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A Review Article on Novel Drug Delivery Dosage Forms

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ABSTRACT:-

Novel pharmaceutical drug dosage forms cover broad range of formulation delivery platforms like - tablets, capsules, cachets, sustained release dosage forms, parenteral dosage forms, transdermal dosage forms, metered dose inhalants, solutions, emulsions, and suspension. there are a number of analytical techniques (i.e. chromatographic, titrimetric, gravimetric, etc.) and manual (i.e. grinding, shaking, sonication, centrifugation,etc.) or automated robotic (i.e.homogenizers) sample preparation procedures available for the pharmaceutical dosage forms analysis, the nature of the dosage form dictates the kind of analytical technique and sample preparation that procedure to employ.

1. INTRODUCTION

The method by which a drug is delivered may have a significant effect on its efficacy. Some drugs have an optimum concentration range within which maximum benefit are derived, and concentrations above or below this range may be toxic or produce no therapeutic benefit at all .

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 the new ideas on controlling the pharmacokinetics, pharmacodynamics, non-specific toxicity, immunogenicity, biorecognition, and efficacy of drugs were generated.

These are new strategies, often called drug delivery systems (DDS), which are based on interdisciplinary approaches that combine polymer science, pharmaceutics.

Controlled and Novel Drug Delivery which are only a dream or at best a possibility is now a reality.

During last decade and half pharmaceutical and other scientists have carried out extensive and intensive investigations in this field of drug research.

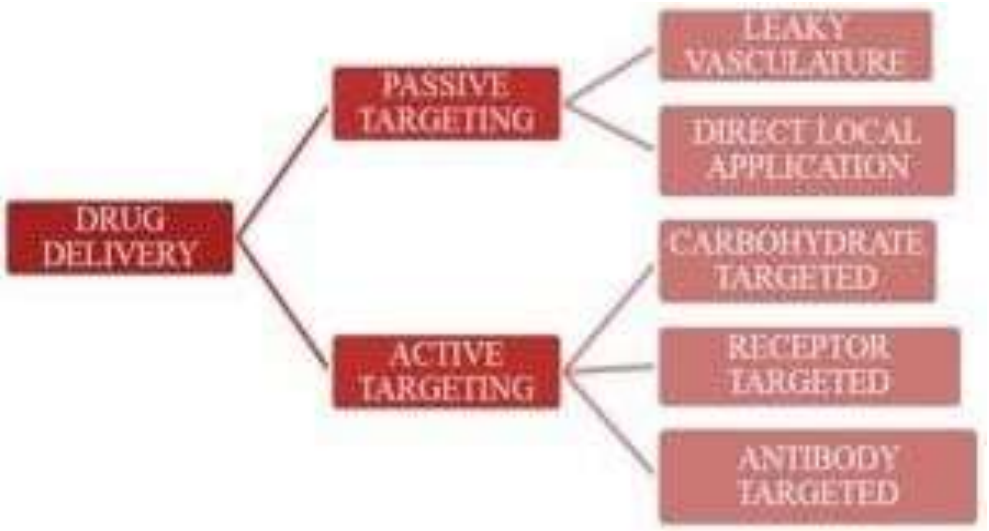
Among drug carriers name of soluble polymers, microparticles made of insoluble or biodegradable, natural and synthetic polymers, microcapsules, cells, cell ghosts, lipoproteins, liposomes, and micelles. The carriers can be made slowly degradable, stimuli-reactive (e.g., pH- or temperature-sensitive), and even targeted (e.g., by conjugating them with specific antibodies against certain characteristic components of the area of interest). Targeting are the ability to direct the drug-loaded system to the site of interest.

Two major mechanisms can be distinguished for addressing the desired sites for drug release.

1. Passive target
2. Active target

There are some example of passive targeting is the preferential accumulation of chemotherapeutic agents in solid tumors as a result of the enhanced vascular permeability of tumor tissues compared with healthy tissue.

A strategy that could allow active targeting involves the surface functionalization of drug carriers with ligands that are selectively recognized by receptors on the surface of the cells of interest. Since ligand–receptor interactions can be highly selective, this may be allow to more precise targeting of the site of interest.



