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Review Article

A Review on Novel Drug Delivery System

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ABSTRACT

Quest for Novel Drug Delivery System (NDDS) has started since long back, but it has got momentum since last few decades. NDDS has several advantages over the conventional dosage form which includes better therapeutic outcome. NDDS is also preferred in the new patent regimen as this is one of the ways to introduce new products in the regulated market. Several types of NDDS have been developed during last few decades which are- Microparticles, Nanoparticles, Osmotically Modulated Drug Delivery Systems, Transdermal Therapeutic Systems (TTS), Aquasome, Dendrimers, Multiple Emulsions, Microemulsions, Liposomes, Niosomes, Pharmacosomes, Self-Regulating Drug Delivery System, Brain Targeted Delivery System etc. A recent study reveals that in 2000 the global market of NDDS was 37.9 billion which shoots upto 75B by 2005, whereas another study estimated that the U.S. sales of advanced drug delivery systems were over $54.2 billion in 2004 which will reach $153.5 billion by 2011. India is also showing similar trend and some Pharma companies have shifted their research focus to develop NDDS. Intensive researches are going on in India both in public and private sector and a number of such products are available in the Indian market.

INTRODUCTION

A novel drug delivery system is a new approach that utilizes new technologies, innovative ideas, and methodologies to deliver the active molecules in safe yet effective concentration to produce desired pharmacological action. It is a formulation or device that deliver as drug to a specific site in the body at a specific rate. Novel substances are novel, or new, substances not previously identified by drug experts and include illicit drugs and counter felt prescription medications. A novel drug delivery system plays important role to enhancing therapeutic efficacy, reducing toxicity, increasing patient compliance and enabling entirely new medical treatments. The various routes of NDDS include oral, parenteral (injected), sublingual, topical, transdermal, nasal, ocular, rectal, and vaginal, however drug delivery is not limited to these routes and there may be several ways to deliver medications through other routes.

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There are several different carriers with benefits over made on the basis types in the novel drug delivery systems (NDDS). The traditional dosage forms display high dose and low availability, in-stability, first pass effect, fluctuation of plasma drug levels, and fast release of medicinal products. By-performance, protection, compliance with patients, and product shelf life. NDDS will mitigate the problems. Becoming aware of the potential effects on human health and environmental sustainability and due to the growled environmental performance of human-made nanoparticles, nanoparticles are of current interest. In several different applications, nanoparticles are used and generated by various processes. Interesting theoretical problems are their calculation and characterization. Nanoparticles are classified as nanoparticles with a diameter between 10 and 100 nm. Their pharmacodynamics and pharmacokinetic properties are modified as a targeted supply mechanism for the distribution of small and large molecules. They can be characterized as system containing dissolved active agent, encapsulated or adsorbed in the matrix material used to deliver the target tissue. The effect of medication on the target tissue has been shown to increase the retention stability by enzymes and intravascular solubilization of nanoparticles. During the design of nanoparticles, some controls need to be vigilant, including the release pattern, dimensions and surface characteristics, which decide the particular site action at optimum rates with a right dose scheme. The first nanoparticles documented were based on a polymeric non-biodegradable frame work (polyacrylamide, polymethyl-methacrylate, polystyrene). The polymeric nanoparticles may hold pharmaceuticals or proteins. These bioactive are trapped as particulates or solid solutions in the polymer matrix, or they may be physically or chemically stuck to the surface of the particle. The medicine(s) may be applied to the previously prepared nanoparticles in the preparation of nanoparticles. This term does not reflect the morphological or structural organization of the system and is are suggestively general. Nano medicine is an innovative field of medicine.

Definition: The drug is known as a dissolved, trapped, encapsulated, or nanoparticle- attached nanoparticle matrix as a particulate dislocation or a solid particulate with sizes between 10 and 1000NM. Nanoparticles are in solid form and are either amorphous or crystalline4-7 like nanospheres and nanocapsules of the size 10-200 nm. For the preparation of nanoparticles, polymeric materials were commonly used. Nanoparticles, nanospheres or nanocapsules may be obtained according to the preparation method. Nanocapsules are systems in which the medicinal product is confined to a cavity with a unique polymeric membrane, while the nanosphere is a matrix system that physically and consistently disperses the pharmaceutical product. DNA carriers in the field of gene therapy have been used as potential devices to supply proteins and other nanoparticles over recent years, particularly with hydrophilic polymers like poly ethylene glycol (PEGs), due to their ability to circulate for a prolonging duration as a specific organ, and their ability to supply proteins and other DNA in gene therapy.

DRUG DELIVERY

A drug delivery system (DDS) is defined as a formulation or a device that enables the introduction of a therapeutic substance in the body and improve sits efficacy and safety by controlling the rate, time, and place of release of drugs in the body. This process includes the administration of the therapeutic product, the release of the active ingredients by the product, and the subsequent transport of the active ingredients across the biological membranes to the site of action.

