

Novel Drug Delivery System and Drug Targeting

14. WEEK

Drug Delivery

- Drug delivery is the method or process of administering pharmaceutical compound to achieve a therapeutic effect in humans or animals.
- Most common methods of delivery include the preferred non-invasive peroral (through the mouth), topical (skin), transmucosal (nasal, buccal, sublingual, vaginal, ocular and rectal) and inhalation routes.

- Many medications such as peptide and protein, antibody, vaccine and gene based drugs, in general may not be administered using these routes because they might be susceptible to enzymatic degradation or can not be absorbed into the systemic circulation efficiently due to molecular size and charge issues to be therapeutically effective.
- Protein and peptide drugs have to be delivered by injection.

Novel Drug Delivery System

Novel Drug delivery System (NDDS) refers to the approaches, formulations, technologies, and systems for transporting a pharmaceutical compound in the body as needed to safely achieve its desired therapeutic effects. It may involve scientific site-targeting within the body, or it might involve facilitating systemic pharmacokinetics; in any case, it is typically concerned with both quantity and duration of drug presence”.

Why do we need NDDS?

- The conventional dosage forms provide drug release immediately and it causes fluctuation of drug level in blood depending upon dosage form.
- Therefore to maintain the drug concentration within therapeutically effective range need novel drug delivery system.

- Novel drug delivery is often approached via a drug's chemical formulation, but it may also involve medical devices or drug-device combination products. Drug delivery is a concept heavily integrated with dosage form and route of administration.
- NDDS is advanced drug delivery system which improves drug potency, control drug release to give a sustained therapeutic effect, provide greater safety, finally it is to target a drug specifically to a desired tissue.

- NDDS is a system for delivery of drug other than conventional drug delivery system.
- NDDS is a combination of advance technique and new dosage forms which are far better than conventional dosage forms.

Advantages of NDDS

- Decreased dosing frequency.
- Reduced rate of rise of drug concentration in blood.
- Sustained and consistent blood level within the therapeutic window.
- Enhanced bioavailability.
- To achieve a targeted drug release.
- Reduced side effects.
- Improved patient compliance.

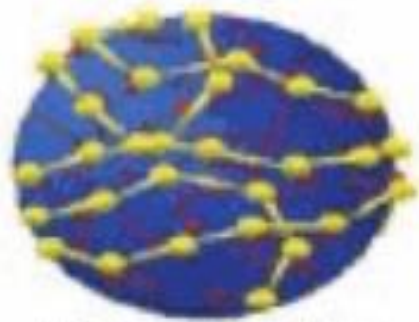
Factors affecting NDDS

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

List of drug carriers in NDDS

- Liposomes
- Niosomes
- Nanocapsules
- Nanospheres
- Nanosuspension
- Nanoemulsions
- Micelles
- Microspheres
- Microcapsules
- Micropellets
- Microemulsion

