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A REVIEW ON NOVEL DRUG DELIVERY SYSTEM

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Abstract

Plants are medicinal and used by people. Soil has been used as food and medicine since ancient times. The movement in today's world is the discovery of herbs in the laboratory and the preliminary tests and post-analysis are good drug users. The main points of the treatment of all diseases are actually hidden behind the scenes. However, improvement in the delivery of herbs, focusing on sustained release to improve patient compliance, etc. Is required. Early herbal therapy did not attract researchers to develop new technologies for drug delivery, and there were problems in formulation, extraction, and analysis. However, New Drug Delivery Systems (NDDS) have now opened the door to producing herbal products using developing technology. Current pharmaceutical technology is changing the amount of herbal products that increase medicinal value and reduce toxicity. Over the past years, many new cultivation techniques have been documented to achieve transformation of different plants, including liposomes, nanoparticles, phytosomes and ethanolosomes. The purpose of this article is to develop different new technologies designed for drug delivery and provide herbs to improve responsible

KEYWORDS : NDDS, NANOPARTICLES STUDY OF DRUG RESEARCH

Introduction:

There are many different New Drug Standard (NDDS) carriers of varying quality. Conventional formulations have problems such as overdose, Andrews, lack of stability, first effects, changes in plasma concentration and rapid release. Basic – Efficacy, protection, patient compliance and product shelf life [1] NDDS will address these issues. Nanoparticles are the focus of current attention as people realize their impact on human health and environmental sustainability and the environmental benefits of nanoparticles. Nanoparticles are produced by various processes in many different applications. Interesting theoretical problems are their calculation and

behavior. Nanoparticles are classified as having diameters between 10 and 100 nm. Their pharmacodynamic and pharmacokinetic properties have been adjusted to meet the criteria for small and large molecule classification. They are characterized as systems containing agents dissolved, encapsulated, or adsorbed in a matrix material used for tissue delivery. Tissue movement has been shown to be stabilized by intravascular dissolution of enzymes and nanoparticles. It is necessary to pay attention to a number of parameters such as release pattern, size and surface properties that determine the specific surface in the formation of nanoparticles, and to understand the price and quality effects of using the right drug. The first materials are a non-biodegradable framework based on polymer nanoparticles (polyacrylamide, polymethyl methacrylate, polystyrene). Polymeric nanoparticles can contain, for example, drugs or proteins. These bioactive substances are retained in solid or solution form in the polymer matrix or may be physically or chemically present on the surface. In the preparation of nanoparticles, drugs for preformed nanoparticles can be used. The term does not reflect the morphological or structural organization of the body and indicates generality. Nanomedicine is a new field of medicine[2] Polymeric nanoparticles can contain drugs or proteins, i.e. (s). These bioactive substances are entrapped as particles or solid solutions in the polymer matrix, or they can be physically or chemically attached to the surface of the particle. The drug(s) can be applied to the pre-prepared nanoparticles during the preparation of the nanoparticles. This term does not reflect the morphological or structural organization of the system and is suggestively general. Nanomedicine is an innovative field of medicine[3]

Definitions:

The drug is known as a dissolved, entrapped, encapsulated or nanoparticle-bound matrix of nanoparticles as particle dislocations or solid particles between 10 and 1000 NM in size. Nanoparticles are in solid form and are either amorphous or crystalline As nanospheres and nanocapsules with a size of 10-200 nm. For the preparation of nanoparticles, polymer materials were commonly used as nanoparticles, nanospheres or nanocapsules can be obtained according to the method of preparation. Nanocapsules are systems in which the drug is enclosed in a cavity with a unique polymer membrane, while a nanosphere is a matrix system that physically and consistently disperses the pharmaceutical·DNA carriers in the field of gene therapy have been used in recent years as potential devices for the delivery of proteins and other nanoparticles, especially for hydrophilic polymers such as poly(ethylene glycol) (PEG), due to their ability to circulate for extended periods as a specific organ and their ability to deliver proteins and other DNA in gene therapy.[4]

The advantages of the new drug delivery systems are as follows

1)Protection from Physical and Chemical Degradation - The physical or chemical stability of any drug, if altered, results in the deterioration of the effectiveness of that drug. The quality of this medicine is reduced and therefore its effectiveness is negligible. Physical degradation occurs when there is a change in the appearance of any drug such as its color, brittleness, hardness, change in taste, settling, caking, etc. Chemical degradation occurs when the chemical compounds of the drug are broken down into simpler compounds. The ways in which this chemical

degradation occurs are – oxidation, isomerization, polymerization, hydrolysis and decarboxylation. The use of nanosystems for drug delivery allows the protection of drugs from such degradations.

