REVIEW ON EMULSOMES

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ABSTRACT:

Novel drug delivery systems aim to optimize drug action by sustaining its release at a predetermined rate or maintaining a relatively constant effective drug level in the body while reducing undesirable side effects. Vesicular drug delivery systems, such as liposomes, niosomes, transferosomes, pharmacosomes, emulsomes, electrosomes, and ethosomes, offer promising solutions for controlled and targeted drug release. Pharmacosomes are amphiphilic phospholipid complexes of drugs that bind covalently to lipid molecules. They allow for site-directed drug delivery, minimizing toxicity and adverse effects. Additionally, they enhance the bioavailability of poorly soluble drugs, thereby reducing therapy costs. Emulsomes, on the other hand, are lipoidal vesicular systems composed of a solid fat core surrounded by a phospholipid bilayer. They are formulated with cholesterol and soya lecithin, and their small size is achieved through sonication during drug loading. This review focuses on the concept of emulsomes and pharmacosomes as vesicular drug delivery systems and highlights their successful application for delivering small molecules. It covers various aspects including formulation design, biopharmaceutical considerations, stability, and future prospects. The advantages, disadvantages, and methods of preparation of emulsomes are discussed, along with their applications in fighting viral and fungal infections, dermal therapies, cancer treatment, and autoimmunity. Emulsomes have demonstrated controlled and sustained drug release for up to 24 hours, surpassing the release capabilities of liposomes (up to 6 hours). Moreover, emulsomes protect drugs from harsh gastric environments and enzymatic degradation, resulting in improved drug bioavailability. Furthermore, emulsomal-based formulations show promise in delivering genetic drugs, antisense oligonucleotides, and plasmids for gene therapy, highlighting their potential for systemic utility in various therapeutic areas.

Key words- liposomes, niosomes, transferosomes, pharmacosomes, emulsomes, electrosomes

INTRODUCTION:

Emulsomes are novel lipid vesicle systems with an internal solid fatty core surrounded by a phospholipid bilayer. The structure of an emulsome is shown. Emulsome formulations are composed of a solid lipid core material, stabilized by cholesterol and soy lecithin. After the drug is applied, it is treated with ultrasound to create small emulsomes. The polymer used for the core material must be solid at room temperature (25°C). The high soybean lecithin concentration stabilized the emulsomes in the form of an O/W emulsion. These fat cored lipid particles are dispersed in an aqueous phase.[1] Emulsomes have characteristics of both emulsomes and emulsion thus provide advantage over emulsomes of having more drug loading of lipophilic drugs, as the drug is encapsulated both in phospholipid bilayer as well as lipidcore.6 Emulsomes also provides sustained release of entrapped drug as compared to Liposome and the sustained release may be achieved upto 24 hr.7 There are many factors affecting formulation of emulsomes such as lipid material used along with properties of drug to be incorporated. Some studies have demonstrated that ingredients like choice of phospholipids, triglycerides, charge inducers, drug candidate and their concentrations significantly affected the isphysicochemical properties of emulsomes. Various characteristic properties of emulsomes such as particle size, drug release and entrapment efficiency is controlled by varying the relative amount of lipid and other ingredients in the formulation. In formulation development process study is required to understand detailed relationship between process parameters and quality attributes. In recent years many statistical methodswere applied to investigate the effect of process variables on the quality attributes of formulation. Almost more than 50% sustained-release vesicular drug delivery systems have been optimized through various experimental designs. [2] Compared with other vesicular drug delivery systems such as niosomes, pharmacosomes, and ethosomes, emulsomes have a nanoscale scale. Due to its small size, it can be used to increase drug bioavailability and as an ideal carrier for intravenous and oral drug administration. Oral administration is the best way to reduce the number of side effects. Emulsomes are novel oral drug delivery systems containing lipophilic drugs. Emulsomes are lipid vesicles containing a solid fatty core surrounded by a phospholipid bilayer. These are liposomes with an additional single internal phospholipid layer containing solid fat. The drug release pattern by emulsomes is sustained and slow release, and furthermore, they are soluble in the aqueous phase and can easily circulate in the blood. Emulsome nanocarrier technology is a lipid-based drug delivery system intended to serve as a vehicle for poorly water-soluble drugs. Emulso particles are composed of microscopic lipid aggregates with an internal fatty core that dissolves water-insoluble drugs without the use of surfactants or solvents. [3]

Advantages of emulsomes:

1. Because the drug is encased in a triglyceride lipid core, emulsomes protect the drug from the harsh gastric environment before oral administration. This hypothesis may be supported by the gastric pH and the fact that gastric enzymes are unable to hydrolyze triglycerides.

2. Emulsomes increase the solubility and bioavailability of poorly water-soluble drugs. These are composed of triglycerides that form micelles or are organized as lipid bilayers flanked by hydrophobic tails and with hydrophilic head groups facing water on both sides. These unique properties make phospholipids ideal as excipients for poorly water-soluble drugs.

