SUPPOSITORIES

1. Introduction & Definition

Suppositories are solid or semisolid dosage forms meant for insertion into body cavities such as the rectum, vagina, or urethra. Upon insertion, suppositories melt, disintegrate, or dissolve at body temperature to produce either local or systemic pharmacological effects. Examples include pessaries, rectal suppositories, and urethral bougies.

Advantages of Suppositories

- **Avoids First-Pass Metabolism:** Direct administration into rectal/vaginal mucosa avoids hepatic drug degradation.
- **Ideal for Unconscious Patients:** Provides a viable drug delivery route when oral administration is impossible.
- **High Dose Delivery:** Capable of delivering higher amounts/doses of active drug substances.
- **Suitable for Dysphagia:** Excellent alternative for pediatric or elderly patients having difficulty swallowing tablets/capsules.
- **Rapid & Local Effect:** Offers quick onset of action locally as well as systemically.

Disadvantages of Suppositories

- **Patient Compliance:** Low patient acceptance and uncomfortable mode of administration.
- **Cost:** More expensive to manufacture and package compared to standard oral tablets.
- **Irritant Drugs:** Irritant drugs cannot be easily administered via this route as they cause localized mucosal discomfort.
- **Storage Conditions:** Requires controlled low-temperature storage (cool place/refrigeration) to prevent premature melting.

2. Types of Suppositories

Based on their intended site of use, suppositories are broadly classified into five major types:

Type	Site of Insertion	Shape & Dimensions	Weight / Base / Examples
Rectal Suppositories	Rectum	Tapered / Bullet shape (tapered at one end)	Adults: ~2g; Infants: ~1g Base: Cocoa butter Eg: Sedatives, Analgesics
Vaginal Suppositories (Pessaries)	Vagina	Globular / Oviform shape	Weight: ~5g Base: PEG / Gelatoglycerine Use: Vaginal infections,

			Contraceptives
Urethral Suppositories (Bougies)	Urethra	Micropellet shape (1.4mm dia, 6mm long, insert 3cm deep)	Male: ~4g; Female: ~2g Base: Cocoa butter Eg: Alprostadil for erectile dysfunction
Nasal Suppositories (Bougies)	Nasal Cavity	Thinner, tapered at both ends (8cm long)	Weight: ~1g Base: Gelatoglycerine
Ear Cones (Aurinaries)	Ear Cavity	Cylindrical shape (Rarely used)	Weight: ~1g

3. Suppository Bases

Suppository bases are excipients used as vehicle matrices in the manufacture of suppositories. They constituent the major bulk of the formulation and play a critical role in maintaining physical solidity, shape, and controlling drug release kinetics after insertion.

Ideal Properties of Suppository Bases

- **Melting Point:** Should melt at or just below body temperature (37°C) to facilitate drug release.
- **Safety:** Must be non-toxic, non-irritant, non-sensitizing, and biologically inert.
- **Compatibility:** Should be chemically compatible with a wide range of active pharmaceutical ingredients (APIs).
- **Molding:** Must be easily moldable and readily detach without adhering to mold surfaces.
- **Stability:** Must remain chemically and physically stable above its melting point and during long-term storage.
- **Mechanical Strength:** Should retain structural integrity and shape when handled and packaged.

Classification of Suppository Bases

- **1. Oleaginous (Fatty) Bases:** Water-insoluble fatty substances that melt at body temperature.
- **2. Aqueous (Water-Soluble / Miscible) Bases:** Hydrophilic materials that dissolve or disperse in bodily fluids.
- **3. Emulsifying Bases:** Synthetic fatty bases containing emulsifying agents.

Detailed Types of Bases

A. Oleaginous Bases

- **Theobroma Oil (Cocoa Butter):** Most commonly used ideal suppository base. It is a yellowish-white, brittle, butter-like solid obtained from roasted seeds of Theobroma cacao. Hard/amorphous at 15–20°C and melts sharply at 30–35°C (body temp). Precautions: Avoid

overheating during processing to prevent unstable polymorphic forms; certain drugs may alter its melting point.
- **Synthetic Triglycerides:** Composed of hydrogenated vegetable oils (e.g., palm oil, coconut oil). Used as substitutes for cocoa butter. More expensive but provide consistent melting behavior.

