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Development and Evaluation of NDDS: Review

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Abstract *— Plants are the nature of medicine of nature and are used by people earth has been for food and medicine since Ancient times. Today's World wide movements to locate herbal medicines in laboratory plants scale and subsequent pre-clinical and clinical trials business with an effective human drug supply system. To enhance the delivery of herbal drugs by increasing their therapeutic benefits and reducing their toxicity, the need for Innovation drug delivery system has increased. This review provides information on numerous strategies used to increase the efficiency and safety of phytomedicines, as well as employing novel formulations. It includes enhancement of solubility, bioavailability and protection from toxicity, etc . The herbal drugs can be used in a more upright source with enhance effectiveness by incorporating them into suitable dosage forms.*

Keywords *— **Novel drug delivery system, Herbal drugs , Phytosomes, Liposomes, Nanoparticles, drug carries, stability.***

I. INTRODUCTION

A Nobel drug delivery system is the new system advances in the understanding of pharmacokinetics & pharmacodynamics behavior of the drug which offer a more rational approach to the development of optimal drug delivery system.

The novel drug delivery system **(NDDS)** are carries which maintain the drug conc. In therapeutic ranges for longer time . There are several advantages of novel drug delivery system over conventional drug delivery , as follows

I. Optimum therapeutic – drug concentration in the blood system or in a tissue may be maintained over a prolonged period of time.
II. Pre-determined rate of the drug which help to extend drug action.
III. Short half-life drug may be increased.
IV. By targeting the site of action, side effects may be decreased. V. Frequent dosing and wastage of the drug may be reduced.
V. Better patient compliance.

NOVAL DRUG DELIVERY SYSTEM

There are various drug delivery system have been developed and some of them under development with an aim to minimize drug loss, to prevent from harmful side effects and to increased drug bioavailability and also to favor and facilitate.

It is easy to evaluate different terms used under the different broad categories of novel drug delivery system.**(1*)**

NDDS

Drug delivery system **(DDS'S)** are developed to deliver the required amount of drug effectively to

appropriate target sites and to maintain the desired drug levels.

Research in newer **DDS** is being carried out in liposomes, nanoparticles , niosomes, transdermal drug delivery, implants, microencapsulation, and polymers .

Nanoparticles have been thoroughly studied as a targeted drug delivery system.

Active targeting or passive targeting can achieve targeted drug delivery. Active drug targeting many occur through either the conjugation of the drug molecule with a cell or tissue – specific ligand

- Matrix - type nanospheres
- Reservoir – type nanospheres

II. NEED TO STUDY

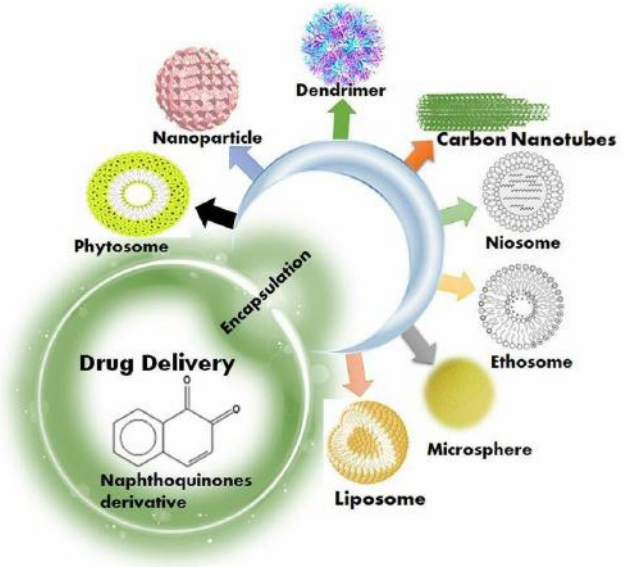
95% of all experimental drugs have low pharmacokinetics properties at present.