Any drug delivery system may be defined as a system comprising of:

1. Medical device or dosage form/technology to carry the drudrug inside the body
2. Drug formulation
3. Mechanism for the release

These dosage forms have been found to be serious limitations in terms of higher dosage required, lower effectiveness, toxicity and adverse side effects.

New drug delivery systems have developed or are being developed to overcome the limitation of the conventional drug delivery systems to meet the need of the healthcare profession.

Conventional drugs delivery involves the formulation of drug into a suitable form, like a compressed tablet for oral administration or a solution for intravenous administration.

These are systems can be characterised as controlled drug release systems and targeted drug delivery systems.

These are therapeutic benefits of these new systems include:

- Viable treatments for previously incurable diseases
- Increased efficacy of the drug
- Site specific delivery
- Decreased toxicity/side effects
- Increased convenience
- Potential for prophylactic applications
- Better patient compliance.

There are no uniform and established definition of drug delivery systems. It is assumed to be based on two basic parameters:

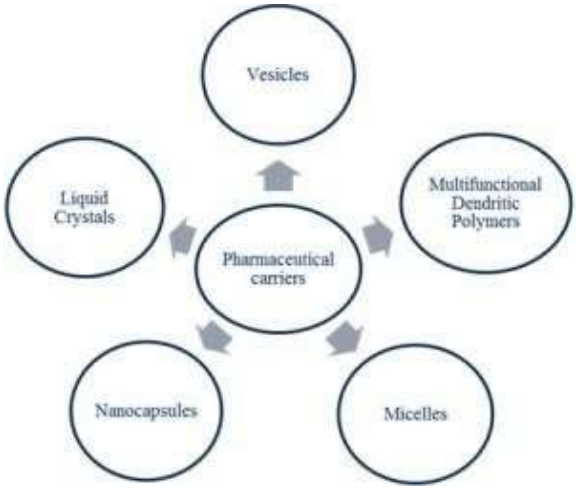
A. Route of entry
B. Dosage form

Carrier based Drug Delivery System

1. Microspheres
2. Nanoparticles
3. Niosomes
4. Liposomes
5. Monoclonal antibodies
6. Resealed erythrocytes as drug carriers

Drug Delivery Carriers: Colloidal drug are carrier systems such as micellar solutions, vesicle and liquid crystal dispersions, as well as nanoparticle dispersions consisting of small particles of 10–400 nm diameter show great promise as drug delivery systems. When the developing these are formulations, the goal is to obtain systems with optimized drug loading and release properties, long shelf-life and low toxicity.

The incorporated drugs are participat in the microstructure of the system, and may even influence it due to molecular interactions, especially when the drug are possesses amphiphilic and mesogenic properties.



DIFFERENT PHARMACEUTICAL CARRIERS

Pharmaceutical Carriers: Micelles are formed by self-assembly of amphiphilic block copolymers (5-50 nm) in aqueous solutions are of great interest for drug delivery applications. The drugs may be physically entrapped in the core of block copolymers are micelles and transported at concentrations that can be exceed their intrinsic water- solubility. Moreover the hydrophilic blocks may form hydrogen bonds with the aqueous surroundings and form a tight shell around the micellar core. As a result the contents of the hydrophobic cores are effectively protected against hydrolysis and enzymatic degradation.

A final feature may be makes amphiphilic block copolymers attractive for drug delivery applications are the fact that their chemical composition, total molecular weight and block length ratios can be easily changed, which allows control of the size and morphology of the micelles.

Functionalizations of block copolymers with cross linkable groups may increase the stability of the corresponding micelles and improve their temporal control. Substitutions of block copolymer micelles with specific ligands is a very promising strategy to a broader range of sites of activity with a much higher selectivity.

Liposomes:

Liposomes are the form of vesicles that consist of many few or just one phospholipid bilayers. The polar characters of liposomal core enables polar drugs molecules may be encapsulated.

Amphiphilic and lipophilic molecules are may be solubilised within the phospholipid bilayers according to their affinity towards of phospholipids. Participations of nonionic surfactants are instead of phospholipids in the bilayer formation results in niosomes. Channel proteins may be incorporated without loss of their activity within the hydrophobic domain of vesicle membranes, act as a size-selective filter, only passive diffusion of small solutes such as ions, nutrients and antibiotics.