TYPES OF DRUG DELIVERY SYSTEMS

a) Conventional/Traditional Drug Delivery System:

Conventional or traditional drug delivery systems have been the mainstay in pharmaceutical practice for many years. These systems are characterized by their simplicity, ease of administration, and familiarity. While newer, more advanced drug delivery technologies have been developed, conventional systems continue to be widely used due to their practicality and established safety profiles. Here is an overview of key aspects of conventional drug delivery systems:

1. Oral Drug Delivery
2. Injectable Drug Delivery
3. Topical Drug Delivery
4. Inhalation Drug Delivery
5. Rectal And Vaginal Drug Delivery
6. Transdermal Drug Delivery
7. Sublingual And Buccal Drug Delivery
8. Controlled–Released Formulation

b) Novel Drug Delivery System: -

Novel drug delivery systems represent innovative approaches designed to optimize drug administration, enhance therapeutic efficacy, and minimize side effects. These systems leverage advanced technologies to overcome challenges associated with conventional drug delivery methods. Here is an overview of key aspects of novel drug delivery systems:

1. Nano capsules, Nano shells
2. Nano crystal, Dendrimers
3. Micro sponge, Nano sponge
4. Solid Lipid Nanoparticles
5. Micelle, Hydrogel
6. Transfersome, Phytosome, Cubposomes
7. Nano suspension And Nano Emulsion
8. Liposomes, Ethosomes and Niosomes

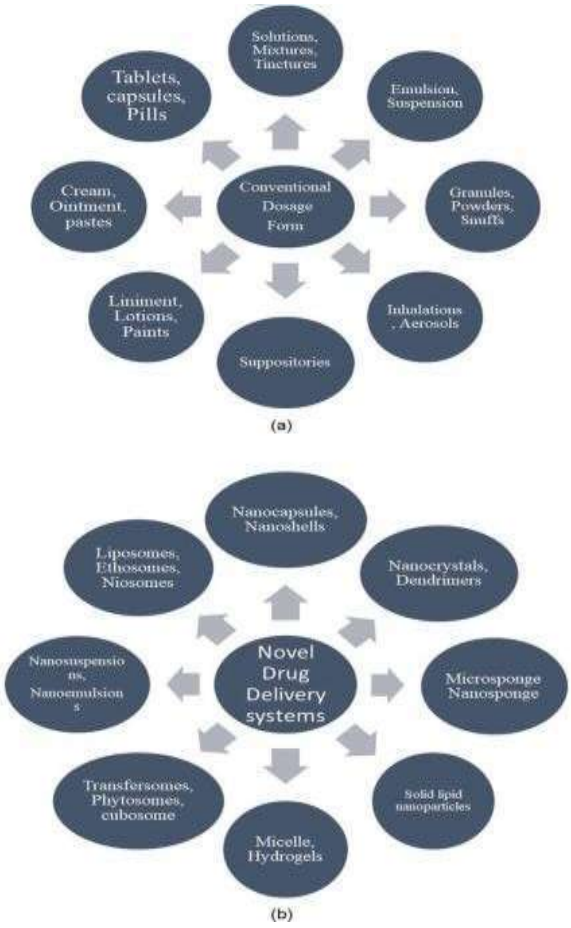

Figure 1. Types Of Drug Delivery Systems

DRUG DELIVERY CARRIERS

Vehicles for Drug Delivery: Micelle solutions, vesicle, liquid crystal dispersions, and nanoparticle dispersions comprising small particles between 10 and 400 nm in diameter are all examples of colloidal drug carrier systems that have shown significant promise as drug delivery methods. Incorporated drugs take part in the systems microstructure and may potentially affect it through molecular interactions, particularly if they have amphiphilic and mesogenic characteristics. The amphiphilic block copolymers adaptability in terms of chemical composition, total molecular weight, and block length ratios, which permit regulation of the size and shape of the micelles, makes them desirable for use in drug administration applications. Block copolymers that have cross-linkable groups added to them can have their micelles stabilized and their temporal

control enhanced. A very promising approach to a wider variety of locations of action with considerably higher selectivity is the substitution of block copolymer micelles with particular ligands.

NEED FOR NOVEL DRUG DELIVERY SYSTEM

95% of all experimental drugs have low pharmacokinetic and biopharmaceutical properties at present. Consequently, suitable medication distribution schemes must only be established at the site without harming healthy bodies and tissues, which will disperse the therapeutically activated drug molecules, lower the efficacy doses as well as improve therapeutic indices and safety profiles in new therapists. Various explanations are,

1) **pharmaceutical** – Confusion in traditional dosing– Solubility
2) **Biotechnology**- Poor uptake – High diaphragm borders- Instability of the organism
3) **Pharmaceuticals/ pharmacodynamics** - short half of a life span - Wide distribution volumes - Limited pace
4) **Clinical**- Poor Index of Therapy