B. Aqueous / Water-Soluble Bases

- **Glycerinated Gelatin Base:** A mixture of glycerin and water stiffened into a jelly matrix by adding gelatin. Mostly used for vaginal suppositories. Highly hygroscopic in nature; requires preservation and storage in cool places (10–15°C).
- **Polyethylene Glycols (PEG / Macrogols):** Polymeric bases used for prolonged drug release. Chemically stable, non-irritating, miscible with mucosal fluids, and do not require strict refrigeration.

C. Emulsifying Bases

- **Massa Estarinum:** Comprises mono-, di-, and triglycerides of saturated fatty acids.
- **Witepsol:** Consists of hydrogenated triglycerides of lauric acid with added monoglycerides.

4. Methods of Preparation

Suppositories are manufactured using three primary techniques depending on the scale and properties of the base:

1. Hand Rolling Method

- **Overview:** Simplest and traditional small-scale method using cocoa butter base.
- **Procedure:** Cocoa butter, active drug, and excipients are thoroughly triturated in a mortar using a pestle. The mass is manually rolled into a spherical ball using palms, rolled into a cylinder with a spatula, and then cut into uniform pieces shaped into cones by skilled operators.

2. Compression Method (Cold Compression)

- **Overview:** Cold compression process ideal for heat-labile medicaments.
- **Procedure:** All ingredients are blended with the base to form a uniform fine powder mass. The mass is loaded into the cylinder of a compression suppository machine. Moulds are lubricated, and high compression force pushes the mass into mold cavities. Formed suppositories are ejected and packed.

3. Hot Fusion Method (Moulding from a Melt)

- **Overview:** Most widely used method on both small and large production scales. Not suitable for thermolabile drugs.
- **Procedure:** The suppository base is melted over a water bath, and active medicaments are dissolved or suspended uniformly. The liquid mixture is poured into pre-lubricated mold cavities (6–12 cavities for small scale, up to 500 cavities for industrial scale). Upon cooling

and solidification, excess mass is scraped off, and suppositories are removed from the molds.

5. Displacement Value (D.V.)

Definition: Displacement value is defined as the quantity of drug that displaces 1 part by weight of suppository base (typically cocoa butter).
Significance: Since medicaments have different specific gravities than the base, adding drug alters the volume occupied in the mold cavity. Calculating displacement value ensures accurate dosing and uniform suppository weights.

> **Displacement Value Formula**
> *Displacement Value (D or DV) = d / (a - c)*
>
> *Where:*
> • *d = Amount of medicament present in the suppositories*
> • *a = Weight of unmedicated suppositories (pure base only)*
> • *c = Weight of medicated suppositories (base + medicament)*
> • *(a - c) = Amount of suppository base displaced by the medicament*

6. Evaluation of Suppositories

Suppositories must undergo official quality control testing to verify safety, uniformity, and compliance with standards:

- **I. Visual Examination / Appearance Test:** Manual inspection of shape, surface texture, color uniformity, and odor.
- **II. Mechanical Strength / Crushing Test:** Evaluates brittleness and elasticity to ensure resistance to handling and transit breaking. An ideal suppository withstands 1.8 to 2.0 kg of pressure in testing apparatus.
- **III. Uniformity of Weight / Drug Content:** 20 suppositories are weighed individually and averaged. The weight deviation of individual suppositories should not exceed ±5% from the average weight.
- **IV. Melting Range Test:** Checks the melting temperature of suppositories by placing them in a water bath held at 37°C for 30 minutes.
- **V. Disintegration & Dissolution Test:** Measures rate of drug release and disintegration time in a fluid medium at 37°C using standard disintegration apparatus.
- **VI. Softening / Liquefaction Test:** Measures the exact time required for the suppository to completely liquefy under physiological conditions.

7. Packaging & Storage

- **Packaging:** Suppositories are individually wrapped in protective foils or films and packed in plastic, tin, or aluminum containers.
- **Storage:** Must be stored in cool environments (below 15–20°C or refrigerated) to prevent melting, degradation, or deformation.