation of lipophilic medicines whose medical use may be restricted due to their lack of solubility (Table 2) [10].

Anti-fungal therapy

Amphotericin B (AmB) is a polyene macrolide antifungal antibiotic with a limited oral bioavailability. AmB antifungal medication has been linked to fever, chills, nausea, vomiting, headache, and renal failure, as well as anemia, hypokalemia, and hypomagnesemia. Lipid-based AmB formulations beat classic AmB formulations in terms of renal damage.

Anti-inflammatory action

Lornoxicam is a new analgesic non-steroidal anti-inflammatory medication (NSAID). It's a member of the oxicam family. It has a plasma half-life of around 3 hours. Lornoxicam is a musculoskeletal and joint pain reliever that is given via the skin using soya lecithin-based emulsomal nanoparticles. It is used to treat rheumatoid arthritis, osteoarthritis, and ankylosing spondylitis.

Anti-neoplastic therapy

Anti-neoplastic therapy might have substantial side effects. Emulsomes may alter a medication's metabolism, prolonging

Table 2: Emulsomes as carrier systems.

Drug	Characteristics
Methotrexate	Methotrexate distribution using emulsomes has shown to be promising. In addition, before oral delivery, formulations should be shielded from the stomach's gastrointestinal environment. Lipid-based emulsomes have the potential to increase methotrexate bioavailability significantly
Amphotericin B	The antileishmanial activity of amphotericin B emulsomes is higher. The research also shows that using Amphotericin B in the OPM-grafted emulsome form improves its effectiveness against visceral leishmaniasis. Intracellular macrophage targeting using emulsome-based devices has shown to be quite effective. The formulations have the potential to substantially alter the pharmacokinetics of AmB, allowing for longer activity at lower drug dosages and therefore lowering toxicity issues such as nephrotoxicity and cardiac arrhythmia
Zidovudine	Cationic Emulsomes were created, and they showed a lot of promise for targeting intracellular hepatocytes. The formulations have the potential to substantially alter Zidovudine's pharmacokinetics, allowing for longer activity at lower medication dosages

its circulation and half-life and lowering side effects. The two most frequent drugs that may be used to generate emulsomes are methotrexate (MTX) and curcumin. Human osteosarcoma, lymphoma, choriocarcinoma, and leukaemia are treated with MTX, an anti-folate drug. Psoriasis, rheumatoid arthritis, systemic sclerosis, placenta accreta, and ectopic pregnancy are all treated with MTX, which is an anti-metabolite chemotherapeutic medication. To transport MTX via the lymphatic system, emulsome formulations containing Compritol® 888 ATO as the lipid core and soya lecithin as the stabilizing shell are utilized. In vitro drug release research demonstrated that emulsomes release MTX slowly at pH 7.4 (simulated intestinal fluid), while MTX bursts at pH 1.2 (simulated gastric fluid), showing that the PL bilayers and Compritol® 888 ATO did not offer formulation stability in the gastrointestinal system. In vivo, emulsome formulations boost MTX bioavailability by up to 5.7 times.

Curcumin (diferuloylmethane) is a hydrophobic polyphenol derived from the rhizome of *Curcuma longa*, a Zingiberaceae plant (turmeric). It fights tumors of the gastrointestinal tract, genitourinary system, breast, ovarian, lung, and neurological systems, as well as leukaemia and lymphoma, head and neck squamous cell carcinoma, melanoma, and sarcoma.

The key parameters impacting its efficacy are its short biological half-life, poor water solubility, and restricted bioavailability after oral administration. Curcumin-emulsomes (CurcuEmulsomes) are nano formulations that boost curcumin solubility and make it simpler to distribute it to cells and tissues. After encapsulation, curcumin becomes 10,000 times more soluble, resulting in a concentration of 0.11 mg/ml. Curcumin was administered efficiently into human liver cancer HepG2 cells in vitro utilizing CurcuEmulsomes, and the drug's release was prolonged at the target site.