Consequently, suitable medication distribution schema must only be established at the site without harming healthy bodies and tissues , which will disperse therapeutically activated drug molecule, lower the efficacy doses as well as improve therapeutic indices and safety in new therapists . Various explanation are,

- **Pharmaceutical**
  - Confusion in traditional dosing – solubility
- **Biotechnology**
  - High diaphragm borders
  - Instability of the organism
- **Pharmaceutical/pharmacodynamics** Short half of a lifespan
  - Wide distribution volumes
  - Limited pace**(2*)**

HERBAL DRUGS

Herbal formulations means a dosage form consisting of one or more herbs or pressed herb(s) in specified quantities to provide specific nutritional, cosmetic benefits, and/or other benefits meant for use to diagnose treat, mitigate disease of human being or animals and /or to alter the structure or physiology of human beings or animals.**(3*)**



Advantages of herbal drugs

Herbal drugs posses following advantages;;

4.1.1 *low risk of risk effects*

Mostly herbal drugs are well tolerated by the patient, having fewer unintended consequences and fewer side-effects than traditional medicine, and may be safer to use.

4.1.2 *Effectiveness*

Modern medicine treats sudden and serious illnesses and accident much more effectively than herbal or alternative treatments. An herbalist would not be able to treat serious trauma, such as broken leg, not would he be able to heal appendicitis or a heart attack as effectively as a conventional doctor using modern diagnostic tests , surgery , and drugs.

4.1.3 *lower cost*

Cost of herbal drugs is much less than prescription medication. Research, testing and marketing add considerably to the cost of prescription medication. Herbs tend to be inexpensive compared to drugs .

4.1.4 *widespread availability*

Herbs are available without a prescription.

Simple herbs, such as peppermint and chamomile, can be cultivated at home .**(3*)**

Limitations of herbal drugs

Herbal drugs possess following limitations;

4.2.1 *Not suitable for many diseases*

Modern medicine treats sudden and serious illnesses and accidents.

4.2.2 *lack of dosage instructions*

Self-treatment with herbal drugs may consist of many risk factors. Moreover, with no proper direction of doses may lead to overdose.

4.2.3 *poison risk associated with wild herbs*

Consumption of herbal drugs without correct identification of plants i.e., use of wrong part of plant may lead to poisoning. **(3*)**

Total Advancement in Herbal Remedies Delivery system

PHYTOSOMES :-

With a close resemblance to liposomes, PHYTOSOMES are a cutting edge lipid based delivery system that can be exploited to entrap numerous phytoconstitution with polyphenolic bases to promote their absorption when delivered.**(4*)**

The drug itself is conjugated with lipids to generate vesicles , which promote phytosomal entrapment efficiency even further. As a result, the dose requirements has been minimize while the drug's bioavailability has been significantly increased.**(5*)**

PHYTOSOMES possess numerous benefits, such as lipid layer surrounding the phytoconstitution

. PHYTOSOMES have the capacity to penetrate skin and hence significantly enhance effectiveness. Phospholipid, aka phosphatidycholine , is among the essential components of phytosomes, serves as a vesicles , and has health advantages such as hepatoprotective action .

(6*)

Phytosomes have an optimized stability profile as a result of the chemical interactions that have been established b/w the phosphatidycholine molecule and the botanical extracts, and due to the enhanced absorption of the active ingredients, even the mildest dose can result in the desired effect.**(7*)**

NANOPARTICLES:-

Nanoparticle (NP's), which typically vary in size from 1 to 1000 nm , can contain active component that are either internal to the particles or surface adsorbed to be used for controlled release, to mask drugs and other molecule from the environment and to enhance bioavailability and therapeutic index.**(8*)**

Depending on the method of preparation, it is possible to synthesis nanoparticles (**nanospheres and nanocapsules**). The drug is enclosed within the cavity that is enclosed by a polymer membrane in nanocapsules, whereas the drug is physically and uniformly spread throughout the matrix in the nanospheres.**(9*)**

Microemulsions and microspheres :-

Due to their , increased drug solubilization , longer shelf life and adaptability in preparation and administration, Microemulsions are among the ideal option as novel drug delivery system. Microemulsions are liquid solution of oil, water, and amphiphile that are thermodynamically stable and optically, isotropic and enable medication administration via ovular, percutaneous, topical , oral, transdermal and parenteral routes with controlled or sustained release. Microemulsions differ from conventional emulsion as

they have low viscosity and transparency and are thermodynamically stable.**(10*)**

By using Microemulsions as a delivery mechanism , a drugs effectiveness can be increased, lowering the overall dose and adverse effects . Moreover,

Microemulsions possess the capability to deliver medicine that are both lipophilic and hydrophilic , further because of the thermodynamic stability of