3. Emulsomes are composed of a lipid core. Lipids are used to develop oral controlled delivery of drugs. There are limitations to the widespread adoption of lipid-based strategies to improve drug exposure.

4. Emulsomes are an economical alternative to current commercially available lipid formulations to reduce the frequency of drug administration.

5. Emulsome-based systems showed excellent targeting potential. The formulations could significantly modify providing prolonged action at comparatively low drug doses thereby reduction in the toxicity problem due to complimentary localization of the drug in target cells.They provide significantly modify the pharmacokinetics of drugs.

6.Also, they resist development of multi drug resistance, often associated with over expression of a cell membrane glycoprotein, which cause efflux of the drug from the cytoplasm and results in an ineffective drug concentration inside the cellular compartment.

7. Emulsomes protect drug from harsh gastric environment of stomach before oral administration because the drug is surroundedby the triglyceride lipid core. This hypothesis could be supported by the fact that gastric pH and gastric enzymes are unable to hydrolyze triglycerides.

8. Emulsomes improve the solubility and bioavailability of poorly water-soluble drugs. These are composed of triglycerides that form micelles or are organized as lipid bilayers flanked by hydrophobic tails and with hydrophilic head groups facing water on both sides. These unique properties make phospholipids ideal as excipients for poorly water-soluble drugs.

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10. Emulsomes are an economical alternative to current commercially available lipid formulations as they minimize the frequency of drug administration. The emulsome-based system showed excellent targeting

potential. This formulation can significantly alter the sustained effects at relatively low drug doses and alleviate the problem of toxicity due to complementary localization of the drug in target cells.

11. They significantly change the pharmacokinetics of drugs. In addition, it is often accompanied by overexpression of cell membrane glycoproteins, causing drug efflux from the cytoplasm and preventing the development of multidrug resistance leading to unusable drug concentrations within the cellular compartment.

Disadvantages of emulsomes:

1. Manufacturing Complexity: The manufacturing process of emulsomes can be complex and time-consuming, requiring specialized equipment and expertise. This can increase production costs and limit scalability.

2. Stability Challenges: Emulsomes can be sensitive to temperature, light, and oxidation, which may result in changes in their physical and chemical properties. This instability can affect the efficacy and shelf life of the product.

3. Size Variation: Emulsomes may exhibit size variation within a single formulation, leading to inconsistency in drug delivery and potentially affecting the therapeutic outcome.

4. Potential Drug Interactions: In certain cases, emulsifiers or other ingredients used in emulsome formulations may interact with the drug molecules, altering their stability, efficacy, or safety profile.

5. Lack of Long-term Safety Data: As emulsomal drug delivery systems are relatively new, long-term safety data for some formulations may be limited. Continuous monitoring and evaluation of potential adverse effects are necessary.

6. Regulatory Considerations: The regulatory approval process for emulsomes may pose challenges compared to conventional dosage forms due to their unique formulation and delivery characteristics, requiring additional studies and documentation.

Components of emulsomes:

Lipid core:

The internal lipid core or lipid hydrophobic core is an important component of emulsomes. At ambient temperature (25 °C), this core exhibits a solid, lipid, mixed solid/liquid phase, or a lipid crystalline phase. Lipids and lipid-like excipients are widely available commercially. In the pharmaceutical industry, these are all called lipids. A single lipid or a combination of lipids can be used. These are chemicals that are biologically and functionally related to fatty acids and their derivatives. 23 - 25 Because lipids are often soluble in oil but insoluble in water, the melting point, fatty acid content, and hydrophilic–lipophilic balance of lipids are important to determine the hydrophilic–lipophilic balance (HLB). Commonly used. Lipids with high melting points and low HLBs are suitable for sustained release. The excipient is semi-solid and has a high HLB value, but acts as an excipient for immediate release and improved bioavailability. Triglycerides such as tristearin, tripalmitin, tricaprin, and trilaurin are considered good core materials because they coagulate at 25°C, reducing the period over which O/W emulsions can be stored in a suitable manner. Te triglycerides are utilized to pre-pare an emulsome with unbranched fatty acid chains that range in length from c-10 to c-18 . Addition-ally, lipid core makes it simple to alter their surface characteristics, enabling the attachment of ligands or targeting molecules for precise tissue or cell targeting and boosting their therapeutic potential.[8] An essential component of emulsomes is an internal hydrophobic core or lipid core comprises lipid, which exhibits solid or lipid crystal phase or mixed solid and liquid crystal phase at room temperature (25°C). There are abundant lipids or lipid like excipients available commercially. All of which are collectively called lipids in the pharmaceutical field. 22 The lipid used may be single or mixture of lipids. These are fatty acids and their derivatives, or substances biosynthetically and functionally related to these compounds. 23-25 Lipids are generally water-insoluble and are often identified by fatty acid composition, melting point, and hydrophilic-lipophilic balance (HLB). Low HLB and high melting point lipids are suitable for sustained release. On the other hand, semisolid excipients or excipients with high HLB serve as excipients for immediate release and improve bioavailability.26-29 Triglycerides that are solid at 25 °C has been shown to be a suitable core material. Provides an acceptable shelf life for O/W emulsions. Triglycerides are used to generate emulsomes consisting of unbranched fatty acids with chain lengths from c-10 to c-18. 30 [1]