ADVANTAGES

1. Make medication more user- friendly
2. Improved results
3. Reduced side effects
4. Avoidance of costly health care services
5. Tweaking the duration of action of drugs
6. Decrease in dosing frequency
7. We can decide where the drug would be released
8. Constant drug levels maintenance
9. Reducing the number of emergency visits
10. Direct delivery of drugs to Central Nerves System
11. Good penetration
12. Enhancement of solubility

DISADVANTAGES

1. Risks of local side effect
2. Designing and developing novel drug delivery systems can be complex
3. High research and development costs
4. Regulatory approval for novel drug delivery systems can be more challenging due to the need for comprehensive safety and efficacy assessments.
5. Some novel materials used in drug delivery systems may raise concerns about biocompatibility and long-term safety.
6. Some advanced drug delivery technologies may not be easily accessible in resource-limited or developing regions.
7. Certain novel drug delivery systems may involve the use of materials that pose environmental challenges, especially if they are not biodegradable.
8. Disposal of devices or carriers may contribute to environmental pollution.

NOVELDRUG DELIVERY SYSTEM

1. Phytosome
2. Liposome
3. Nanoparticles
4. Emulsions
5. Microsphere
6. Ethosome
7. Solid lipid nanoparticle
8. Niosomes
9. Proniosomes
10. Transdermal Drug Delivery System
11. Dendrimers
12. Transferosome

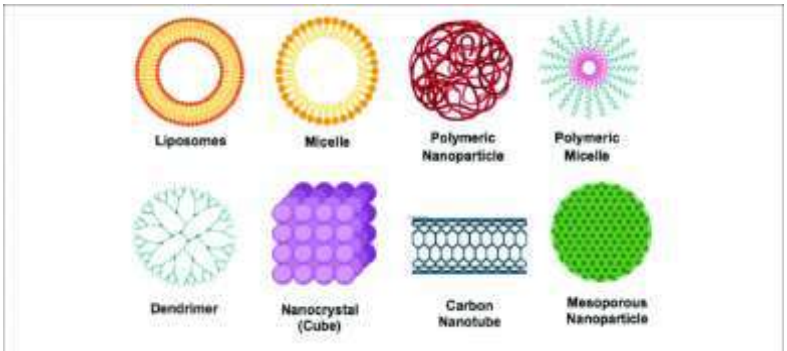

Figure.2. Types Of Noval Drug Delivery System

1. PHYTOSOME

Most of the bioactive constituents of Phyto medicines are flavonoids, which are poorly bioavailable when taken orally. Water-soluble phytoconstituent molecules (mainly polyphenols) can be converted into lipid-compatible molecular complexes, which are called Phytosome.

Phytosome are more bioavailable as compared to simple herbal extracts owing to their enhanced mental ability to skip through the lipid-rich bio membranes and finally arriving to the origin. The lipid-phase substances employed to make phytoconstituents lipid compatible are phospholipids from soy, mainly phosphatidylcholine.

Phytosome complexes were first investigated for cosmetic applications, but mounting evidence of potential for drug delivery has been amassed over the past few years, with beneficial activity in the realms of cardiovascular, anti-inflammatory, hepatoprotective, and anticancer applications. Phytosome complexes show better pharmacokinetics and therapeutic profile than their noncomplexed herbal extract. The Phytosome technology has markedly enhanced the bioavailability of selected phytochemicals.

The word "Phyto" indicates plant while others mean cell-like. "Phyto" means plant. Phytosome were the Method of vesicular supply of herbal extract photoelectric ingredients and Lipid bound (one molecular Phyto-constituent, bound to a phospholipid at least molecular). Phytosome guard against degradation of important herbal extract components Digestive secretion and intestinal bacteria which have increased absorption Provides improved pharmacological and pharmacokinetic biological and improved availability Parameters of herbal extract traditional.16 and the distinction between Phytosome and liposome. Figure 1. shows liposome & Phytosome.

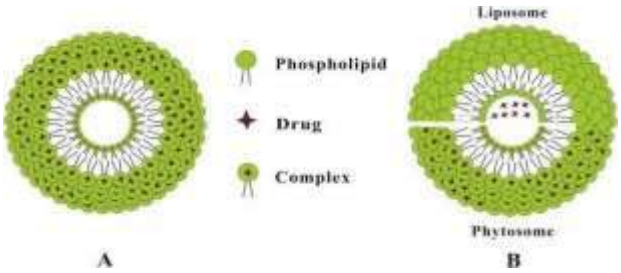

Figure. 3. liposome & Phytosome

Phytosome Benefits

1. Improved phospholipid complex bioavailability.
2. Enhanced GIT absorption.
3. Improved therapeutic results are attributed to increased bioavailability.
4. High bioavailability requires less dosage.
5. Greater stability, More stability.
6. High lipophilicity causes high penetration and is thus used over liposomes in cosmetics
7. Significant clinical advantages.
8. Phosphatidyl choline is not a carrier, but serves as a liver protection.

