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The Novel Drug Delivery System

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ABSTRACT:
The performance of an existing medicinal molecule in terms of patient compliance, safety, and efficacy can be greatly enhanced by evolving it from a traditional form to an unique delivery mechanism. An old medication molecule can be given new life as a Novel Drug Delivery System. An appropriately designed Novel Drug Delivery System can be a major advance for solving the problems related towards the release of the drug at specific site with specific rate. The need for delivering drugs to patients efficiently and with fewer side effects has prompted pharmaceutical companies to engage in the development of new drug delivery system. This article covers the basic information regarding Novel Drug Delivery Systems and also different types of the same.

Key Words: Nanomedicine, natural plant metabolite, biomedical application, NDDS, Nanoparticles, Study of Drug Release.

I. INTRODUCTION:

The method by which a drug is delivered can have a significant effect on its efficacy. Some drugs have an optimum concentration range within which maximum benefit is derived, and concentrations above or below this range can be toxic or produce no therapeutic benefit at all 1 . On the other hand, the very slow progress in the efficacy of the treatment of severe diseases, has suggested a growing need for a multidisciplinary approach to the delivery of therapeutics to targets in tissues. From this, new ideas on controlling the pharmacokinetics, pharmacodynamics, nonspecific toxicity, immunogenicity, bio recognition, and efficacy of drugs were generated. These new strategies, often called drug delivery systems (DDS), which are based on interdisciplinary approaches that combine polymer science, pharmaceutics, bio conjugate chemistry, and molecular biology. To minimize drug degradation and loss, to prevent harmful side-effects and to increase drug bioavailability and the fraction of the drug accumulated in the required zone, various drug delivery and drug targeting systems are currently under development 1 . Controlled and Novel Drug Delivery which was only a dream or at best apossibility is now a reality. During the last decade and half pharmaceutical and other scientists have carried out extensive and intensive investigations in this field of drug research. Among drug carriers one can name soluble polymers, microparticles made of insoluble or biodegradable, natural and synthetic polymers, microcapsules, cells, cell ghosts, lipoproteins, liposomes, and micelles.Two major mechanisms can be distinguished for addressing the desired sites for drug release: (i) Passive and; (ii) Active targeting

Definition:
A Novel Drug Delivery System (NDDS) can be defined as a new approach that combines innovative development, formulations, new technologies, novel methodologies for delivering pharmaceutical compounds in the body as needed to safely achieve its desired pharmacological effects.

Characteristics of Novel Drug Delivery System:
- Increase the bioavailability
- Provide controlled delivery of drug
- Transport the drug intact to the site of action avoiding the non-diseased tissue.
- Stable and delivery be maintained under various physiological variables.
- Easy to administer, safe and reliable.
- Cost-effective.

Benefits of NDDS:
- **Medical:** Optimum dose, at the right time and at the light location.
- **Industrial:**Efficient use of expensive ingredients, reduction in production cost.
- **Social:**Beneficial to patients, better therapy, improved compliance and standard of living.

Ideal Features (3)

Targeted framework for drug delivery Non-immunogenic, inert biochemically (not toxic). In vivo and in vitro, both physically and chemically stable.Drug delivery is limited to target cells (or)

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organs and should be standardized. Medicine release controllable and predicate rate. The release of medicines does not affect the action of drugs. Medicine release therapeutic quantity. During travel, minimal drug leak. Carriers used have no issue or bear mediated modulation of disease without biodegradable (or) readily removed from the body. Quick (or relatively easy reproductive & cost efficient preparation of the delivery system.

Advantage & disadvantage(4)

Nano -particles benefits:

1. They are site-specific, biodegradable, non-toxic and store for at least a year.
2. You may target a drug to a particular position in the body by adding targeted ligands to particle surfaces or by using magnetic guidance.
3. They give regulated drug release rates and characteristics for particle degradation that can easily be modulated using matrix constituent selection.
4. The loading of the medication is high and without a chemical reaction drugs can be introduced into the systems; this is an essential factor to safeguard drug operation.
5. They have better therapeutic efficacy and overall response/unit dose.