Surfactant:

One of the phospholipid molecules in the layer that envelops the lipid core. Te surface tension is reduced by the stabilizing or surface-active role of the phospho-lipid layer. It is thought that a monolayer of surface-active phospholipids forms around the lipid core of the particles, with a polar head group at the interface. Using extra phospholipids, lipid cores can be encased by one or more roughly concentric bilayers, with the number of bilayers that surround the core varying. Tis bilayer envelope contains one or more watery components that could include a medication that is water soluble. A water-soluble medication may be present in this bilayer envelope's one or more aqueous components. Te ability of the particle to carry a high load of medications that are both lipid and water soluble is explained by the usage of several concentric bilayer models in emulsome structure. Drug entrapment in vesicles is infuenced by the transi-tion temperature of surfactants as well. Te drug is most efectively trapped in starts with the lowest temperature at the phase transition, and vice versa [8]. Selection of surfactant should be done on the basis of Hydrophilic Lipophilic Balance (HLB) value. As HLB is a good indicator of the vesicle forming ability of any surfactant, HLB number in between 4 and 8 was found to be compatible with vesicle formation. Transition temperature of surfactants also affects the entrapment of drug in vesicles. Spans with highest phase transition temperature provide the highest entrapment for the drug and vice versa The drug leaching from the vesicles is reduced due to high phase transition temperature and low permeability. High HLB value of Span 40 and 60 results in reduction in surface free energy, which allows forming vesicles of larger size and hence large area exposedtothedissolutionmedium.[1]

Negatively charged particle:

One of the phospholipid molecules in the layer covering the lipid core. The surface tension is reduced by the stabilizing or surface activating role of the phospholipid layer. A monolayer of surface-active phospholipids with polar head groups at the interface is thought to form around the lipid core of the particles. Additional phospholipids can be used to cover the lipid core with one or more nearly concentric bilayers, and the number of bilayers surrounding the core varies. This bilayer shell contains one or more aqueous components that may contain water-soluble drugs. Water-soluble drugs may be included in one or more aqueous components of the bilayer shell. The ability of the particles to transport highly loaded drugs, both lipophilic and water-soluble, is explained by the use of a multiple concentric bilayer model in the emulsome structure. Drug entrapment in vesicles is also influenced by the surfactant's transition temperature. Active ingredients are most effectively captured in the phase with the lowest temperature during phase transition, and vice versa [8]. Surfactant selection should be based on HLB (hydrophilic-lipophilic balance) values. Since the HLB value is a good indicator of the vesicle-forming ability of each

surfactant, we found that HLB values of 4 to 8 were consistent with vesicle formation. The transition temperature of the surfactant also influences drug entrapment into vesicles. The region with the highest phase transition temperature has the highest drug entrapment, and vice versa. The high phase transition temperature and low permeability reduce drug leaching from the vesicles. Higher HLB values for spans 40 and 60 reduce the surface free energy, allowing the formation of larger vesicles and increasing the area exposed to the dissolution medium [1].

Phosphatidylcholine:

Lecithin contains a large amount of phosphatidylcholine. Water does not easily dissolve phosphatidylcholine. Depending on the temperature and degree of hydration, the phospholipids in this solution form lamellar, micellar, or bilayer layers. This produces surfactants that are typically classified as amphiphilic. They are readily available from many readily available sources, such as egg yolk and soybean, and are important components of biological membranes. Depending on the manufacturer, it is called soy lecithin or egg lecithin. Incorporation of lecithin increased the drug entrapment rate to 96.1% and decreased the vesicle size due to increased hydrophobicity [8]. Phosphatidylcholine is an important component of lecithin. Phosphatidylcholine has low water solubility. In aqueous solution, the phospholipids can form bilayers, micelles, or lamellar structures depending on hydration and temperature. This results in a type of surfactant that is usually classified as amphipathic. They are a major component of biological membranes and can be easily obtained from a variety of readily available sources such as egg yolk or soya beans. Depending upon the source from which they are obtained they are named as egg lecithin and soya lecithin. Incorporation of lecithin further enhanced the percent drug entrapment to 96.1% and leads to vesicles of smaller size due to increase in hydrophobicity, which results in reduction of vesicle kisize.[1]