Method for preparation for Phytosome:

1. Phospholipids Dissolved inorganic solvent Containing Drug/ Extract.

2. Solution of phospholipids in organic Solvent with drug/extract Drying Formation of thin film Hydration Formation of phytosomal suspension.

2. LIPOSOMES

Liposomes are condensed bilayer vesicles with a completely contained aqueous volume A lipid membrane bilayer consisting mainly of natural or synthetic phospholipids. The Face The liposome name comes from two Greek words: "Lipos" which means fat, “Soma" The flesh. A liposome can be produced in arrange of sizes as single or multi-lamella the house, and its name concerns its building blocks, phospholipids, not Its dimension. A liposome has no lipophobic substance, for instance water, even if it does not Typically do. Usually does. Artificial vesicles consisting of bilayer lipid are liposomes. Drugs may be filled and used to administer cancer and other diseases medicines. Liposome Biological membranes such

as sonic disruption can be prepared. They are micro particulate or colloidal carriers, typically 0.05-5.0 μm in diameter, spontaneously forming in aqueous media as such lipids hydrate. Liposomes are made up a relatively bio-compatible, biodegradable and aqueous material A amount of natural and/or synthetic lipids entangled in one or more bilayers. A large variety of medications in liposomes, either in phosphor lipids bilayer, varying lipophilicity can be capsulated the captured number of aqueous substances or at the interface of the two-layers.

These are microparticulate or colloidal carriers, usually 0.05–5.0 μm in diameter which forms spontaneously when certain lipids are hydrated in aqueous media. The liposomes are spherical particles that encapsulate a fraction of the solvent, in which they freely pass around or float into their interior. They can carry one, several, or multiple concentric membranes. Liposomes are constructed of polar lipids, which are characterized by having a lipophilic and hydrophilic group of the same molecules. On interaction with water, polar lipids self-layup and form self-organized colloidal particles. Liposome-based drug delivery systems offer the potential to raise the therapeutic index of anticancer agents, by increasing the drug concentration in tumor cells or by lessening the exposure in normal tissues exploiting enhanced permeability and retention effect phenomenon or by utilizing targeting strategies. The primary advantages of using liposomes include.

i. the high biocompatibility,
ii. the easiness of preparation,
iii. the chemical versatility that allows the loading of hydrophilic, amphiphilic, and lipophilic compounds, and
iv. the simple modulation of their pharmacokinetic properties by varying the chemical composition of the player components.

Liposome classification based on structural features

1. MLV-Multi lamellar large vesicles
2. OLV-Oligo lamellar vesicles
3. UV-Unilamellar vesicles
4. SUV-Small Unilamellar Vesicles
5. MUV-Sized Unilamellar Vesicles
6. LUV-Large Unilamellar Vesicles
7. GUV-Giant Unilamellar Vesicles
8. MVV-Multi vesicular Vesicles

Liposome classification based on method of liposome preparation.

1. REV-Single or oligo lamellar vesicle made by revere phase evaporation method.
2. MLV/ REV-Multilamellar vesicles made by reverse phase evaporation method.
3. SPLV-Stable pluri lamellar vesicles.
4. FAT-MLV Frozen and thawed MLV
5. VET-Vesicles prepared by extrusion method.
6. FUV-Vesicles prepared by fusion
7. FPV-Vesicles prepared by French press
8. DRV-Dehydration-rehydration vesicles

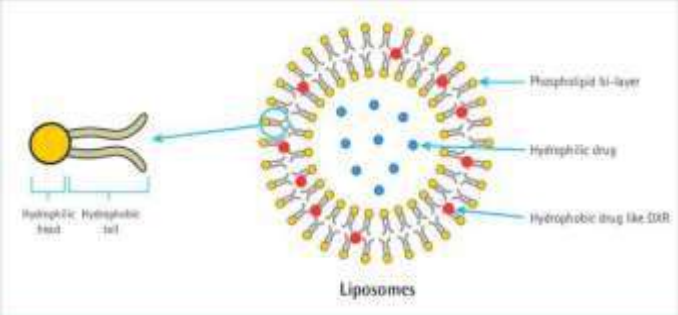

Figure 4. Liposomes

1. NANOPARTICLES

Nano particles are efficient delivery systems for the delivery of both hydrophilic cand hydrophobic drugs. Nanoparticles are the submicron-sized particles, ranging 10–1000 mm. The major goal behind designing nanoparticle as a delivery arrangement is to control particle size, surface properties, and release of pharmacologically active agents in order to achieve the site-specific action of the drug at the therapeutically optimal rate and dose regimen. In recent years,

biodegradable polymeric nanoparticles have attracted considerable attention as potential drug delivery devices. The nanospheres have a matrix type structure in which the active ingredient is dispersed throughout (the molecules), whereas the nanocapsules have a polymeric membrane and an active ingredient core. Nanonization possesses many advantages, such as increasing compound solubility, reducing medicinal doses, and improving the absorbency of herbal medicines compared with the respective crude drugs preparations.