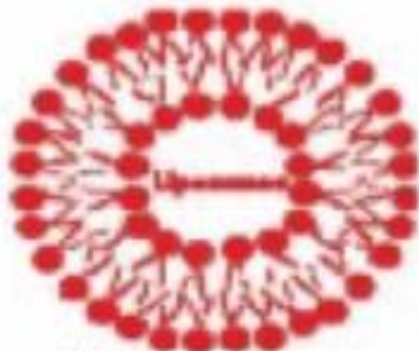
Novel Carriers for NDDS



Nanospheres



Nanocapsules

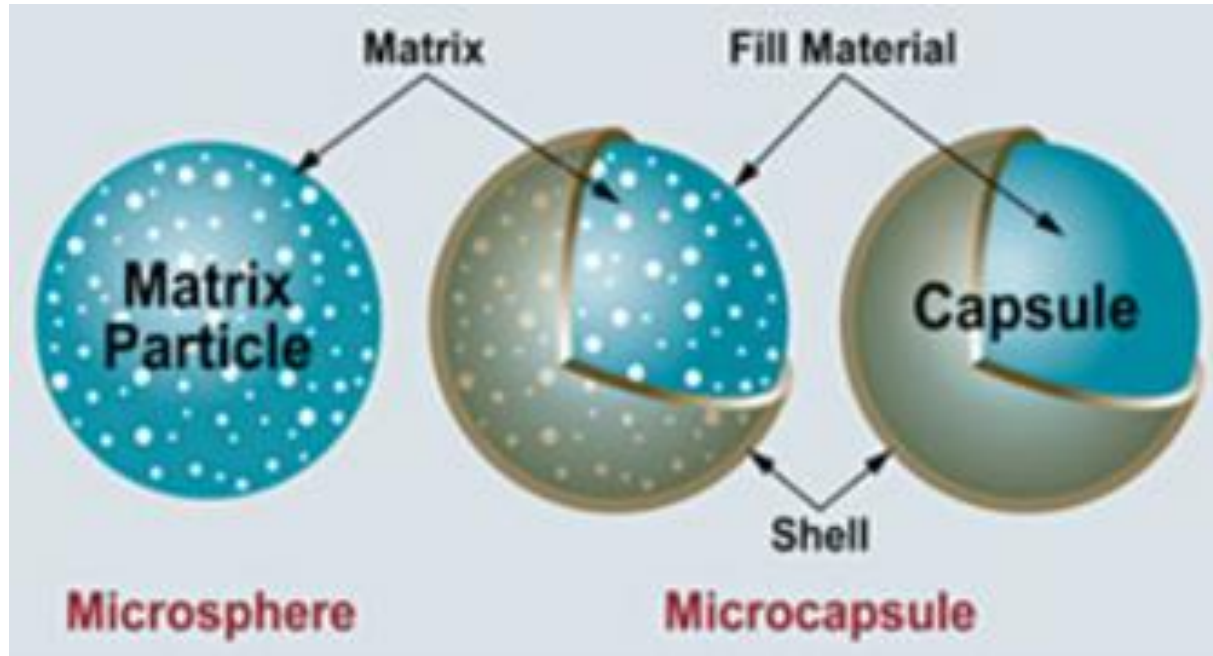


Liposomes



Micelles

Microspheres & Microcapsules



Targeted Drug Delivery System

- The drug is delivered in such a way that drug is only active in the target area of the body (cancerous tissues) in which drug is released over a period of time in a controlled manner. e.g., Colon targeted drugs.
- Delivery of drugs to their site of action is one of the major problem facing the pharmaceutical industries.

- Target drug delivery system is a special form of drug delivery system where the pharmacologically active agent or medicament is selectively targeted or delivered only to its site of action or absorption and not to the non-target organs or tissues or cells.

- Targeted drug delivery implies for selective and effective localization of pharmacologically active moiety at pre identified (preselected) target in therapeutic concentration, while restricting its access to non-target normal cellular linings, thus minimizing toxic effects and maximizing therapeutic index.

- Targeting of drugs to special cells and tissues of the body without their becoming a part of systemic circulation is a very novel idea.
- If a drug can be administered in a form such that it reaches the receptor sites in sufficient concentration without disturbing in extraneous tissue cells.

Advantages of Drug Targeting:

- Drug administration protocols may be simplified;
- Drug quantity may be greatly reduced as well as the cost of therapy;
- Drug concentration in the required sites can be sharply increased without negative effects on non-target compartments.

Disadvantages of Drug Targeting:

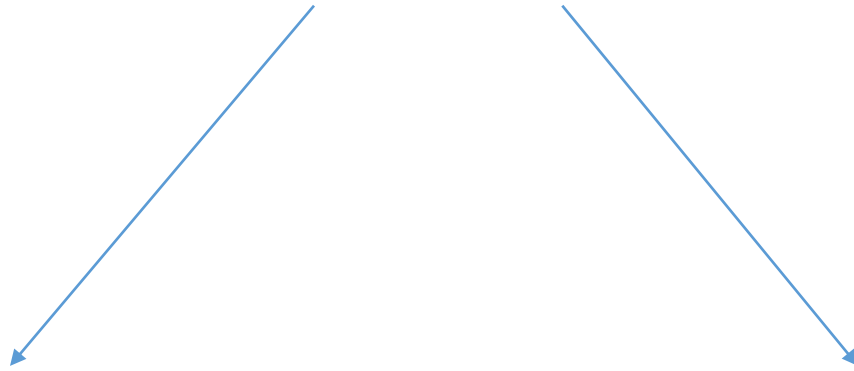
- Rapid clearance of targeted systems.
- Immune reactions against intravenous administered carrier systems.
- Insufficient localization of targeted systems into tumour cells.
- Diffusion and redistribution of released drugs.

Ideal Characteristics of Targeted Drug Delivery System

- Targeted drug delivery system should be biochemically inert (non-toxic), non-immunogenic.
- Both physically and chemically stable in vivo and in vitro.
- Restrict drug distribution to target cells or tissues or organs and should have uniform capillary distribution.
- Controllable and predictable rate of drug release.
- Drug release should not affect the drug action.
- Therapeutic amount of drug release.
- Minimal drug leakage during transit.
- Carriers used must be bio-degradable or readily eliminated from the body without any problem.
- The preparation of the delivery system should be easy or reasonably simple, reproductive and cost effective.

TYPES OF DRUG TARGETING

An ideal targeted drug delivery approach would not only increase therapeutic efficacy of drugs but also decrease the toxicity associated with drug to allow lower doses of the drug to be used in therapy. Two approaches are used passive targeting and active targeting.



Passive Targeting

Active Targeting

Passive Targeting:

Passive targeting refers to the accumulation of drug or drug-carrier system at a particular site due to physicochemical or pharmacological factors. Drug or drug carrier nanosystems can be passively targeted making use of the pathophysiological and anatomical opportunities. eg include targeting of anticancer molecules for treatment of various cancer or antimalarial drugs for treatment of leishmiansis, brucellosis, candiadsis

Active Targeting :

Active targeting employs specific modification of a drug carrier nano systems with active agents having selective affinity for recognizing and interacting with a specific cell, tissue or organ in the body . Direct coupling of drugs to targeting ligand, restricts the coupling capacity to a few drug molecules. In contrast, coupling of drug carrier nanosystems to ligands allows import of thousands of drug molecules by means of one receptor targeted ligand. Example of active targeting is use of monoclonal antibody the treatment of cancer.