Cholesterol: Emulsomes function as vesicles and require cholesterol as their main component. Vesicle stability is greatly influenced by cholesterol insertion. It has also been reported to increase the buffering effect in liquids of all components of the combined formulation. Cholesterol was added to all formulations as a stabilizer since it can change the basic packing structure and cause the formation of liquid crystalline phases. Additionally, it has the ability to stabilize the outer phospholipid layer, which increases the effectiveness of drug entrapment and reduces the exit age of drugs. Cholesterol also plays an important role in increasing the entrapment efficiency of emulsomes. Certain studies have shown that higher cholesterol concentrations increase the effectiveness of removal. Very high cholesterol content was found to have a negative effect on drug entrapment within the vesicles. This is thought to be because when cholesterol levels exceed a certain level, the normal bilayer structure begins to break down, resulting in a loss of drug entrapment [8]. Cholesterol is an essential component of emulsomes as vesicles. Incorporation of

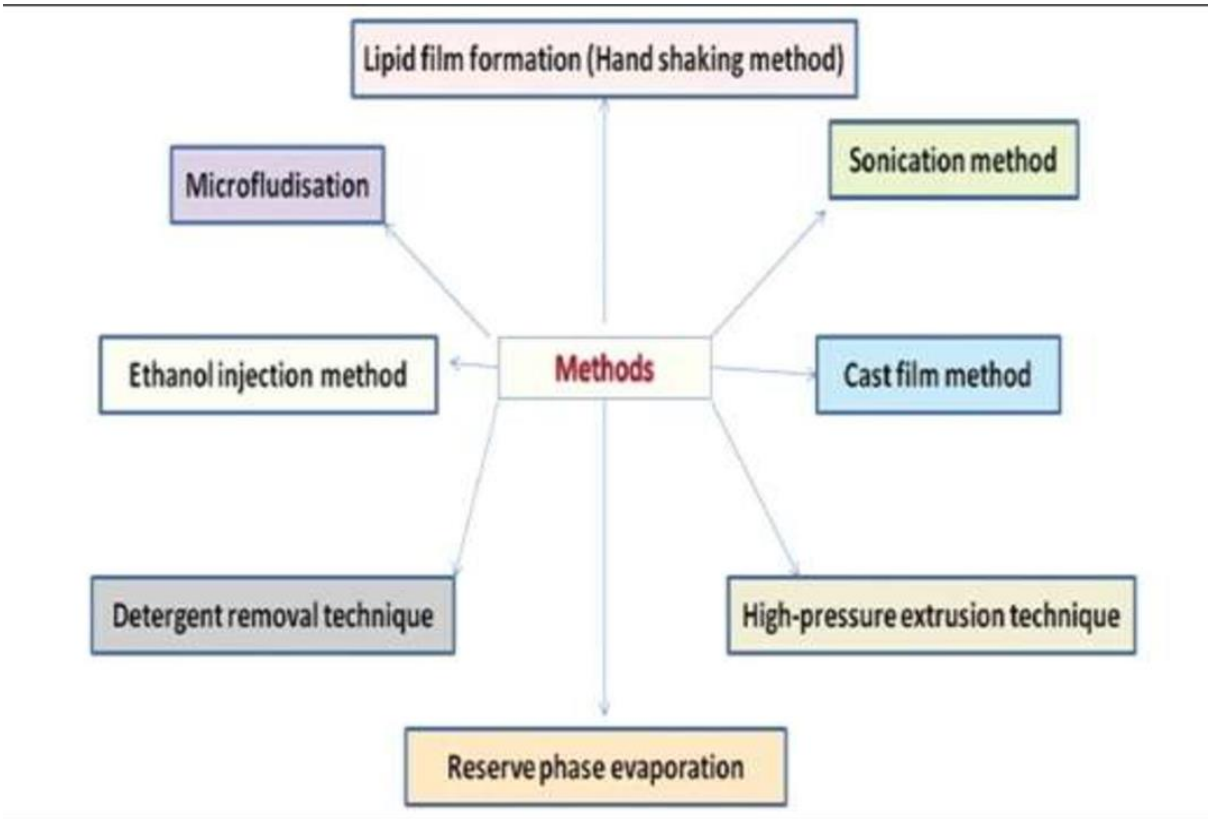
cholesterol influences vesicles stability.40-41 Concentration of cholesterol plays an important role in entrapment of drug in vesicles. 42-43 Thereare reports that entrapment efficiency increase with increasing cholesterol content. It was observed that with very high cholesterol content had a lowering effect on drug entrapment to the vesicles. 44 This could be due to the fact that cholesterol beyond a certain level starts disturbing the regular bilayer structure leading to loss of drug entrapment. 45 Various materials used for emulsomal preparation along with their uses are given in [1]

Antioxidant:

The lipid core of emulsome particles of this invention optionally may contain one or more antioxidant. The preferred antioxidant is a-tocopherol or its derivative, which are members of vitamin E family. Other antioxidants include butylated hydroxytouline (BHT). Antioxidants lessen the formation of oxidative degradation products of unsaturated lipids such as peroxides. The need of antioxidant may be protected by preparing the lipid core form saturatedfattyacid.[1]

Methods of preparation-

Fig 1-Method Of Preparation



● Emulsomes are combination of solid lipid core, choles-terol, and phosphatidylcholine in a ratio of 1:0.5:1, thus leading to a formulation aspect of a highly optimized and stable preparation. Emulsomes could be efciently prepared from a wide range of nanoparticle formula-tion techniques. Achieving particle sizes in the range of 10–1000 nm and maintaining formulation stability are fundamental goals in emulsome preparation. The transition temperature used during the preparation ranges from (25 to 45) °C. Organic solvents such as n-hexane, dichloromethane, toluene, diethyl ether, etc., along with the basic formulation, are dissolved in its components under vacuum conditions, mainly for the incorporation of lipid membranes. Therefore, along with other excipients in the formulation, it also plays an important role in the successful encapsulation of poorly water-soluble drugs in drug delivery systems [8]

● In preliminary studies trial batches were prepared to check the feasibility of method of preparation. Three factors i.e. Phospholipid to Bifonazole ratio, Phospholipid to Tristearin ratio; Phospholipid to Stearylamine ratio were studied considering Lecithin to Cholesterol ratio (1:0.5), sonication time (12 min)16,17fixed to study their effect onParticle size, Zeta potential and Entrapment efficiency.Bifonazole loaded emulsomes were prepared by lipid film hydration method.18,19 Accurately weighed amount of lecithin, cholesterol, tristearin, stearylamine were transferred into 500 ml round bottom flask and mixture was dissolved in 10 ml of chloroform. In another vessel accurately weighed bifonazole was dissolved in small quantity of methanol. After complete dissolution of ingredients both the solutions were mixed in round bottom flask. Volatile liquid has been evaporated using rotatory flash evaporator to obtain thin dry film on the inner wall of round bottom flask. The dried films were then hydrated overnight in phosphate buffered saline (PBS), pH 7.4. After hydration, a milky white dispersion was obtained, which was sonicated for 12 min to obtain vesicles in the desired size range. The dispersion was filtered through a Sephadex G-50 column to remove unformed vesicles and unentrapped drug [3].

1. Lipid film formation (handshake method) -

This process uses a rotary evaporator under reduced pressure to cast a layer of surfactant and lipid film from an organic solution. The cast film is then dispersed in an aqueous medium. When a surfactant is used for a given period of time (hydration time) at a temperature just above its phase transition temperature, the lipids swell and detach from the walls of the round-bottomed container. Hand shaking or 15 min of exposure to a steam of water saturated nitrogen before allowing the flms to swell in an aqueous solution without shaking both supply the mechanical energy required for the swelling of lipids and the dispersion of cast lipid flms. It is also inferred while in hand shaking method that the suspension like appearance occurs and further after hydration large uni-lamellar vesicles (LUV) are formed that could further be made to go under probe sonicationand centrifugation as per the formulation design and requirements. Te non shaking method

resulted in large unilamellar vesicles, whereas the hand shakingmethod led to multi lamellar vesicles (MLV) [8]

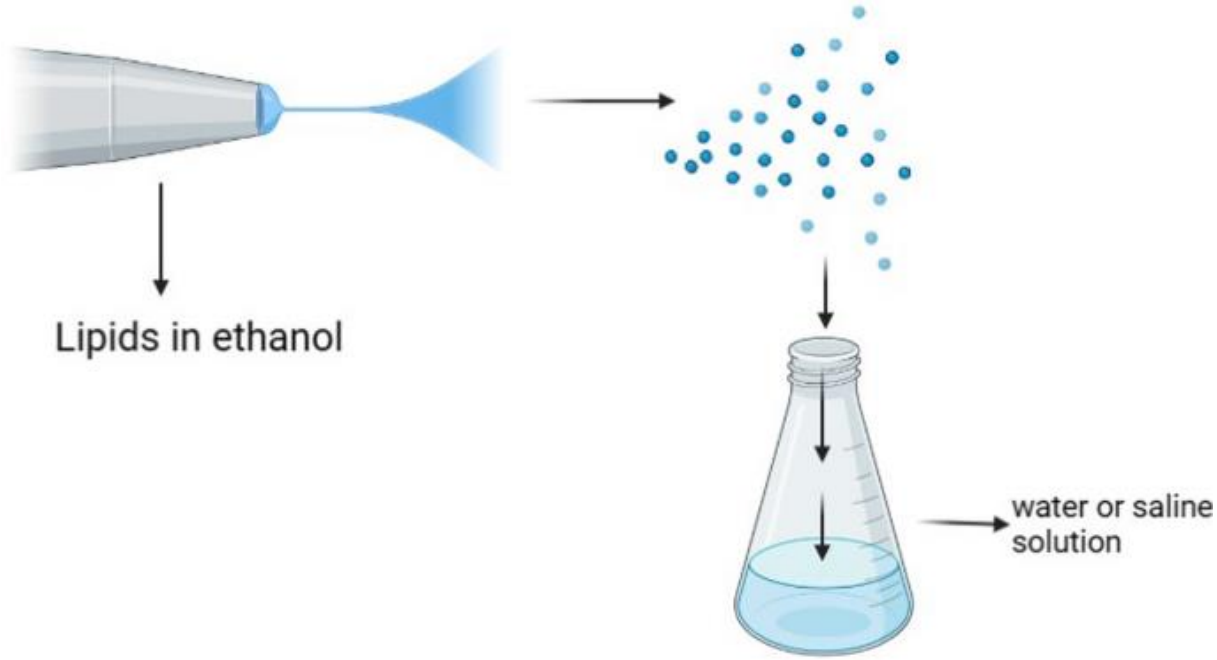
2.Reverse phase evaporation:

This technique, so-called `reverse-phase evaporation' or REV method is comprised of two steps. Prepare a water-in-oil emulsion of phospholipids and buffer in excess organic phase. Remove organic phase under reduced pressure. The two phases (phospholipids and water) are usually emulsified by mechanical methods or ultrasound. Upon removal of the organic solvent in vacuum, the phospholipid-covered water droplets coalesce to form a gel-like matrix. Further, by removing the organic solvent under reduced pressure, the gel-like matrix forms a paste with a smooth consistency. This paste is a suspension of LUV. 48 With this method, drug entrapment efficiencies of up to 60–65% can be achieved. This method can be used to encapsulate both small and large molecules. 49 The main drawback of this method is exposure.

3.Ethanol injection method:

This is an alternative method for producing small unilamellar vesicles (SUVs). The ethanolic surfactant solution is quickly injected into excess saline or other aqueous medium through a fine needle. Evaporate the ethanol to form vesicles. Narrow distribution of small liposomes (less than 100 nm) can be achieved simply by injecting an ethanolic lipid solution into water. H. Can be processed in one step without the need for extrusion or ultrasonic treatment. This method is a suitable technique to achieve the spontaneous formation of emulsomes with a small average radius. Alternatively, the lipid or lipid mixture is dissolved in alcoholic solvent and an aliquot of 200, 500, or 600 ml fast injected at room temperature, 1 ml syringe into the dispersant solution, which contains water or saline solution, of 9.8 ml further 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 hand-shaken for 20-30 seconds. After that the ethanol solution is fast-injected in a 5% glucose solution. The vesicles had shown average diameter of about 60 nm and may be stable for at least one week[4]

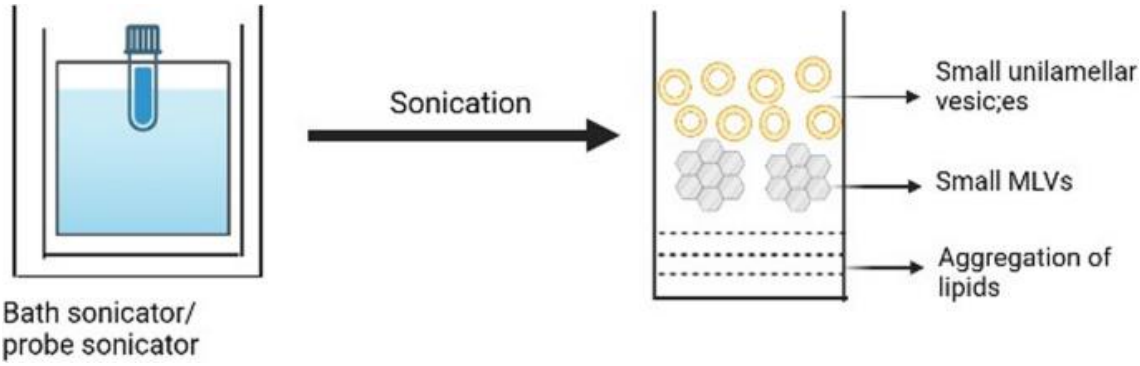
Fig 2-Ethenol Injection Method[2]