2)Sustained Delivery - When the drug is delivered by methods that promote longer retention a drug in the body that provides a long-term benefit is called sustained drug delivery. Using nanotechnology, this can be done very easily, especially for those drugs that have a fast metabolism rate or for those drugs that are very quickly removed from the body after ingestion.[5]

3)Enhanced tissue macrophages Distribution - Macrophages are distributed in tissues to fight against any pathogen or foreign agent. They are the most flexible, which help in the treatment of inflammatory diseases of the respiratory tract. The role of macrophages is to maintain homeostatic tissue process, repair tissues and improve immunity. The nano drug delivery system enables better tissue distribution of these macrophages

4) improvement - The stability of the drug is assessed by the retention of the drug substance from the moment it is produced until storage for its entire shelf life. It is necessary for drugs to remain stable throughout their lifetime so that their ability to treat a specific disease is not degraded. With the use of a nano drug application system, this stability is effectively achieved. Drugs remain in their best form from the time they are made until they are used in the future.

5) Enhancement of Pharmacological Activity - Use of new drug delivery systems like nanoparticles, microsomes etc. Which are very small in size enhance the pharmacological activity of the respective drug. These new methods increase pharmacological activity due to their small size, together with increasing their surface area for drug absorption. This increased surface area results in greater and more efficient absorption of the drug and consequently effective delivery of the drug at the site of action.

6) Prevention of toxicity - Advanced and new delivery systems protect the body's tissues and cells from unnecessary toxicity caused by residual compounds that would otherwise reach the affected site. New drug delivery systems allow the desired drug particle to reach the site of action when the body needs it. These transport systems are chemically stable and ensure a safe chemical composition in the body.[6]

7) Increased bioavailability – The bioavailability of a drug is defined as the part or component of the drug that enters the body's bloodstream and is able to exert its active effects in the body. A drug is considered strong and highly effective if it has higher bioavailability. To increase the bioavailability of any drug, carriers such as nanoparticles, phytosomes, microsomes, etc. Are used as part of the new drug delivery system[7].

Disadvantage:

1.In current therapy inactivation by gastric juice metabolism before reaching target cell- First pass metabolism in lung / liver / Intestine.

2. Too many adverse reactions, Amount of drug deliver , Repeated dosage is necessary.

3. Less patients compliance, dependency on patient's inspiratory flow rate and profile.

4. .More expensive than preserrized metered dose inhalers. Low solubility ..

5. Sometimes phospholipid undergoes oxidation and hydrolysis like reaction .

6. Production cost is high.,Dose dumping. Short half life [8]

Factors affecting NDDS :

- Physicochemical properties of a drug
- Route of administration
- Acute / Chronic therapy
- Target sites
- The Patient
- The disease state/level[9]

Types of Novel Drug Delivery Systems for Herbal Formulations:

Phytosomes:

Phytosomes are lipid-compatible molecular complexes and their name is derived from "phyto" meaning plant and "some" meaning cell-like. Phytosomes are created by combining polyphenolic phytocomponents and phosphatidic choline in a certain ratio. This combination leads to the creation of a new drug delivery system for better drug delivery. When this system is compared to a conventional drug delivery system, phytosomes are shown to be advanced because they are easily absorbed and utilized by the body than products made by conventional methods. The reason for the better performance of phytosomes is the better pharmacokinetic and therapeutic profile of this new drug delivery system [10].

Benefits of Phytosome:

1. Improve the bioavailability of phospholipid complexes.

2. Absorption from the gastrointestinal tract is improved.

3. Improved therapeutic outcomes result from increased bioavailability.

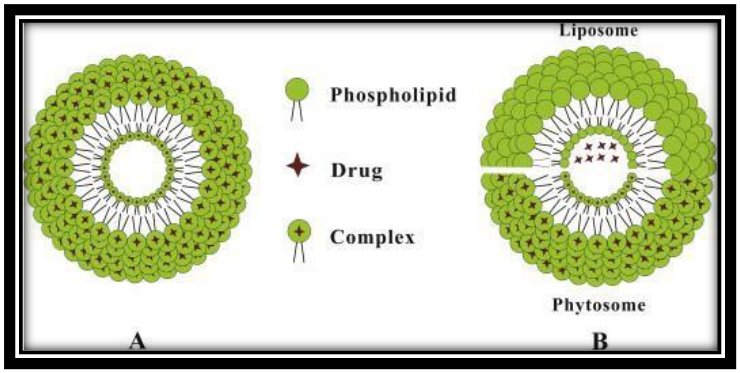
4. Higher bioavailability requires lower dosages.