Nano particles deliver the drug on site by preventing the reticule Endo the lial system, using improved permeability, retention effect and targeting. Dogs with nano particles as carriers apply two forms of approaches.

a. Surface bound: The drug molecules are connected to the nanoparticles surface

b. Core bound: The drug particles are concentrated in such a technique into the nano pharma matrix and transported into the body to the target. Drugs can be loaded onto nano particles by adding or adding to the reaction mixture during polymerization to a solution that includes previously prepared nano particles. Chemistry, superficial adsorption or any binding or contact may be the essence of the interaction of nano particles to drug products. The number Rely on the chemical structure of the drug and polymer and the conditions for drug loading, the binding drug and the form of interaction of drug and nanoparticles.

Figure 5. Based on Nanoparticles

4. EMULSIONS

Emulsion refers to an on homogeneous dispersion system that is composed of two kinds of liquids unable to dissolve each other, and one of which disperses in the other one in a form of droplets. Broadly speaking, the emulsion is composed of the oil phase, water phase, surfactant, and sub surfactant. Its appearance is translucent to transparent liquid. Emulsion can be split up into ordinary emulsion (0.1–100 μm), micro emulsion (10–100 NM), sub-micro-emulsion (100–600 NM), etc. Among them, the micro emulsion is also called Nano emulsions, and the sub-micro-emulsion is also called lipid emulsion. As a drug delivery system, emulsion gets distributed in vivo in the targeted are as due to its affinity towards lymphatic fluids. In addition, the drug can be a sustained release in a long time because the drug is packaged in the inner phase and kept off direct touch with the body and tissue fluid. Afterward, along the oily drugs or lipophilic drugs being made into O/W or O/W/O emulsion, the oil droplets are phagocytosed by the macro phage and get a high concentration in the liver, spleen, and kidney in which the quantity of the dissolved drug is truly heavy. While water-soluble drug is produced into W/O or W/O/W emulsion, it can be well contracted in the lymphatic system by intramuscular or subcutaneous injection. The size of the emulsion particle has an impact onitstarget distribution. Aside from its targeted sustained release, producing the herbal drug into emulsion will also beef up the stability of the hydrolyzed materials, improve the penetrability of drugs to the skin and mucous, and reduce the drug's stimulus to the tissues. So far, some kinds of herbal drugs, such as camp to the in, Brucea Jivanica oil, coixenolide oil, and zedoary oil, have been made in to emulsion. For example, Kun Zetal. examined the influence of the aluminum emulsion on the human lung adeno carcinoma cell line A549 and protein formulation. Results indicated that the aluminum emulsion has a

significant inhibition on the grow than proliferation of theA549 in vitro and it showed a time and dosed expenditure lationshi. Elemenum emulsion is a type of new anticancer drug with great application prospects. Furthermore, it has no marrow inhibition and no damage to the tenderness and liver.

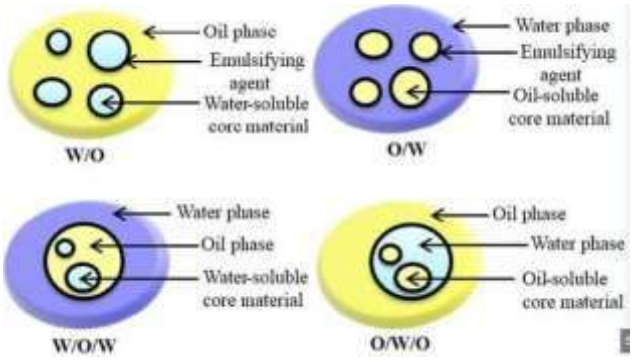

Figure 6. Types of Emulsion

MICROSPHERE

Microspheres are discrete spherical particles ranging in average particle size from 1 to 50 µ. Microparticulate drug delivery systems are studied and taken on as a reliable one to rescue the drug to the target site with specificity, to assert the desired concentration at the situation of interest without untoward effects. Micro encapsulation is a useful method which extends the duration of drug effect significantly and improves patient compliance. Finally, the entire dose and few adverse reactions may be thinned outs increased plasma concentration is kept. So far, a series of active ingredients of plants, such as rutin, calprotectin, zedoary oil, tetrandrine, quercetin, and Cynara scolymus extract, has been made into microspheres. In addition, reports on immune microsphere and magnetic microsphere are also usual in recent years. Immune micro sphere possesses the immune competence as a consequence of the anti-body, and antigen was coated or adsorb bed on the polymer microspheres.