Disadvantages :

1) There are limits on bioacceptability.
2) Hard to produce in big quantities.
3) The small amount of particles and the large area can make it difficult to aggregate particles due to their small size, thereby making it difficult to physically handle nanoparticles in liquid and dry form.
4) Restricted loading and explosion contributes to the small particle size, as well as large surface area. Until nanoparticles can be clinically or commercially available, these practical problems should be solved.
5) The present work is a step towards the production of drug delivery systems for nanoparticles, surface modulation, drug loading strategies, release control and future applications for nanoparticles. 5

Drug delivery mechanism by nanoparticles :

Nanoparticles deliver the drug onsite by preventing the reticulo endothelial system, using improved permeability, retention effect and targeting. Dogs with nano particles as carriers apply two forms of approaches15 . a. Surface bound: The drug molecules are connected to the nano particles surface b. Core bound: The drug particles are concentrated in such a technique into the nanopharma 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 . 6

TYPES OF NOVEL DRUG DELIVERY SYSTEM

Phytosome

The word "Phyto" indicates plant while others means cell-like. "Phyto" means plant. Phytosomes were the Method of vesicular supply of herbal extract phytoelectric ingredients and Lipid bound (one molecular phyto-constituent, bound to a phospholipid at least molecular). Phytosomes 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 phytosomes and liposome.

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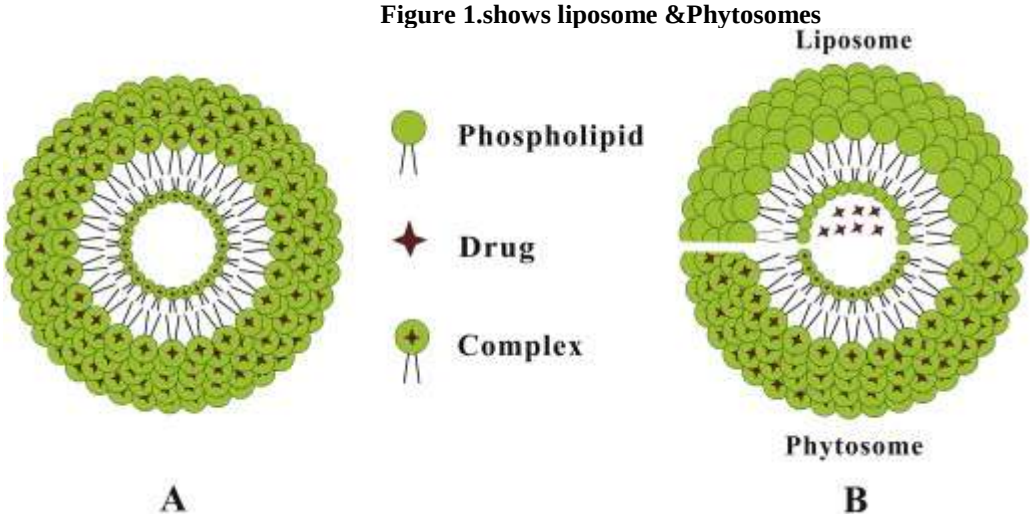
Figure 1.shows liposome &Phytosomes



PhytosomeBenefits :

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. Phosphatidylcholine is not a carrier, but serves as a liver protection. 7

Method for preparation for Phytosomes: [8]

- Phospholipids
- Dissolved in organic solvent Containing: Drug/Extract.
- Solution of phospholipids in organic Solvent with drug/extract
- Drying
- Formation of thin film Hydration Formation of phytosomal suspension

Figure 2: Common stages for preparation of Phytosome

Liposomes

Liposomes are condensed bilayered 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 a range of sizes as single or multi-lamella the house, and its name concerns its building blocks, phospholipids, not Its dimension. Its scale. A liposome has no lipophobic substance, for instance water, even if it does not Typically does. Usually does. Artificial vesicles consisting of bilayer lipid are liposomes. Liposomes. Liposome Liposomes Drugs may be filled and used to administer cancer and other diseases medicines. Liposome Liposomes Biological membranes such as sonic disruption can be prepared. Liposome Liposomes They aremicroparticulate 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 phospholipids bilayer, varying lipophilicity can be encapsulatedThe captured amount of aqueous substances or at the interface of the two-layers.