5. Greater stability. More stability.

6. High lipophilicity causes strong pain, so it is used instead of liposomes in cosmetics.

7. Significant clinical benefit. 8. Phosphatidylcholine is not a transporter but plays a hepatoprotective role.[11]

Figure 1 shows liposomes and phytosomes



Advantages of using phytosomes as a drug delivery system:

It increases the absorption capacity of the active ingredients, so smaller doses are needed.

Phytosomes enable drug encapsulation and bile solubility of plant components. Therefore, liver disease can be easily targeted.

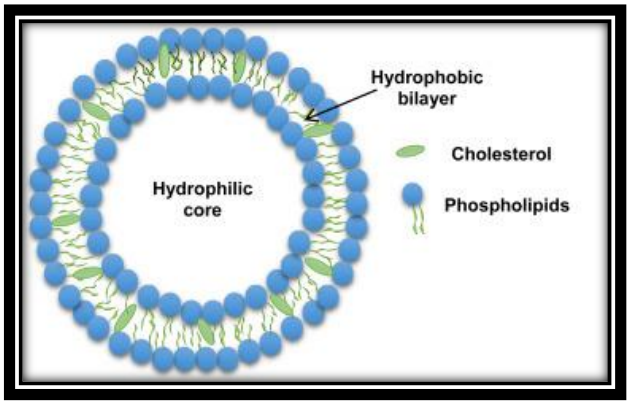
This drug has a very high stability due to the formation of chemical bonds between molecules. The use of phytosomes ensures rapid absorption of plant components.[12]

Liposome:

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 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 lipophilic substance, for instance water, even if it does not typically does usually does. Artificial vesicles consisting of bilayer lipid are liposomes. Liposomes. Liposome drugs may be filled and used to administer cancer and other diseases medicines. Liposomes Biological membranes such as sonic disruption can be prepared. Liposome Liposomes 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 phospholipids bilayer, varying lipophilicity can be encapsulated the captured amount of aqueous substances or at the interface of the two layer.[13]

Figure 3. Liposomes

Liposome classification based on structural features :



1. MLV – Multilamellar large vesicles
2. OLV – Oligolamellar vesicles
3. UV – Unilamellar vesicles
4. SUV- Small unilamellar vesicles
5. LUV – Large unilamellar vesicles
6. GUV – Giant unilamellar vesicles
7. MVV -Multivesicular vesicles

Liposome classification based on method of liposome preparation.

REV -Single or oligolamellar vesicle made by reverse phase evaporation method.

1. MLV / REV -Multilamellar vesicles made by reverse phase evaporation method.
2. SPLV -Stable plurilamellar vesicles.
3. FAT-MLV Frozen and thawed MLV
4. VET- Vesicles prepared by extrusion method.
5. FUV-Vesicles prepared by fusion
6. FPV -Vesicles prepared by French press
7. DRV- Dehydration- rehydration vesicles[15]

Advantages of Liposome :

Provides selective passive targeting to tumor tissues (Liposomal doxorubicin).

Increased efficacy and therapeutic index.

Increased stability via encapsulation.

Reduction in toxicity of the encapsulated agent.Site avoidance effect .

Improved pharmacokinetic effects (reduced elimination, increased circulation life times).