4. Sonication method

Solid lipids, cholesterol, and phosphatidylcholine in different molar ratios were taken in a round-bottom flask and dissolved in a minimum quantity of chloroform containing 3 or 4 drops of methanol. An accurately weighed amount of drug was dissolved in this solution. The organic solvent was evaporated to complete dryness under reduced pressure using a rotary evaporator, forming a thin lipid film on the walls of the round bottom flask. 54-56 The dried films were hydrated with phosphate buffered saline pH 7.4 (10 mL) and homogenized by ultrasound at 40% frequency for 15 min to obtain nanosized emulsomes [1]. This technique is similar to the lipid FLM hydration technique with some minor modifications. Solid lipids such as cholesterol and phosphatidylcholine were added in various molar ratios to round-bottom vessels and dissolved in a minimal amount of chloroform containing 3–4 drops of methanol. An accurately weighed amount of drug was dissolved in this solution. The organic solvent is rotary evaporated under reduced pressure until completely dry, forming a thin lipid layer on the walls of the round-bottom container. Typically, the solvent is evaporated under reduced pressure. When wrapped in an aqueous solution and shaken, the lipid layer hydrates and disperses. If the organic solution lacks drug components, the aqueous hydration solution can be supplemented with drug components. The lipid solution or dispersion is then ground using a high-shear homogenizer, often operating at pressures up to 800 bar [8].

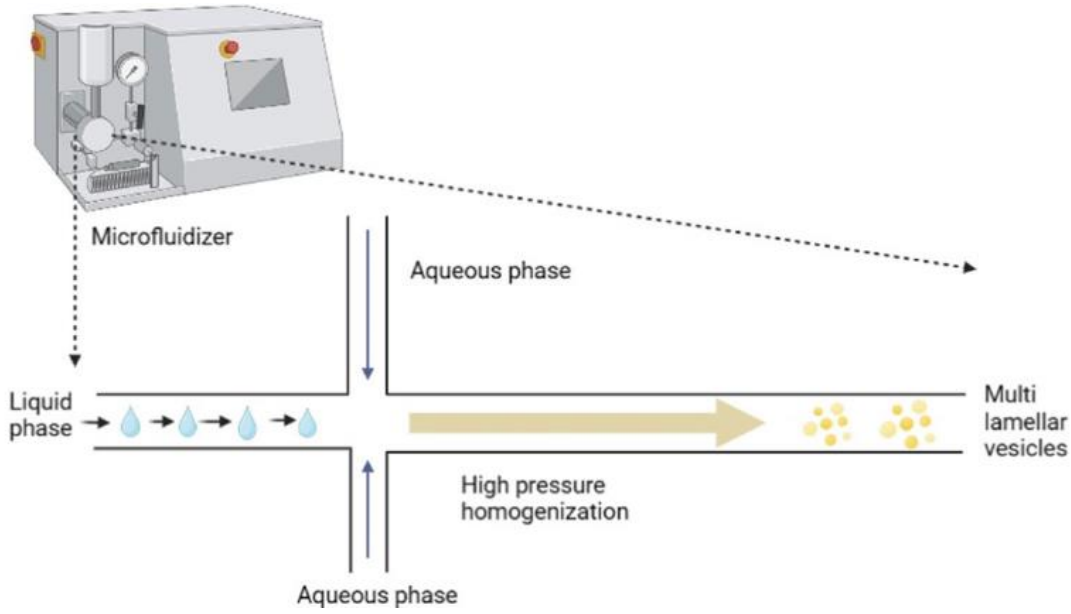
Fig 3- ultrasound method [2]



5.High pressure extrusion technique:

Studies have shown that when MLVs are repeatedly passed under high pressure through very small pore polycarbonate membranes (0.8-1.0 μm), the average diameter of the vesicles decreases over time, reaching a minimum of 60 μm after 5-10 passes. Many scientists reach ~80nm. Vesicles tend to become monolayered as their average size decreases. Other researchers who used his MLV in conjunction with microfluidization devices reported similar results. Microfidizers are intensive use devices. The layer separation mechanism applies only to vesicles composed of positively charged phospholipids and vesicles larger than 70 μm. [8] Narrow opening. When the MLV is forced through a small opening, the bilayer layer appears to be removed from the vesicular structure, as if the layers of an onion skin are separated during exfoliation. It has also been suggested that the layer separation mechanism is only applicable to vesicles composed of positively charged phospholipids and to vesicles larger than 70 μm. Several researchers have shown that MLVs repeatedly pass through very small pore polycarbonate membranes (0.8–1.0 μm). Under high pressure, the average diameter of the vesicles gradually decreases, reaching a minimum value of 60–80 nm after 5–10 passes. As the average size decreases, vesicles tend to become monolayered. Similar results were found by other researchers when MLVs were passed through a microfluidizer. A microfluidizer is a device that extrudes feed material under high pressure

Fig 4- High-pressure extrusion technology [2]