Microemulsions , they are simple to make and require no amount of energy, and the synthesis can be controlled or reserved. The Microemulsions reforms when the temperature, which was unstable at low or high temperature, is brought back within the stability range . **(11*)**

Niosomes :-

By hydrating a mixture of cholesterol and non ionic surfactant, niosomes, which are non ionic surfactant vesicles, are synthesized. It can be used to transport both lipophilic and amphiphilic drugs . The medicine 💊 is enclosed in a vesicles in the niosomes dug delivery mechanism. Niosomes are flexible in their structural characteristics, biodegradable, non immunogenic and biocompatible. **(12*)**

The vesicles formulations properties can be modified their composition, size , lamellarity , tapping volume, surface charge and concentration; therefore, they can reduce drug toxicity because of their non ionic nature. Niosomes can accept drug molecule with a wide variety of solubility due to their infrastructure, which combine hydrophilic, amphiphilic and lipophilic constitution. Also , the vesicles suspension is based on water . When compared to dosage forms that are oily , this promotes great patient compliance. **(13*)**

Proniosomes :-

A stable pro vesicular system called the proniosomal drug delivery system was developed in nanotechnology to address the problem with other vesicular system. These are non ionic pro vesicular drug carries that are water soluble and transform into niosomes when hydrated. The system contains and exhibits a systemic and focused distribution of poorly soluble medication with higher bioavailability and lower negative effects.**(14*)**

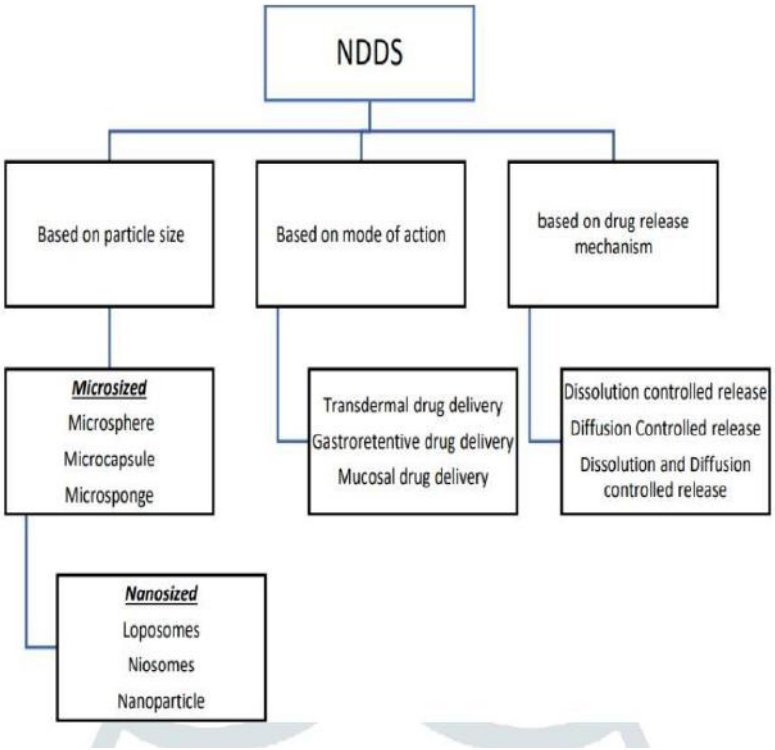
Niosomes made from proniosomes will behave *in vivo* similarly to liposomes and have advantages in terms of drug delivery, including lower cost and toxicity, ease of storage and handling and enhanced stability. **(15*)**

Pinzaru *et al.* 2021: prepared a novel rutin formulations as a proniosomal gel for cutaneous application. Proniosomal gel was prepared using the coacervation phase – separation method and meets all standards for particle size **(140.5 ± 2.56 nm) ,** Zeta potential **(-27.33 ± 0.08 mV) ,** encapsulation capacity **(→50%) ,** pH **(7.002 ± 0.18) ,** and reological characteristics.**(16*)**

Dendrimer :-

Dendrimer, which generally weigh 5000-500000 g/mol and are three dimensional, highly branching, well organized nanoscale macromolecules, have demonstrated a crucial role in the developing area of nanomedicine . Dendrimer are recognised for their well defined structures , adaptability in drug delivery, and high functionality, many of those characteristics are similar to those of biomolecules. By using host guest interactions and covalent bonding , respectively, these nanostructured macromolecules have demonstrated their prospective capabilities to entrap or conjugated the high molecular weight hydrophilic and hydrophobic entities. They are also promising synthetic vectors for gene transport due to high ratio of surface groups to molecule volume.**(17*)**

Classification of NDDS :-



 # EVALUATION PARAMETERS OF THE FORMULATIONS :-

These review focus on various evaluation parameters to different novel drug delivery system such as physical characteristics including particle size , particle shape , homogeneity, drug loading , drug entrapment efficiency, swelling index, bulk density etc.