Flexibility to couple with site specific ligands to achieve active[15]

Niosomes:

They are lamellar microscopic structures that are formed by a non-ionic surfactant, cholesterol admixture and a charge inducer with subsequent hydration in an aqueous environment. Niosomes have a hydrophobic and hydrophilic infrastructure that allows drug molecules with a wide range of solubility to accommodate. Niosomes have been evaluated in several pharmaceutical applications. Significant advantages in clinical application, such as the ability to reduce systemic toxicity by encapsulating therapeutic agents, include the ability to reduce clearance from the body by slowing the release of such agents[16]

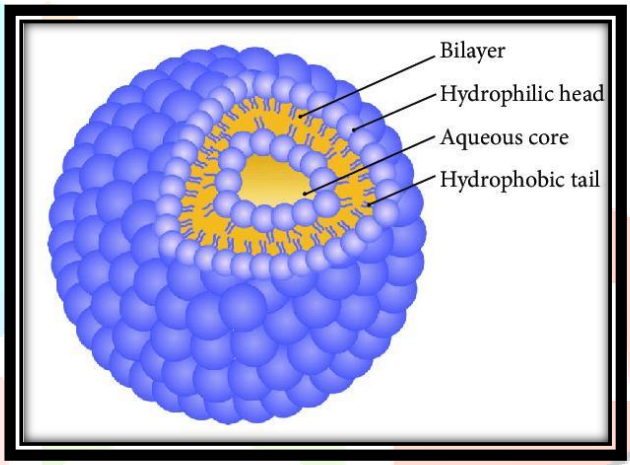


Fig. No.4 Niosomes[17]

Types of Niosomes:

1. Niosomes are classified according to the number and size of bilayers.

2. And manufacturing method.

3. Multilamellar – 0.5 to 10 microns in diameter.

4. Larger single layers – 0.1 to 1 micron in diameter.

5. Small monolayers – 25-500 nm in diameter [17]

Niosome Benefits:

1. Niosomes are non-toxic, non-immunogenic, biodegradable and compatible
2. In small volume vesicles, niosomes can encapsulate large amounts of substances.
3. Niosome is more flexible, happier and more effective than regular oil products.
4. .Niosomes can capture a wide range of (hydrophilic, lipophilic and amphiphilic) chemicals (unique drug structures).

5. . Characteristics such as type, flow rate, and size of niosomes can be easily adjusted. Changes in structural structure and production processes.
6. Niosomes can be administered in a variety of ways, including oral, parenteral, and administration. It can be applied topically in various forms such as semi-solid, powder, and suspension.
7. Niosomes are easy to store due to the chemical stability of their structural structure[18]

Nanoparticles:

There are many proposed structures, assembly architectures and particle systems, the unifying feature of which is the nanometer size range (from a few to 250 nm). Materials at the nanometer scale often have different physical and biochemical properties than those of the same materials in the bulk—properties that make nanostructures attractive for diagnostic and therapeutic applications. Since the size of nanoparticles is significantly smaller than the cell, they can deliver large amounts of drugs, contrast agents, or fluorescent probes to the surface or interior of the cell without disrupting its function. These particles are able to penetrate deep into the tissues and pass through the fenestration of the epithelial tissue of the small blood vessels. They can enter the systemic circulation without forming platelet aggregates. Their reduced particle size results in a high surface area and thus a strategy for faster drug release. Drug delivery rate and particle integrity can be modulated and controlled by engineered carriers in such a way that they can be activated by environmental pH changes, chemical stimuli by application of a rapidly oscillating magnetic field, or application of an external heat source. . Among the proposed constructs investigated and developed for this specific goal are: polymeric micelles, dendrites, polymeric and ceramic nanoparticles, protein cage architectures, virus-derived capsid nanoparticles, polyplexes, and liposomes. There are several techniques for fabricating polymer nanocarriers, such as soft lithography, nanoimprinting, and injection molding, which are capable of producing nanostructures with complicated patterns, and other simpler processing methods for fabricating polymer membranes with nanopores, nanofibers, nanotubes, and multiple nanofilms/layers[19]

Nanoemulsion:

Nanoemulsions can be defined as oil-in-water (o/w) emulsions with average droplet diameters ranging from 50 to 1000 nm. Typically, the average droplet size is between 100 and 500 nm. Particles can exist in “water-in-oil” and “oil-in-water” forms, and the core of the particle is either water or oil. The terms submicron emulsion (SME) and miniemulsion are used interchangeably. Typically, SME contains 10 to 20% oil stabilized with 0.5 to 2% egg or soy lecithin 8 . The drops are stabilized by surfactants. They do not arise spontaneously; their properties depend not only on thermodynamic conditions, but also on preparation methods and the order of adding components. On the other hand, nanoemulsions are equilibrium structures significantly different from emulsions Nanoemulsions can have high kinetic stability and optical transparency resembling microemulsions Nanoemulsions can be used as size-controlled microreactors for the preparation of monodisperse particles[20].

