Semisolid Dosage Forms

Ointments, creams and gels

Ointments, creams and gels are semisolid dosage forms intended for topical application. They may be applied to the skin, placed onto the surface of the eye or used nasally, vaginally or rectally.

The majority of these preparations are used for the effects of the therapeutic agents they contain. Those which are non-medicated are used for their physical effects as protectants or lubricants.

Topical preparations are used for the localised effects produced at the site of their application, although some unintended systemic drug absorption may occur, it is usually in sub-therapeutic quantities. However, systemic drug absorption can be an important consideration in certain instances, as when the patient is pregnant or nursing because drugs can enter the fetal blood supply and breast milk and be transferred to the fetus or nursing infant.

Transdermal drug delivery systems are designed for the systemic absorption of drug substances in therapeutic quantities.

The following distinction is an important one with regard to dermatologic applications, a topical product is designed to deliver drug into the skin to treat dermal disorders with the skin as the target organ.

A transdermal drug delivery system is designed to deliver drugs through the skin (percutaneous absorption) to the general circulation for systemic effects with the skin not being the target organ.

Ointments

Ointments are semisolid preparations intended for external application to the skin or mucous membranes.

Ointments may be medicated or non-medicated, non-medicated ointments are used for the physical effects that they provide as protectants, emollients or lubricants.

Ointment Bases

Ointment bases may be used for their physical effects or as vehicles in the preparation of medicated ointments. Ointment bases are classified into four general groups:

1. Hydrocarbon bases (oleaginous bases)
2. Absorption bases
3. Water-removable bases
4. Water-soluble bases

Hydrocarbon Bases

Hydrocarbon bases are also termed oleaginous bases, on application to the skin they have an emollient effect, protect against the escape of moisture, effective as occlusive dressing and can remain on the skin for prolonged periods of time without drying out and because of their immiscibility with water are difficult to wash off.

Water and aqueous preparations may be incorporated into them but only in small amounts and with some difficulty.

Petrolatum, white petrolatum, white ointment and yellow ointment are examples of hydrocarbon ointment bases.

When powdered substances are to be incorporated into hydrocarbon bases, liquid petrolatum (mineral oil) may be used as levigating agent.

Petrolatum, USP:

Petrolatum, USP is a purified mixture of semisolid hydrocarbons obtained from petroleum. It is an oily mass, varying in colour from yellowish to light amber. It melts at temperature between (38-60 °C) and may be used alone or in combination with other agents as an ointment base.

Petrolatum is also known as ‘Yellow Petrolatum’ and ‘Petroleum Jelly’. A commercial product is ‘Vaseline’.

Yellow ointment, USP:

This ointment has the following formula for the preparation of 1000 g:

Yellow wax	50 g
Petrolatum	950 g

Yellow wax is the purified wax obtained from the honey comb of the bee. The ointment is prepared by melting the yellow wax on a water bath, adding the petrolatum until the mixture is uniform, then cooling with stirring until congealed.

White ointment, USP:

This ointment differs from yellow ointment by substituting white wax (bleached and purified yellow wax) and white petrolatum in the formula.

Absorption Bases

Absorption bases are of two types:

1. Those that permit the incorporation of aqueous solutions resulting in the formation of w/o emulsions e.g. Hydrophilic petrolatum.
2. Those that are w/o emulsions (emulsion bases) permit the incorporation of additional quantities of aqueous solutions. e.g. Lanolin

These bases may be used as emollients although they don't provide the degree of occlusion afforded by the hydrocarbon bases. Absorption bases are not easily removed from the skin, since the external phase of the emulsion is oleaginous.

Absorption bases are useful as pharmaceutical adjuncts to incorporate small volumes of aqueous solutions into hydrocarbon bases. This is accomplished by incorporating the aqueous solution into the absorption base and then incorporating this mixture into the hydrocarbon base.

Hydrophilic Petrolatum, USP:

Hydrophilic petrolatum, USP has the following formula for the preparation of 1000 g:

Cholesterol	30 g
Stearyl alcohol	30 g
White wax	80 g
White petrolatum	860 g

It is prepared by melting stearyl alcohol and the white wax on a steam bath, adding the cholesterol with stirring until dissolved, then adding the white petrolatum and allowing the mixture to cool while being stirred until congealed.

Lanolin, USP:

Lanolin, USP obtained from the wool of sheep. It is a purified wax like substance that has been cleaned, deodorised and decolourised. It contains not more than 0.25% water. Additional water may be incorporated into lanolin by mixing.

Water-removable Bases

Water-removable bases are o/w emulsions resembling creams in appearance and because the external phase of the emulsion is aqueous, they are easily washed from the skin and are often called ‘water-washable bases’. They may be diluted with water or aqueous solutions. They have the ability to absorb serous discharge.

Hydrophilic ointment USP, is an example of this type of base.

Hydrophilic ointment, USP:

Hydrophilic ointment has the following formula for the preparation of about 1000 g:

Methyl paraben	0.25 g
Propyl paraben	0.15 g
Sodium lauryl sulfate	10 g
Propylene glycol	120 g
Stearyl alcohol	250 g
White petrolatum	250 g
Purified water	370 g

In preparing this ointment, the stearyl alcohol and white petrolatum are melted together at about 75 °C.

The other agents are dissolved in the purified water and then added with stirring until the mixture congeals.

- Sodium lauryl sulphate (SLS) is the emulsifying agent.
- Stearyl alcohol and white petrolatum comprising the oleaginous phase of the emulsion and the other ingredients form the aqueous phase.
- Methyl paraben and propyl paraben are antimicrobial preservatives.

Water-soluble Bases

Water-soluble bases don't contain oleaginous components, they are completely water-washable and often referred to as 'greaseless'.

Since they soften greatly with the addition of water, large amounts of aqueous solutions are not effectively incorporated into these bases.

Polyethylene glycol ointment, NF is an example of water-soluble base.

Polyethylene Glycol ointment, NF:

Polyethylene glycol (PEG) is a polymer of ethylene oxide and water represented by the formula $H(OCH_2CH_2)_nOH$ in which (n) represents the average number of oxyethylene groups. The numerical designations associated with PEG refer to the average molecular weight of the polymer.

PEG having average molecular weights below 600 are clear, colourless liquids and those with molecular weights above 1000 are wax-like materials and those with molecular weights in between are semisolids. The greater the molecular weight, the greater the viscosity.

The general formula for the preparation of 1000 g of PEG ointment is:

Polyethylene Glycol 3350	400 g
Polyethylene Glycol 400	600 g

The combining of PEG 3350, a solid, with PEG 400, a liquid, results in a very pliable (flexible) semisolid ointment.

If a firmer ointment is desired, the formula may be altered to contain up to equal parts of the two ingredients.

When aqueous solutions are to be incorporated into the base, the substitution of 50 g of PEG 3350 with an equal amount of stearyl alcohol is advantageous in rendering the final product more firm.

Selection of appropriate base

The selection of the base to be used in the formula of an ointment depends on a number of factors:

1. Desired release rate of the drug substance from the ointment base.

2. Desirability of occlusion of moisture from the skin.

3. Stability of the drug in the ointment base.
4. Effect of the drug on the consistency of the ointment base.
5. The desire for a base that is easily removed by washing with water.
6. Characteristics of the skin surface to which it is applied.

Preparation of ointments

Ointments are prepared by two general methods:

1. Incorporation
2. Fusion

The method used depends primarily on the nature of the ingredients.