6. Surfactant removal technology:

To remove surfactants, phospholipids are dissolved in an aqueous solution containing surfactants at a constant critical micelle concentration (CMC). When the surfactant is removed, the reaction medium releases individual phospholipid molecules, which then spontaneously assemble to form a bilayer structure. The most commonly used detergent removal methods include dialysis bags, polystyrene-based absorption beads, and Sephadex columns using gel permeation chromatography. Upon dilution with a suitable aqueous medium, the resulting micelles reorganize and grow into emulsomes. Removal of detergent residues is a critical step in the manufacturing process to ensure emulsome stability, biocompatibility, and suitability for drug delivery applications. Various approaches have been used to remove detergents. ultracentrifugation, which causes the heavier emulsomes to sediment and the detergent to remain in the supernatant. The remaining traces of detergent are subsequently removed by gathering and washing the detergent-free emulsomes. Alternatively, emulsomes may be placed in a semipermeable membrane bag during dialysis, which retains the emulsomes while allowing the detergent to seep into the surrounding buffer. To guarantee effective detergent elimination, this procedure must be carefully executed.[8]

Future Prespective:

1 .Emulsomes present a promising strategy for formulating drug compounds with limited solubility in water and variable oral bioavailability. These lipid-based carriers have demonstrated significant improvements in oral bioavailability, making them an attractive option for drug delivery. Over the past few decades, there has been a resurgence in the use of emulsomes, garnering increased attention. Current trends focus on developing modified solid or semisolid emulsomal formulations as an alternative to traditional liquid

systems. However, the development of emulsomes still heavily relies on empirical approaches, lacking in vitro models that accurately predict oral bioavailability enhancement. To address this gap, there is a need for in vitro methods that can predict the dynamic changes occurring in the gut and monitor the drug`s solubilization state in vivo. Additionally, attention should be given to the interactions between lipid systems and the pharmacologically active substance. Understanding the properties of different lipid formulations is important for establishing guidelines for early identification of suitable candidate formulations. Future research should include human bioavailability studies to address the mechanism of action of this attractive and diverse group of formulations. [1]

2. In emulsomes, an inner core of lipids (such as TG) is stabilized by PL molecules in the form of an oil/water emulsion. The solidified internal fat core provides a better opportunity to load lipophilic drugs into these versatile DDSs at high concentrations. Furthermore, there is also the possibility of encapsulating water-soluble drugs in the aqueous compartment surrounding the PL layer. Emulsomes, which have the properties of both liposomes and emulsions, can be used to overcome drug-related problems such as low bioavailability, protection from harsh gastric environment, and enzyme hydrolysis, as TG protects the drug. Developed. Emulsome provides an efficient means of controlling drug release, thereby reducing toxicity and other associated side effects. Recently, this technology has been extensively investigated to improve both drug delivery efficiency and drug selectivity. Emulsomes have a wide range of therapeutic uses. B. in parenteral drug administration, gene therapy, and oral formulations. Furthermore, in the future, emulsomes made from antisense oligonucleotides or plasmids, for example, will often become available for gene therapy as gene therapy agents. Importantly for future healthcare, emulsomes can act as sustained-release systems and reduce the frequency of drug administration, making them a clear economical alternative to current commercially available lipid formulations. It will be a product. Additionally, these new DDSs serve as ideal carriers for intravenous and oral drug administration, essential for the effective treatment of life-threatening viral and fungal infections such as hepatitis, HIV, EBV, and leishmaniasis. There is a possibility. etc. Curcumin is a highly effective drug against various cancers and has recently been included in emulsomes. These so-called-CurcuEmulsomes were tested for in vitro release of -curcumin in a HepG2 model cell line. Most importantly, incorporation into emulsomes has been shown to reduce the water solubility of curcumin. Furthermore, the biological activity and fluorescence integrity of curcumin were preserved. Finally,-curcumin was gradually released into cells, resulting in prolonged HepG2 cytotoxicity and cell cycle arrest. Also, over the long term of , incorporated curcumin functioned as efficiently as free-curcumin dissolved in an organic solvent. [7]

Conclusions:-

Emulsomes present a promising solution for the controlled and sustained delivery of drugs with improved bioavailability, reduced toxicity and fewer side effects. Emulsomes are a type of vesicular drug delivery system that consist of a solid fat core surrounded by a phospholipid bilayer, stimulated by cholesterol and soya lecithin for small particle size. They offer better stability and longer release duration compared to other vesicular systems such as liposomes. One of the major advantages of emulsomes is that they can protect the drug from harsh gastric environments and enzymatic degradation during oral administration, which improves bioavailability. Emulsomes also offer a versatile formulation design, allowing for the loading of various therapeutic agents, including genetic drugs and plasmids for gene therapy. Despite the many benefits of emulsomes, there are also some disadvantages to consider, including the potential for instability during storage and the increased complexity of their formulation. However, these challenges can be overcome through proper formulation design. In conclusion, emulsomes represent a valuable addition to the arsenal of drug delivery systems due to their reliable controlled release, improved bioavailability, and targeted drug delivery capabilities. Ongoing research into emulsomal-based formulations has the potential to create more effective therapies for a wide range of diseases and conditions.

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