MICROCAPSULES:

The poor solubility of many anticancer agents (such as paclitaxel, PCT; camptothecin, CPT; and certain porphyries such as mesotetraphenylporphine, TPP, used in photodynamic therapy, PDT) hinders their application and complicates direct parenteral administration. To overcome their poor solubility, low stability and toxic side effects, various formulation strategies based on the use of drug carrier systems have been proposed [22]. Among such systems, polymeric micelles have attracted much attention due to their highly controlled properties and good pharmacological properties. Of particular interest are micelles prepared from PEG-Daylilies conjugates such as PEGPE. Here, we describe the preparation, properties, and anticancer activity in vitro of PCT-, CPT-, and TPP-loaded PEG-PE micelles, as well as mixed micelles made of PEG-PE and D-α-tocopheryl polyetheyene glycol 1000 succinate (TPGS).[21]

MICROEMULSION:

Microemulsions are liquid dispersions of water and oil that are homogeneous, transparent or translucent, and thermodynamically stable by the addition of relatively large amounts of surfactant and cosurfactant and having droplet diameters in the range of 10–100 nm. Microemulsions have been widely studied for drug targeting to the brain and for increasing the bioavailability of poorly soluble drugs. In such cases, they offer a cost-effective approach. Microemulsions have very low surface tension and small droplet size, resulting in high absorption and permeation. Interest in these versatile carriers is growing and their applications have been diversified into different routes of administration in addition to the conventional oral route.[23]This can be attributed to their umique solubilizing properties and thermodynamic stability, which have attracted attention for their use as carriers for drug targeting to the brain. Intranasal drug delivery is one of the targeted delivery options for targeting the brain because the brain and nose compartments are interconnected by the olfactory pathway and through the peripheral circulation epipodophyllotoxin, an anticancer drug is useful for the treatment of small cell lung cancer and testicular cancer. Before administration, the drug must be diluted in the infusion fluid; its low water solubility thus acts as a limitation in the formulation of its parenteral dosage form. This attribute results in precipitation of the drug in the infusion fluid, which is harmful to health due to the possibility of capillary blockage.[23]

MICROSPHERES:

Microspheres are an example of a drug delivery system that has been widely evaluated in cancer chemotherapy. They are basically solid porous particles (with a diameter of 1-100 μm) that can both target their drug load by physical capture in blood vessels (chemoembolization) and maintain the effect of the therapeutic agent through controlled-release polymeric materials, including proteins, polysaccharides, polyesters and lipids by a number of different techniques (emulsification, thermal stabilization and phase inversion technology). Their diversity identifies the microsphere as a drug delivery system with considerable flexibility. The present.Review develops the hypothesis that matrix material and method of preparation are critical determinants in defining pharmaceutical

properties, which in turn dictate biological activity. Examples of different approaches taken with cytotoxic drugs (mainly doxorubicin, mitomycin C, cisplatin and 5-fluorouracil) to achieve specific drug delivery profiles are given. However, it is clear that certain cytotoxic drugs are encapsulated in systems with pharmaceutical properties inappropriate for a particular mechanism class. Also, studies demonstrating the selective targeting of cytotoxic drugs to tumors after systemic administration are rare.[24]

Transdermal drug delivery system :

Transdermal medication delivery is the application of self- contained, discrete dosage forms to intact skin in order to administer drugs to the bloodstream at a controlled rate. An essential component of new drug delivery systems, the transdermal drug delivery system (TDDS) has become well -established · The transdermal route is an intriguing choice For delivery because it is practical and secure .

- The advantages of administering medications through the Skin to produce systemic effects include: Avoiding first Pass metabolism.
- Preventing gastro intestinal compatibility issues
- Predictable action with a long duration
- Enhancing pharmacological and physiological Responsiveness
- Therapy can come stopped at any time with ease.
- Increased patient compliance as a result of the removal of Multiple dosing
- The profile Possess the capacity for self-management
- To improve therapeutic efficacy[26]

Mucoadhesive drug delivery systems :