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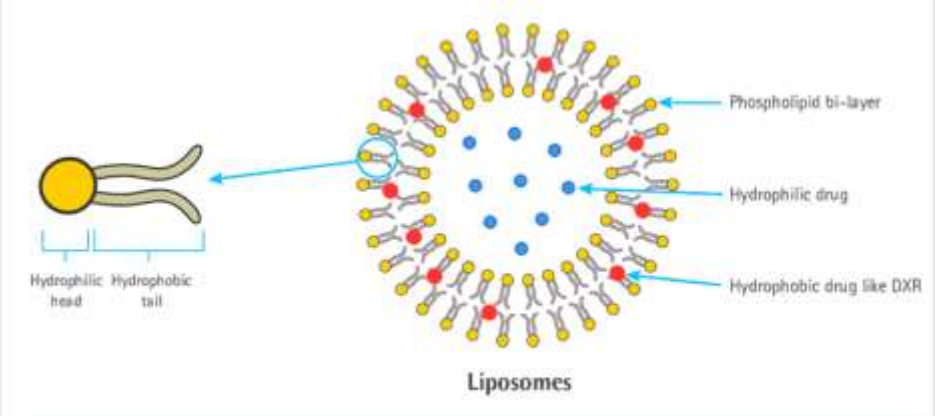

Figure 3. Liposomes.

Advantages of Liposome[9]

1) Provides selective passive targeting to tumor tissues (Liposomal doxorubicin).
2) Increased efficacy and therapeutic index.
3) Increased stability via encapsulation.
4) Reduction in toxicity of the encapsulated agents.
5) Site avoidance effect.
6) Improved pharmacokinetic effects (reduced elimination, increased circulation life times).
7) Flexibility to couple with site specific ligands to achieve active.

NIOSOMES

They are lamellar microscopic structures which are produced by a nonionic 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. [19] and the niosome structure of figure 4 .[20]

Types of Niosomes[10]

1. Niosomes are classified based on number of bilayer, size
2. and method of preparation.
3. Mulitlamellar- 0.5µm to 10µm in diameter.
4. Larger unilamellar- 0.1µm to 1µm in diameter.
5. Small unilamellar – 25-500nm in diameter.

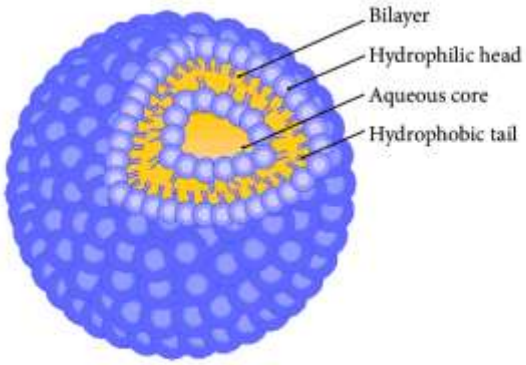

Fig. 4: Structure of Niosome

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Advantages of Niosome[12]

1) Niosomes are non-toxic, non-immunogensic, biodegradable and compatible.
2) In a small volume of vesicles, niosomes can encapsulate large amounts of material.
3) Niosomes have greater compliance, happiness and efficacy than Common oily formulae.
4) Niosomes can trap a broad range of (hydrophilic, lipophilic, and amphiphilic) chemicals.The unique structure of drugs).
5) Niosome features such as type, flow and size can easily be monitored Modification of structural structure and manufacturing processes.
6) Niosomes can be administered through several routes including oral, parenteral and administrative.Available in various types, such as semisolids, powders or suspensions, topical, etc.
7) Since the structural structure's chemical stability, the niosome is simple to store.