(A) Particle size

In order to study the micrometric properties of powered drugs and excipients, particle size determination is a technique used to determine the appearance, shape size , and distribution of the particles . Depending on the test specimen's characteristics and the measurement goal, optical microscopy issued.

To maximize cellular absorption and therapeutic index , various lipidic nanocarrier types have been used as drug delivery system for diagnostic and targeting nanotherapy (using active or passive targeting mechanism).

It is possible to manufacture and process nanocarrier to have different composition, sizes , and lamellarities .**(18*)**

(B) ***Homogeneity***

Homogeneity is defined as the state in which the drug molecule are evenly distributed through out the formulations. It is determined by FTIR spectrophotometer and NMR spectrophotometer. The sample is scanned over there as of wavelength 4000 to 400 nm.

FTIR

Nano diamond one of the nanoparticles, is loaded with pharmaceutical drugs where the homogeneity is measured with the help of FTIR. Additionally , the nano diamond – amlodipine conjugated is apparently FTIR bands of amlodipine and nano diamond.**(19*)**

(C) Drug loading

In the context of nano medicine and nanotechnology based drug delivery system (NDDS) , drug loading refers to the process of

incorporated therapeutic agents (drugs) into the carrier or delivery system.

The loading process involves the physical or chemical associated of the drug with the carrier system .

The loading efficiency refers to amount of drug that is successful incorporated into the carrier system, expressed as a percentage of total drug used in the formulations.

Therefore, careful consideration and optimization of drug loading parameters are crucial in the development of effective and efficient nano medicine based drug delivery system.**(20*)**

(D) ***Drug Entrapment efficiency***

These systems are designed to enhance the therapeutic effectiveness and safety of drugs by delivering them to the target site in a controlled manner . Drug Entrapment in NDDS refers to the process of capturing or encapsulating a drug within the delivery system.

A few common methods used for drug Entrapment in NDDS:

Microencapsulation , Liposomes , Nanoparticles , Nanocapsules ,

Dendrimers .**(21*)**

(E) ***Swelling index***

The term , "swelling index" typically refers to a characteristic of certain drug delivery system, particularly hydrogels or swelling based systems. Swelling index in NDDS refers to the ability of a hydrogels or swelling based Drug Delivery System to absorb and retain fluids , typically water or biological fluids .

It is measured of the extent to which the system swells upon contact with the fluid, and it is often expressed as a percentage.**(22*)**

(F) ***Bulk density***

Bulk density refers to the mass of a powered or granular substance divided by its bulk volume, usually expressed in grams per millilitre (g/mL) or cubic centimetre (g/cm^3). It measures of how closely the particles are packed together within a given volume.

Bulk density in an important parameters in the formulations and characteristics of NDDS , as it can influence various aspects of drug delivery, such as flow properties, compressibility and dissolution behaviour. Bulk densities can affect the manufacturing process, dosage form design and ultimately the dug release kinetics.**(23*)**

(G) ***Tapped Density***

Tapped Density refers to a measurement that characteristics the packing properties of a properties of a powered material. It is an important parameters in the development and manufacturing of solid dosage forms such as tablets and capsules.

The tapped Density is expressed as the mass of the powder divided by the volume occupied after tapping.

It is typically reported in units of grams per millilitre (g/ml) or grams per cubic (g/cm^3) .

Tapped Density provides information about the powder s flow properties.

D=M/Vp

Where , D^0 is bulk density, M is weight of sample in grams and Vp is final tapped volumes of granules in cm^3.**(24*)**

(H) ***Viscosity***

Viscosity in the context of New Drug Delivery System (NDDS) Refers to the measure of a formulations resistance to flow.

It is a fundamental property that characteristics the thickness or stickiness of a liquid or semi solid formulations.

Viscosity plays a crucial role in the development and performance of various dosage forms, including oral suspension, topical creams , gels and injectable solutions.**(25*)**

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