Anti-viral therapy

Azidothymidine (AZT), often known as Zidovudine, was the first drug to be proved to be successful in reducing HIV replication. Solid lipid nanoparticles stabilised using dipalmitoyl phosphatidylcholine (DPPC) or a combination of DPPC and dimyristoylphosphatidylglycerol, or a mixture of DPPC and dimyristoylphosphatidylglycerol, or a mixture of DPPC and dimyristoylphosphatidylglycerol, or a mixture of DPPC and dimyristoyl (DMPG). DPPC gave the emulsomes a neutral surface charge, whereas DMPG gave them a net negative charge. Zidovudine palmitate (AZT-P), a Zidovudine ester prodrug, may be synthesized and incorporated into emulsomes. AZT-P is an amphiphilic chemical that integrates better than the solid core inside the Nano formulation's PL bilayers. Negatively charged PL bilayers, such as DMPG, increase AZT-P incorporation when compared to neutrally charged emulsomes. It may also be possible to produce emulsomal formulations that administer AZT in a sustained and targeted way for the treatment of intracellular liver infections. Positively charged emulsomes based on trilaurin and tristearin should protect the body against lysosomal degradation and ensure that the drug is properly absorbed. Cationic emulsomes have the potential to maintain medicine concentrations in the liver high for an extended period of time (at least 6 hours). Higher bioavailability of lamivudine in the lymphatic system may be achieved using a lipid-based carrier system like emulsome. A lamivudine-loaded emulsome might be used to deliver anti-HIV drugs more efficiently. It may be more therapeutically successful for HIV therapy than the present medicine delivery approach.

Autoimmunity

Emulsomes may be used as adjuvants in mucosal vaccines. Anti-CD3 mAb in combination with emulsome (as adjuvant) decreases antibody production against type II collagen and reduces the severity of joint disease by reducing inflammatory cytokines in the joints. Anti-CD3 therapy, both nasal and oral, boosts the Th2 response, resulting in the activation of LAP+ (latency-associated peptide) regulatory T cells and arthritis suppression. For rheumatoid arthritis mucosal and non-invasive therapy, this approach has been proved to be safe and successful.

When a vaccine is made up of:

1. Antigens of proteins or peptides
2. If required, hydrophobic compounds may be added.
3. The antigenic integrity of the protein or peptide epitopes is preserved, and the vaccine's immunogenicity is boosted, by using an immune-potentiating membranous carrier such as an emulsome.

Biotechnology

Because of their immunological selectivity, low toxicity, and improved stability, emulsomes may be utilised to examine immune response. They might be used to learn more about the immune responses caused by antigens.

Dermal therapy

Dithranol, also known as anthralin, has been used to treat psoriasis sufferers (i.e. a non-contagious autoimmune skin disorder). Its use has increasingly diminished due to unpleasant side effects including as skin irritation, erythema, peeping, and discoloration. Encapsulating dithranol in the lipidic core of emulsomes, on the other hand, significantly increases permeability across the skin, improving drug retention in skin tissues. The formulation by design (FbD) approach may be used to create a variety of compritol-based emulsomes. As a consequence, the greatest entrapment efficacy was found in emulsion formulations comprising 63-75 percent compritol and 25-37 percent PL. An increase in the number of PLs lowered the permeation flow through the skin due to the creation of multilamellar barriers. In a mouse-tail model antipsoriatic study, emulsomes outperformed commercial products in terms of pharmacodynamics, with no erythema or wrinkles on the mice's skin. This shows that emulsomes might improve dithranol's medicinal efficacy while reducing its potential side effects.

Drug targeting

One of the most useful qualities of emulsomes is their ability to focus drugs. It's most often used to target drugs to the reticuloendothelial system. Emulsomes may deliver drugs to organs other than the reticuloendothelial system. A carrier system (antibodies) may be coupled to vesicles to route them to certain organs.