TRANSFERSOME

GregorCevc introduced the definition and idea of transfersome in 1991. The Title is derived from the Latin word 'transferre' 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-optimisation. This helps the customer to cross different effectively convey barriers and then 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 transfers occur by squeezing them through the intracellular lipid of the stratum corneum to induce skin penetration difficulties. The transfersoma membrane versatility is achieved by mixing of appropriate surfactive components 22-28 .structure ratios as shown in fig.5

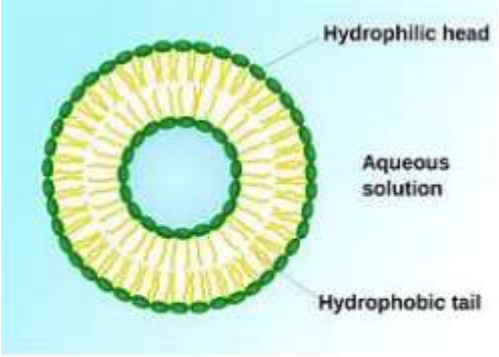

Fig. 5: Undeformable Vesicle (Transferosome)

Transfersomes Advantage [13]

1) Small constriction (5-10 times smaller) can be caused by transfers. Without observable loss, except their own diameter.
2) In the case of lipophilic medicine they have a high capture efficiency of about 90%.
3) This high deformity gives the intact vesicles a greater penetration.
4) They can be used to supply low and high molecular weight medicines like analgesics. Bluetongue, aesthetic, corticosteroids, gender hormone, anticancer, insulin, and Albumin.
5) Transfers have a hydrophobic and hydrophilic infrastructure Together and as a result, drug molecules with a wide variety of Solubility
6) They function as a warehouse, slowly and steadily releasing their contents.

Evaluation of Nanoparticles[14]

The nanoparticles are generally evaluated for the following:

1) Size and morphology
2) Specific surface
3) Surface charge and electrophoretic mobility

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4) Density of nanoparticles 5) Molecular weight
5) Nanoparticle recovery and drug incorporation efficiency
6) In vitro release

Fucture Opportunities and Challenges [16]

Nanoparticles and nanoformulations have already been applied as drug delivery systems with great success; and nanoparticulate drug delivery systems have still greater potential for many applications, including anti-tumor therapy, gene therapy, and AIDS therapy, radiotherapy, in the delivery of proteins, antibiotics, virostatics, vaccines and as vesicles to pass the blood - brain barrier Nanoparticles and nanoformulations have already been applied as drug delivery systems with great success; and nanoparticulate drug delivery systems have still greater potential for many applications, including anti tumour therapy, gene therapy, AIDS therapy, radiotherapy, in the delivery of proteins, antibiotics, virostatics, vaccines and as vesicles to pass the blood-brain barrier. Nanoparticles provide massive advantages regarding drug targeting, delivery and release and, with their additional potential to combine diagnosis and therapy, emerge as one of the major tools in nanomedicine. The main goals are to improve their stability in the biological environment, to mediate the bio-distribution of active compounds, improve drug loading, targeting, transport, release, and interaction with biological barriers. The cytotoxicity of nanoparticles or their degradation products remains a major problem, and improvements in biocompatibility obviously are a main concern of future research .

There are many technological challenges to be met, in developing the following techniques :

1) Nano-drug delivery systems that deliver large but highly localized quantities of drugs to specific areas to be released in controlled ways;
2) Controllable release profiles, especially for sensitive drugs;
3) Materials for nanoparticles that are biocompatible and biodegradable;
4) Architectures / structures, such as biomimetic polymers, nanotubes;
5) Technologies for self-assembly;
6) Functions (active drug targeting, on-command delivery, intelligent drug release devices/ bioresponsive triggered systems, self-regulated delivery systems, systems interacting with the body, smart delivery);

Marketed Products of Nanomedicine

- Nanoparticle
- Nanocrystal
- Nanotube
- Superparamagnetic iron oxide
- Liposomes
- Micelle

II. CONCLUSION

Nanoparticles are a promising controlled and selective release mechanism for drug delivery. The advancement of nanotechnology would undoubtedly have important consequences for the drug supply industry, affecting virtually every route from oral to injectable. And lower drug toxicity, lower cost of treatment, greater bio-availability and expanding the economic life of patented medicines are projected to pay for both physicians and patients. This will increase the efficacy of drug therapies and reduce the side effects before and after diagnosis and treatment. Nanoparticles are also a promising platform for the synthesis of molecular contrast agents12. Significantly capable of transforming poorly soluble, poorly absorbed and labile biological active material into promising administerable drugs nanoparticulate systems. Nanoparticles typically have comparatively greater intracellular absorption than microparticles, and because of their small size and relative mobility, are accessible to a wide range of biological goals (15).

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