

Study of Various DDS

Controlled Release Oral DDS: Concept, Design, Formulation & Evaluation

- Controlled release oral drug delivery systems are designed to **release the drug slowly in the gastrointestinal tract** to maintain a constant drug level for a long period.

Concept

- Drug is given orally (tablet/capsule)
- Instead of immediate release, it releases gradually
- Maintains steady plasma concentration

Why Needed

- Reduce dosing frequency
- Improve patient compliance
- Minimize side effects
- Maintain therapeutic level

Design of Controlled Release Oral DDS

Design depends on both **drug properties** and **system properties**.



A. Drug-Related Factors

a) Half-life

- Ideal: 2–8 hours
- Very short half-life → needs frequent dosing
- Very long half-life → no need for CR system

b) Solubility

- Poor solubility → slow release
- Very high solubility → difficult to control release

c) Dose size

- Very large dose → difficult to incorporate into CR system

d) Stability

- Drug must be stable in GI tract

B. System Design Approaches

a) Matrix Systems

- Drug dispersed in polymer matrix
- Drug released by diffusion and/or erosion

Types:

- Hydrophilic matrix (swells in water)
- Hydrophobic matrix (slow diffusion)

C. Reservoir Systems

- Drug core surrounded by polymer coating
- Drug diffuses through membrane

D. Osmotic Systems

- Use osmotic pressure for controlled release
- Provide nearly constant release rate

Formulation of CR Oral DDS

Key components:

A. Polymers

- Control release (e.g., HPMC, ethyl cellulose)

B. Binders

- Provide tablet strength

C. Lubricants

- Help manufacturing

D. Release modifiers

- Adjust release rate

Mechanisms of Drug Release

- Diffusion
- Dissolution
- Erosion of matrix
- Osmotic pressure

Evaluation Parameters

A. In-vitro Dissolution Studies

- Measure drug release over time in lab
- Simulate GI conditions

B. Drug Content Uniformity

- Ensure each tablet contains correct amount

C. Hardness and Friability

- Check mechanical strength

D. In-vivo Studies

- Measure drug levels in blood

E. Stability Studies

- Check how formulation behaves over time

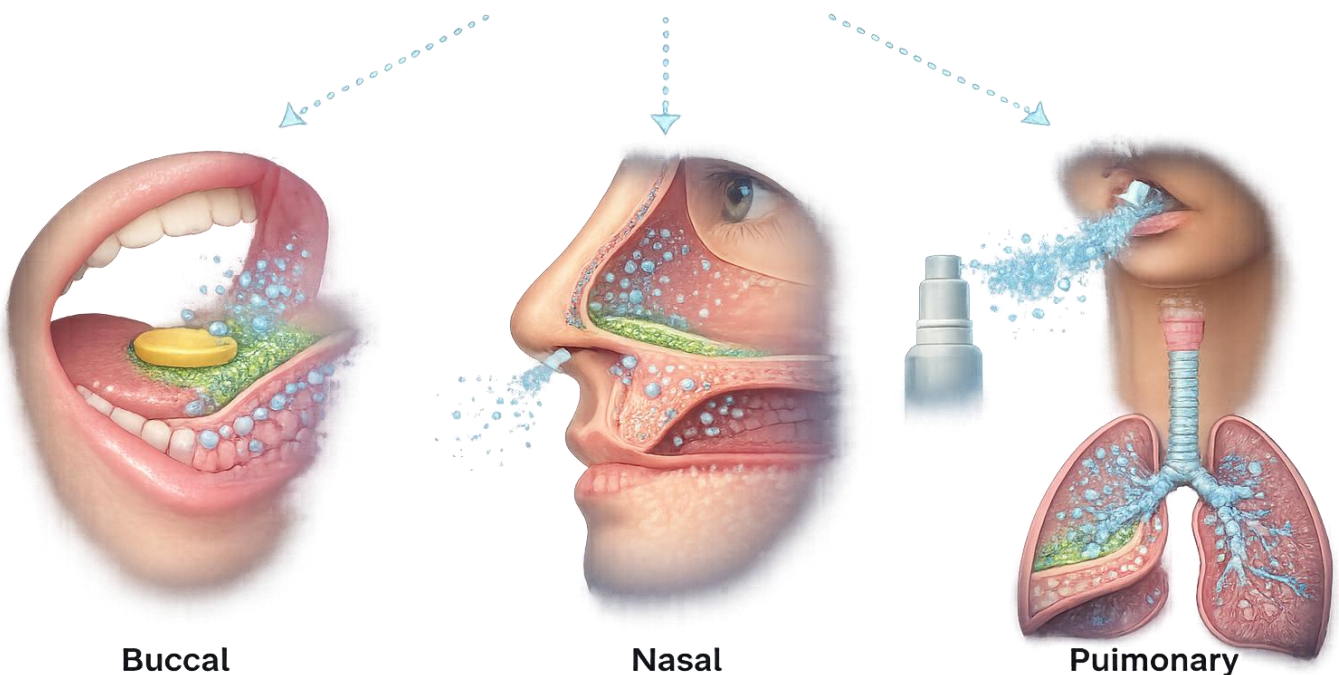
Mucoadhesive DDS (Buccal, Nasal, Pulmonary)

- Mucoadhesive systems are designed to **stick to mucosal surfaces** and release drug at that site.

Concept

- Drug delivery through mucous membranes
- System adheres to mucosa
- Drug absorbed locally or systemically

Mucoadhesive DDS



Mechanism of Mucoadhesion

1. Contact stage

- Dosage form comes in contact with mucus

2. Interpenetration

- Polymer chains mix with mucus glycoproteins

3. Bond formation

- Hydrogen bonds, van der Waals forces formed

Types of Mucoadhesive DDS



1. Buccal Delivery

Site

- Inner lining of cheek

Advantages

- Avoids first-pass metabolism
- Easy administration

Dosage Forms

- Tablets
- Films
- Gels

Limitations

- Limited surface area
- Saliva may wash drug away

2. Nasal Delivery

Site

- Nasal cavity

Dosage Forms

- Nasal sprays
- Drops

- Gels

Advantages

- Rapid absorption
- Direct brain delivery possible

Limitations

- Small dose capacity
- Mucociliary clearance

3. Pulmonary Delivery

Site

- Lungs

Advantages

- Large surface area
- Fast absorption
- Useful for both local and systemic delivery

Dosage Forms

- Inhalers
- Nebulizers
- Dry powder inhalers

Limitations

- Requires proper inhalation technique
- Particle size critical

Evaluation of Mucoadhesive Systems

- Mucoadhesive strength
- Drug release rate
- Residence time
- Permeation studies

Pulsatile Drug Delivery Systems

- Pulsatile systems release drug **after a specific lag time**, rather than continuously.

Concept

- Drug is not released immediately

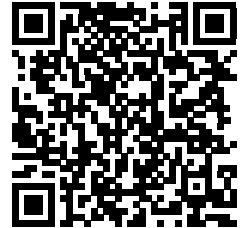


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