5. ETHOSOME

Newer advancements in the patch technology have led to the development of ethosomal patch, which consists of drug in Ethosome. Ethosomal systems are made up of so phosphatidylcholine, ethanol and water. They may form multi lamellar vesicles and have a high entrapment capacity for particles of various lipophilicities. The elastic vesicles and transfersome have also been used as drug carriers for a range of small molecules, peptides, proteins and vaccines. Ethosome has a high deformability and entrapment efficiency and can penetrate through the skin completely and improve drug delivery through the skin. Likened to other liposomes, the physical and chemical properties of ethosomes make the legal transfer of the drug through the stratum corneum into a deeper skin layer efficiently or even into the blood circulation. This property is very important as the two pical drug carrier and transdermal delivery system. Moreover, the ethosomes carrier also can provide an efficient intracellular delivery for both hydrophilic and lipophilic drugs, percutaneous absorption of marine an anti-inflammatory herbal drug is increased, it also permits the antibacterial Peptide to penetrate into the fibrocyte easily. From the review of literature, it has been observed that, only three clinical trials have been conducted on ethosomal systems in human volunteers. Horwitz et al. carried out a pilot, double-blind, randomized clinical study to compare the efficacy of an ethosomal acyclovir preparation and commercially available acyclovir cream (Zovirax®) in treating recurrent herpes labialis in 40 human volunteers. The results revealed that the ethosomal acyclovir preparation performed better than Zovirax cream and showed significant improvement in all the evaluated clinical parameters, such as the time of crust formation and disappearance and pain parameters. The efficacy of ethosomal gel of clindamycin phosphate and salicylic acid was evaluated in a pilot clinical trial of 40 acne patients treated with the gel twice daily for 8 weeks. Volunteers treated with ethosomal gel showed considerable improvement in acne condition, with a decreased number of

comedowns, pustules, and total number of lesions compared to placebo. Ethosomal preparation of prostaglandin E1was evaluated in a pilot clinical study in patients with erectile dysfunction. It was observed that 12 of 15 tested patients had improved peak systolic velocity and penile rigidity. Erection duration was10–60min.Therewere no reported adverse skin reactions associated with the treatment in any of the aforementioned clinical trials.

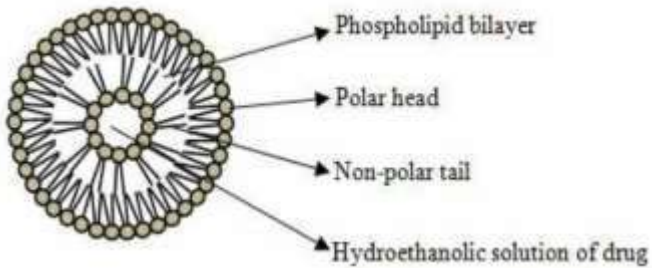

Figure 8. ETHOSOME

6. SOLID LIPID NANOPARTICAL

Solid lipid nanoparticles (SLNs) are introduced as a carrier system for in effectively water dissolvable medication and corrective dynamic medication. Colloidal particles ranging in size between 10 and 1000 nm are known as nanoparticles. They are incorporated from manufactured characteristic polymers and suited to advance medication conveyance and lessen lethality. They have developed as a variable substitute to liposomes as medication carrier. They are fabricated from manufactured/characteristic polymers and preferably suited to improve sedate conveyance and diminish lethality. SLN offer interesting properties, for example, little size, huge surface zone, high medication stacking and the communication of stages at the interface and are appealing for their potential to enhance execution of pharmaceuticals. Solid lipid nanoparticles (SLN) are aqueous colloidal dispersions, the matrix of which comprises of Solid biodegradable lipids. SLNs consolidate the favorable circumstances and maintain a strategic distance from the down sides of a few colloidal carriers of its class, for example, physical stability, assurance of fused labile medications from protection, of incorporated labile drugs from degradation, controlled release, excellent tolerability SLN formulations for various application routes (parenteral, oral, dermal, visual, pulmonary, rectal) have been developed and thoroughly characterized in-vitro and in-vivo. Solid lipid nanoparticles are one of the novel potential colloidal transporter systems as option materials to polymers which is in distinguishable to oil in water emulsion for parenteral nourishment, however the fluid lipid of the emulsion has been supplanted by a Solid lipid nanoparticle on Figure. They have many focal points, for example, great biocompatibility, low danger and lipophilic medications are better conveyed by Solid lipid nanoparticles and the framework is physically stable.

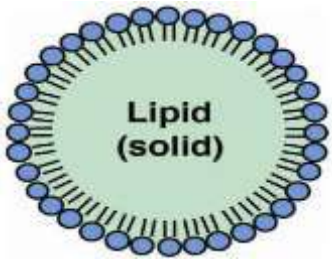

Figure 9. Solid Lipid Nanoparticles

7. NIOSOMES

Niosomes are multilamellar vesicles formed from non-ionic surfactants of the alkyl or diallyl poly glycerol ether class and cholesterol. Earlier studies in association with L'Oreal have shown that, in general, Niosomes have properties as potential drug carriers similar to liposomes. Niosomes are different from liposomes in that they offer certain advantages over liposomes. Liposomes face problems such as they are expensive, their ingredients such as phospholipids are chemically unstable because of their predisposition to oxidative degradation, they require special memory and handling, and purity of natural phospholipids is variable. Niosomes do not have any of these problems. They are lamellar

microscopic structures which are produced by an anionic surfactant, cholesterol admixture and a charges-inducer with a subsequent hydrating in watery media. Niosomes have a hydrophobic and hydrophilic moiety infrastructure, which allows drug molecules with a large range of solubilities to be accommodated. In several pharmaceutical applications, Niosomes have been assessed. Significant benefits in clinical application such as the ability to reduce systemic toxicity by encapsulating treatment agents include the ability to decrease clearance from the body by slowing drug release of such agents. and the niosome structure of figure.