Thus, drugs may be are encapsulated in a nanocage-functionalized with channel proteins are effectively protected from premature degradation by proteolytic enzymes.

Dendrimers are nanometer-sized, highly branched and monodisperse macromolecules with symmetrical architecture. These are consist of a central core, branching units and terminal functional groups. These cores are together with the internal units, determine the environment of the nanocavities and consequently their solubilizing properties, whereas the external groups are solubility and chemical behaviour of the these polymers.

Targeting the effectiveness of affected by attaching targeting ligands at the external surface of the dendrimers, while their stability and protection from the Mononuclear Phagocyte System (MPS). it is being achieved by functionalization of the dendrimers with polyethylene glycol chains (PEG). Liquid Crystals combine the properties of both liquid and solid states.

They may be made to form different geometries with alternative polar and non-polar layers (i.e. a lamellar phase) where aqueous drug solutions can be included.

Nanoparticles:

Nanoparticles may be including nanospheres and nanocapsules of size 10-200nm are in the solid state and are either amorphous or crystalline. They are may be able to adsorb and encapsulate a drug, thus protecting it against the chemical and enzymatic degradation.

In the recent years, biodegradable polymeric nanoparticles has attracted considerable attention as potential drug delivery devices in view of their applications in the controlled release of drugs, in targeting particular organ tissue, as carriers of DNA in gene therapy, and in their abilities to deliver proteins peptides and genes through peroral route.

Classification of Nanomaterials

Nanotubes- They are hallow cylinders which are made of carbon atoms. They may also be filled and sealed, forming test tubes or potential drug delivery devices.

Nanowires- Glowing silica which are nano wire is wraped around a single stand of humans hair. It looks like delicate. These are may be five times smaller than virus applications for nano wires include the early sensing of breast and ovarian malignancies.

Nanocantilever- The honey comb mesh like behind this tiny carbon cantilever is surface of fly's eye.

Cantilevers are beams anchored at only one end. In the nano world they may function as sensors ideal for detecting the presence of extremely small molecules in biological fluid.

Nanoshells- Nanoshells are hollow silica spheres covered with gold.the Scientists may attach antibodies to their surfaces enabling the shells to target certain shells such as cancer cells. Nano shells one day also are filled with drug containing polymers.

Gold nanoparticles- These are nanoparticles seen in transmission electron micrograph image, they may have solid core. Researchs at north western university are using gold particles to develop ultra sensitive detection systems for DNA and protein markers associated with many forms of cancer including breast, prostate cancer.

Bucky balls- Bucky balls are common for the molecule called buckminsterfullerene, which are made of 60 carbon atoms formed in shape of hollow ball discovered in 1985. Bucky balls and other fullerenes because of their chemistry and their unusual hollow cage like shape extremely stable and it may be withstand high temperatures.

Quantum dots- The Quantum dots are miniscule semiconductor particles that may serve as sign pots of certain type of cells or molecules in the body. They can do this because of they emit different wavelengths of radiations which are depending upon the type of cadmium used in their cores. Cadmium sulphide for ultraviolet to blue, cadmium selinide for most of the visible spectrum and cadmium telluride for far infra red and near infra red.

Applications.

Bucky balls may be can see widespread use in future products and applications from the drug delivery vehicles for cancer therapy to ultra hard coating and military harmor.

- Bucky balls have high potential that accumulate in living tissue.
- Bucky balls as powerful antioxidants and also inhibitor of HIV.
- Bucky ball- Antibody combination delivers antitumor drugs.
- Bucky balls to fight allergy.
- balls hurt cells.
- Bucky Difficulty of targeting drug delivery location

Carbon nanotubes: The Carbon nanotubes can be modified to circulate well in side the body. Such modifications may be accomplished with covalent or non covalent bonding. Modifications can increase or decrease circulation time in side the body.

Carbon nanotubes have no significant toxicity when they have modified as to be soluble in aqueous body type of fluids. They enter readily into the cells.