The situation in which two materials, at least one of which is Biological in nature, are kept together for a long time by Interfacial forces is known as bioadhesion. In the field of Pharmaceutical sciences, the phenomenon is known as Mucoadhesion when the sticky connection is to mucus or a Mucous membrane. Mucoadhesive polymers have the Potential to considerably extend the residence time of Sustained release delivery systems on mucosal membranes. This potential has been demonstrated in drug delivery Systems for the eyes, nose, mouth, and vagina. Additionally, There has always been a lot of interest in the development of Oral mucoadhesive delivery systems because those that can Adhere to certain gastrointestinal (GI) segments would have a Number of benefits[27-28]

Osmotically controlled drug delivery systems :

These systems use osmotic pressure as their driving force in Order to deliver the medicine in a regulated manner. The most Intriguing and well-liked method of drug delivery among all The available technologies is osmotic. Osmotic systems have Been the subject of extensive research, and various patents Have also been made public.

Alza was a leader in the Development of osmotic drug delivery systems, and it Currently holds the majority of the patents examined as well as Various products based on the osmotic principle. These Methods can be employed for parenteral as well as oral Administration. Gastro-intestinal therapeutic methods include Oral osmotic systems. Implantable pumps are used for Parenteral osmotic medication delivery. Osmotic pumps come In a variety of shapes and sizes, according to reports in the Literature but in general they can be divided in oral and Implantable systems[29-30]

Microencapsulation:

The method of microencapsulation involves surrounding or Coating tiny droplets or particles of liquid or solid substance With a continuous film made of polymeric materials. First, thgelatin coacervation process was used to prepare gelatin Spheres for the microencapsulation technique, which was Developed by Bungen burg de Jon and Kan in 1931. The Controlled drug delivery system has been utilized to lessen the Drawbacks of traditional therapy and to increase a specific Medicine's therapeutic effectiveness. The active substance Must be delivered to the target tissue at the ideal rate in order To have the greatest therapeutic efficacy, while also producing The least amount of toxicity and side effects possible. The Microencapsulation technique aids in the transformation of Liquids into solids, alteration of colloidal and surface Properties, protection of the environment, and regulation of The release characteristics of various coated materials. In Contrast to microencapsulation, which uses tiny coated Particles to create a wide range of dosage forms, Micromanaging techniques can achieve some of these features.[32]

Use Of novel drug delivery system (NDDS) in Herbal Medications:

The use of NDDS in the herbal medication is of utmost importance because if the herbal medicine is not Properly administered in the body there are chances that the efficacy of the medication is significantly reduced, For example- Some of the herbal formulations when given orally then usually many compounds get destroyed in The highly acidic pH of the stomach. If not digested in the stomach then many compounds are digested by the Liver and pancreatic enzymes before even reaching the blood stream. All these actions result in inadequate Amount of drug to be released in the blood because of which the potency of action of the drug reduces Significantly. For the effective delivery of the plant based medicine Lipid-based drug delivery systems have Been tested in various researches and have shown great potential in target delivery of the plant active Compound. The Lipid based delivery systems also ensure controlled release of the drug. One of the most Effective and novel drug delivery system that can be best in transfer of herbal medicine is the Phytosome. Phytosomes are themselves plant derived, these are lipophilic substances that are derived from the plants like Silybum Marianum,Ginkgo Biloba, ginseng etc. Phytosome are also known as phytolipids delivery system. They help in target delivery of the herbal compound and also enhance the bioavailability of the drug. Certain Acute liver ailments can be effectively treated using phytosomes. Production and formation of phytosomes is Done by using plant extracts like flavonolignans and terpenoids. These plant extracts are later bound to the Phospholipid structures to impart stability in them.

Phytosomes can be very useful in not just medicine but also In the cosmetology. The use of NDDS in transport of herbal medicine still needs to be studied extensively so That better understanding of these can be made and later more potent and effective drugs can be produced Through use of these advanced technologies.[32]

Conclusion:

Nanoparticles represent a promising controlled and selective release mechanism for drug delivery. Advances in nanotechnology will undoubtedly have a significant impact on the pharmaceutical supply industry, impacting virtually every route from oral to injectable. The patented drug's lower drug toxicity, lower treatment costs, improved bioavailability, and extended economic life are expected to benefit both doctors and patients. This can increase the effectiveness of drug treatment and reduce 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

In the current scientific panorama when the area of novel drug delivery system has been recognized for its palpable benefits, unique potential of providing physical stability, sustained and site-specific drug delivery for a scheduled period of time can open new vistas for precise, safe and quality treatment .

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