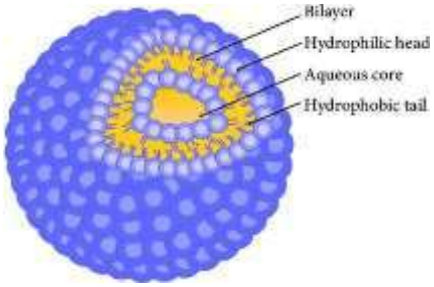

Figure 10. NIOSOMES

Types of Niosomes

1. Niosomes are classified based on number of bilayers,
2. Size and method of preparation.
3. Multilamellar-0.5µmto10µmindiameter.
4. LargerUnilamellar-0.1µmto1µmindiameter
5. Small Unilamellar–25-500nm in diameter

8. PRONIOSOMES

Proniosomes gel system is step forward to niosome, which can be utilized for various applications in delivery of actives at desired site. Proniosomal gels are the formulations, which on in situ hydration with water from the skin are converted into niosomes. Proniosomes are water-soluble carrier particles that are coated with surfactant and can be hydrated to form niosomal dispersion immediately before use on brief agitation in hot aqueous media.

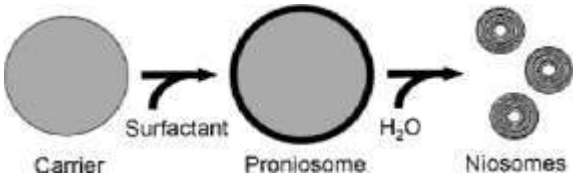

Figure. 11. PRONIOSOMES

9. TRANSDERMAL DRUG DELIVERY SYSTEM

TDDS has been an increased stake in the drug administration via the skin for both local therapeutic effects on diseased skin (topical delivery) as comfortably as for systemic delivery of drugs. However, they did not have had such expected success with other drugs. But immense potential lies in transdermal drug as future smart drug delivery devices. Transdermal delivery system provides the advantage of controlled drug delivery, enhanced bioavailability, reduction inside effects, and easy application. Formulation of transdermal films incorporating herbal drug components such as boswellic acid (Boswellia Serrata) and curcumin (Curcuma longa) is one of the first few attempts to utilize Ayurvedic drugs through TDDS, which utilizes skin as a site for continuous drug administration into the systemic circulation. Thus, this delivery system avoids the first-pass metabolism of the drug without the annoyance associated with injection; moreover, the scheme offers a prolonged drug delivery with infrequent dosing via zero-order kinetics and the therapy can be easily fired at any time. Use of turmeric in TDDS for the local action of the drug at the site of administration can also be regarded as a young version of Ayurvedic turmeric poultice or leap.

10. DENDRIMERS

Dendrimers are extremely branched, globular, multivalent, monodisperse molecules with synthetic elasticity and many possible applications ranging from catalysis to electronics and drug release. Dendrimers and dendritic molecules are the subject of significant educational and industrial interest. Dendrimers are repetitively branched

molecules. The name come from the Greek word "δένδρον" (diverse dendron), which interpret to "tree". Identical terms for dendrimer contain arborols and cascade molecules. However, Dendrimer is presently the internationally established term. A dendrimer is classically symmetric around the core, and often adopt a globular three- dimensional morphology. The word dendron is also encounter regularly. The differentiation between dendrons and dendrimers is well explained in figure (A&B), but the terms are classically encounter inter changeably. Go, G1, G2, G3 and G4 designated as zero generation to four generation respectively.