Canceras cells in tumor are larger than normal cells and also may exhibit leakage. Large number of molecules which circulate slowly can leak into and accumulate in cancer cell. Carbon nanotubes carrying active agents have been demonstrated in animal studies to do this. Researches have also used carbon tubes to deliver the precursors of active drug which are called a prodrug.

eg: Cisplatin .

Microspheres: Microspheres are characteristically free flowing powders consisting of the proteins or synthetic polymers which are biodegradable in nature and ideally that having a particle size less than 200 μm.

Materials used for preparing Microspheres are polymers.

They are classified into two types:

1. Synthetic Polymer
2. Natural Polymer

Synthetic polymers are divided into two types.

1.Non-biodegradable polymers.

- methyl methacrylate (PMMA)
- Poly Glycidyl methacrylate
- Epoxy polymers

2.Biodegradable polymers.

- Lactides, Glycolides & their co polymers
- Poly alkyl cyano acrylates
- Poly anhydrides

Synthetic polymers: Poly alkyl cyano acrylates are a potential drug carrier for parenteral as well as other ophthalmic, oral preparations.

Poly lactic acid is a suitable that is carrier for sustained release of narcotic antagonist, anti cancer agents such as cisplatin, cyclo phosphamide, and doxorubicin.

Poly adipic anhydride is that used to encapsulate timolol maleate for ocular delivery. Poly acrolein microspheres are functional type of microspheres. They are not require any activation step since the surfacial free -CHO groups over the poly acrolein that can react with NH_2 group of protein to form Schiff's base.

Sustained release preparations thar are for the anti-malarial drug as well as for many other drugs that have been formulated by using of co-polymer of poly lactic acid and poly glycolic acid. Poly anhydride microspheres (40μm) that have been investigated to extend the precorneal residence time for ocular delivery.

In the case of non-biodegradable drug carriers, when these are administered parenterally, the carrier remaining in body after the drug is completely released poses possibility of carrier toxicity over a long period of time. Biodegradable carriers which are degraded in the body to non- toxic degradation products do not pose the problem of carrier toxicity and are more suited for parenteral applications

Natural polymers obtained from different sources like proteins, carbohydrates and chemically modified carbohydrates.

- **Carbohydrates:** Agarose, Carrageenan, Chitosan, Starch.
- **Proteins:** Albumin, Gelatin, and Collagen.
- **Chemically modifiedc arbohydrates:** Polydextran**,** Poly starch**.**

Natural polymers: Albumins are widely distributed natural protein. These are considered as a potential carrier of drug or protiens (for either their site specific localization or their local application into anatomical discrete sites). These are being widely used for the targeted drug for the targeted drug delivery to the tumour cells.

Gelatins microspheres that can be used as efficient carrier system capable of delivering the drug or biological response modifiers such as interferon to phagocytes. Starch that belongs to carbohydrate class. These are consists of principle glucopyranose unit, which are on hydrolysis yields D-glucose

It is being a poly saccharide consists of a large number of free OH groups.

By the means of these free -OH groups a large number of active ingredients that can be incorporated within as well as active on surface of microspheres.

Chitosans that are a deacylated product of chitin. The effect of chitosan have been considered because of its charge. These are insoluble at neutral and alkaline pH values, but in forms salts with inorganic and organic salts. Upon dissolution, the amino groups of chitosan which are get protonated, and the resultant polymer becomes positively charged.

CONCLUSION:

The bioavailability of the drugs are crucial to achieving the desired action from any dosage forms. Controlled drug delivery systems have been emerged as an alternative to the conventional sort,it is to improve the bioavailability of druge, extent the drug release and maintain the drug plasma levels within therapeutic window with the minimal side effects.

The dosage forms are the combination of drugs and excipients. Excipients are used to get a structure, enhance stability and mask the taste. Solid, semisolid and liquid dosage forms are the conventional dosage forms that is suffer from the fluctuations in plasma drug levels which are demands high dosing and dosing frequency with the poor patient compliance.

Controlled drug delivery system which increases the drug solubility and stability and offers the selective delivery of drugs which are predictable rate and mechanism to specific organ/tissue/cells. Dissolution, diffusion, water penetration and chemically controlled drug delivery systems which are the types of controlled drug delivery systems.

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