Hepatoprotective activity

Silybin (SIL) is a natural medication used to treat hepatitis, cirrhosis, and protect the liver from toxic compounds found in milk thistle plants. It also prevents hepatic lipid peroxidation and ischemia. Its therapeutic application is limited by its low aqueous solubility (0.43 mg/ml in water), low oral bioavailability, and poor intestinal absorption. SIL is a kind of emulsome. This additive improves the bioavailability of SIL. It was bound in the internal solid lipid core, which

had a sustained-release profile in vitro and in vivo, unlike a control SIL solution. Emulsomes are recommended for SIL administration in the treatment of liver disease. SIL emulsomes are expected to be physically stable, reducing the likelihood of coalescence, because of the huge absolute magnitude of the zeta potential.

Ophthalmic delivery

Sparfloxacin is classed as a biopharmaceutical of class II (BCS CLASS II). It's not highly soluble in aqueous media. The effect of such drugs is limited by their rate of dissolution. It's a third-generation fluoroquinolone derivative. Conjunctivitis and bacterial keratitis, both external infections of the eye, are the most common conditions for which sparfloxacin are prescribed. In vitro, it has antibacterial activity against gram-negative and gram-positive bacteria. It's available as an ophthalmic solution with a 0.3 percent (w/v) concentration. It's taken in 1 to 2 drop dosages every 4 hours, or hourly if the disease is severe. Sparfloxacin emulsomes might be supplied in an in-situ gelling vehicle. It will allow for regulated medicine release at the ocular surface. The physical barrier of the lipid bilayer, together with the slow diffusion of the emulsomes in the hydrogel, will ensure sparfloxacin's steady, protracted release and improved trans-corneal penetration. By combining it into a novel Emulsomal in situ gelling technology, which increases patient compliance, it may solve the problems of existing sparfloxacin ophthalmic formulations, such as short residence time, drug drainage, and frequent instillation. The antibacterial activity of Sparfloxacin Emulsomal in situ gel in vivo and in vitro was promising, showing its potential for effective ocular delivery. As a consequence, thermosensitive in situ emulsomal gel has been shown to be a viable replacement for standard eye drops.

Visceral leishmaniasis

Visceral leishmaniasis is the most dangerous kind of leishmaniasis (VL). This illness is caused by infection of the liver, spleen, and bone marrow macrophages. Antimonials (antimony compounds) are often prescribed as treatment, despite the fact that high dosages may affect the heart, liver, and kidneys. The use of emulsome in tests demonstrated that higher dosages of medicine may be given without creating side effects, allowing for improved therapeutic efficacy.

CONCLUSION

Emulsomes are a new kind of colloidal carrier on the market. Its internal core is lipid in the form of a solid or a liquid at 25°C. Emulsomes may be used to deliver fat- or water-soluble substances through parenteral, oral, ocular, rectal, vaginal, intranasal, or topical routes. It may aid with lipophilic pharmaceutical solubility, bioavailability,

and controlled release. Emulsomes might be used to make therapeutic compounds with limited water solubility and variable oral bioavailability. Emulsomes, which have been shown to boost oral bioavailability considerably, may aid in the oral administration of hydrophobic medications. There has been a revival in the use of emulsomes in recent decades, which has attracted a lot of interest. Recent advancements have focused the invention of superior emulsomal solid or semisolid formulations as an alternative to the old liquid method. However, the synthesis of emulsomes is still mostly empirical, and no in vitro models that reliably predict oral bioavailability improvement exist at this time. In vitro strategies for predicting dynamic changes involving the drug in the gut are necessary to monitor the solubilization status of the treatment in vivo. It is also necessary to evaluate interactions between lipid systems and the pharmacologically active medication. It's also crucial to comprehend the characteristics of various lipid formulations in order to generate suggestions that enable for the early identification of suitable candidate formulations. Human bioavailability investigations, as well as more fundamental enquiries into the mechanisms of action of this intriguing and varied variety of formulations, should be part of future study.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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AUTHORS' CONTRIBUTION

All authors have equally contributed to this manuscript. All authors did the literature survey from standard databases, collected all essential elements, and wrote this manuscript collectively.

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