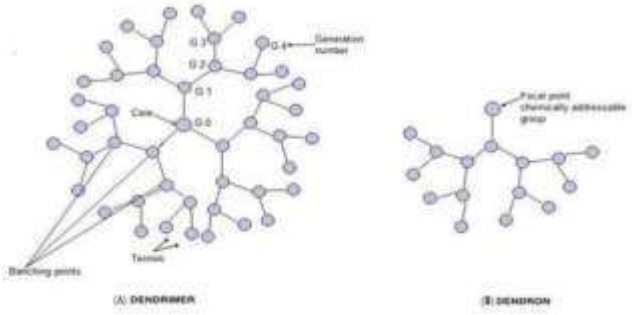

Figure.12 DENDRIMER

11. TRANSFERSOME

Transfersome are specially optimized particles or vesicles that can respond to an external stress by rapid and energetically inexpensive, shape transformations. The development of novel approaches such as transfer some have immensely contributed in overcoming problem faced by transdermal drug delivery such as unable to transport larger molecules, penetration through the stratum corneum's the rate limiting step, physicochemical properties of drugs hinder their own transport through skin. These elastic vesicles can squeeze the selves through skin pores many times smaller than their own size and can transport larger molecules. transfersome are applied in an on occluded method to the skin, which permeate through the stratum corneumlipid lamellar regions as a result of the hydration or osmotic force in the skin. It can be applicable as drug carriers for a orbit of small molecules, peptides, proteins and herbal elements. Transfersome can penetrate the stratum corneum and supply the nutrients, locally to maintain its functions resulting maintenance of skin transfersome are a form of elastic or deformable vesicle, which were first introduced in the early 1990s and their elasticity is generated by incorporation of an edge activator in the lipid bilayer structure. In this connection the transfersome of Capsaic in has been made by Xiao-Ying et al. which shows the better topical absorption in comparison to pure capsaicin. Gregor Cevc introduced the definition and idea of transfersome in 1991. The Title is derived from the Latin word 'transferred' which means, "to carry" means "to transport" Through' and "soma" fora, the Greek term "body." A translator is an artificial carrier A vesicle similar to the normal vesicle of the cell. It is therefore suitable for managed and targeted Delivery of drugs. Transfersome is a dynamic aggregate that is highly adaptable, stress reactive. It is a deformable vesicle with an aqueous center surrounded by the complex Fat bilayer. Fat bilayer. The vesicle depends on the local composition and the form of the bilayer. Self-regulation as well as self- optimization. This helps the customer to cross different effectively convey barriers and the act as a non-invasive target drug transport agent. Provision of therapeutic agents and their continuous release. These self-optimized components. The ultra-flexible membrane can supply either into or via a drug reproducibly. The skin has high quality, depending on the option of application or administration. These transfers are more elastic than the regular liposome in various orders of magnitude and are therefore well suited to skin penetration. The transfer so ccurbys squeezing them through the intracellular lipid of the stratum corneum to induce skin penetration difficulties. The transfersome membrane

versatility is achieved by mixing of appropriate surf active components.

AIM AND OBJECTIVE

AIM: -

A Review of Novel Drug Delivery Systems: Exploring Advancements and Applications

OBJECTIVE:

1. Provide an exhaustive overview of existing conventional drug deliver systems.
2. Focus on advancements in nanotechnology-based drug delivery systems.
3. Assess the impact of these innovations on drug stability, solubility, and bioavailability.
4. Examine the applications of novel drug delivery systems in specific therapeutic areas, such as oncology, neurology, and infectious diseases.
5. Assess the significance of biodegradable and sustained release drug delivery systems.
6. Analyze the impact of novel drug delivery systems on patient convenience and compliance.

CONCLUSION

Novel Drug delivery System (NDDS) is a combination of advance techniques and newly designed dosage forms which are much better than conventional dosage forms. Advantages of Novel Drug Delivery System are Optimum dose at the right time and right location, Efficient use of expensive drugs, excipients and reduction in production cost, Beneficial to patients, better therapy, improved comfort and standard of living. Basic modes of novel drug delivery systems are: Targeted Drug Delivery System, Controlled Drug Delivery System etc. Novel Drug delivery & drug targeting is new techniques which is used in pharmaceutical science. Like targeting drug molecules, vaccine delivery, Gene therapy, commercial development of novel carries (liposomes). Pharmaceutical innovations like the Novel Drug Delivery Systems presents health professionals with a broad range of arsenals to treat diseases with never before efficacy, safety and precision. Clinically the NDDS not only smoothens the saw-tooth pattern of drug levels in blood, but also affords targeting the drugs to their site of action and thus reduces dose-related side effects. Smaller quantity of drug and fewer numbers of dosing could be used to treat a disease with increased success. It is hoped that with more and more research endeavors being focused into this arena, in near future, a large portion of the conventional dosage forms would be replaced by these NDDS and an overall betterment of health care delivery is expected with that change over. Pharmaceutical companies are interested to conduct research on NDDS to get edge over the big pharmaceutical companies to capture the regulated market through ANDA in regulated market. Moreover, development and implementation of new branches like Pharmacovigilance will ensure availability of safer medicines to our people. Pharmacoeconomics will provide cost effective health care, which may help to extend the health care to the underprivileged.

FUTURE PROSPECTS

Targeting drug delivery is the major focus on current research. After the concept of magic bullet, only a few targeted formulations could reach to the market. The discovery of area of molecular biology, biotechnology & pharmacogenomics regularly demand the practical key issues of targeting of biomolecules to the center of attention. Like tumor targeted drug/gene delivery is the most demanded therapeutic requirements of the Future prospective.

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