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NDDS

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
- Cost-effective
- Easy to administer, safe and reliable.
- Transport the drug intact to the site of action avoiding the non-diseased tissue.
- Stable and delivery be maintained under various physiological variables.

Benefits of NDDS:

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

Novel Drug Delivery Approaches:

Various drug delivery and drug targeting systems are currently under development to

- minimize drug degradation and loss,
- to prevent harmful side-effects
- to increase drug bioavailability
- the fraction of the drug accumulated in the required zone.

Among drug carriers one can name soluble polymers, micro particles made of insoluble or biodegradable natural and synthetic polymers:

- Microcapsules
- Lipoproteins
- Liposomes
- Micelles
- Dendrimers
- Nano-Particles
- Hydrogels

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

(i) passive

(ii) active targeting.

Controlled drug release and subsequent biodegradation are important for developing successful formulations.

Potential release mechanisms involve:

(i) desorption of surface bound / adsorbed drugs;

(ii) diffusion through the carrier matrix;

(iii) diffusion (in the case of nanocapsules) through the carrier wall;

(iv) carrier matrix erosion and

(v) a combined erosion / diffusion process.

The mode of delivery can be the difference between a drug's success and failure, as the choice of a drug is often influenced by the way the medicine is administered. Sustained (or continuous) release of a drug involves polymers that release the drug at a controlled rate due to diffusion out of the polymer or by degradation of the polymer over time. Pulsatile release is often the preferred method of drug delivery, as it closely mimics the way by which the body naturally produces hormones such as insulin. It is achieved by using drug carrying polymers that respond to specific stimuli (e.g. exposure to light, changes in pH or temperature)

Sustained Release drug formulations:

A way of formulating a medicine so that it is released into body steadily, over a long period of time.

- Increases duration of action of a drug.
- Reducing dosing frequency.
- Once-daily oral preparations.
- Long lasting depot injections (E.g. Contraceptives, Hormone replacements, Antipsychotic drugs).

Controlled Release drug formulations:

- It closely mimics the way by which the body naturally produces hormones such as insulin.
- A way of formulating the medicine so it is released into the body in respond to specific stimuli e.g. Exposure to light, Changes in pH or temperature.

MICROENCAPSULATION:

Microencapsulation is a process in which tiny particles or droplets are surrounded by a coating to give small capsules, of many useful properties. In general, it is used to incorporate food ingredients, enzymes, cells or other materials on a micro metric scale.

There are two phases:

a. Core Material

b. Coating Material

Reasons for Microencapsulation:

1. To protect reactive substances from the environment.

2. To convert liquid active components into a dry solid system.

3. To separate the incompatible components for functional reasons.

4. To protect the immediate environment of the microcapsules, from the active components.

5. Isolation of core from its surroundings, as in isolating vitamins from the deteriorating effects of oxygen.

6. Retarding evaporation of a volatile core.

7. Improving the handling properties of a sticky material.

8. Isolating a reactive core from chemical attack.

9. For safe handling of toxic materials.

10. To get targeted release of drug.

Advantages of Microencapsulation:

1. Reliable mean to deliver the drug to the target site and to maintain the desired concentration at the site of interest without untoward effects.
2. Solid biodegradable microspheres have the potential throughout the particle matrix for the controlled release of drug.
3. Microspheres received much attention for targeting of anticancer drugs to tumor.
4. Reduces the dosing frequency and thereby improve the patient compliance.

Disadvantages of Microencapsulation:

1. It is an expensive process.
2. Requires skills.
3. Difficult to obtain continuous and uniform film.