



Formulation and Evaluation of Sulphur Ointment from Simple Ointment

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ABSTRACT

Topical drug delivery has advantages such as applying the drug directly into skin and it also provides prolonged action on the specific site. There are different semisolid formulation are available in the market among them ointment is commonly used preparation. Ointment having various advantages over other preparation like they are chemically more stable and easy to handle than liquid dosage, avoid first pass metabolism of drug and convenient for unconscious patients having difficulty in oral administration. This article deals with preparation of sulphur ointment from simple ointment. Here at first simple ointment is prepared by using ingredients like wool fat, hard paraffin, ceto stearyl alcohol and soft paraffin and then by using this prepared simple ointment, sulphur ointment is prepared and evaluated.

KEYWORDS : Skin, ointment, Characteristics, ointment base, Evaluation, keratinocyte

INTRODUCTION

Skin^{1,2}

The skin is consider as the largest organ of our body, accounting for about 16% of the total adult body weight. It is a multi-layered organ complex both in structure and functions. It performs many important functions, including protection against external physical, chemical, and biological stress, as well as prevention of excess water loss from the body and also role in thermoregulation. The skin is unbroken, with the mucous membranes bordering the body's surface. The integumentary system is composed by the skin and its derivatives are given in figure1.

The skin is made up of three layers namely: epidermis, dermis, and subcutaneous tissue. The outermost level known as the epidermis, consists of a specific grouping of cells called as keratinocytes. Which function to produce keratin, which is a long, thread like protein with a protective action. The middle layer known as the dermis, is basically consist of fibrillar structural protein called collagen. The thickness of these layers varies accordingly, depending on the geographic area on the anatomy of the body. For example, eyelid has very thinnest layer of the skin, having less than 0.1 mm, whereas the palms and soles of the feet have the thickest skin layer, owing approximately 1.5 mm. The layer of epidermis is very thickest on the back, where it is 30–40 more times as thick as the laminating epidermis.

Structure of the Skin^{3,4}

Two main parts:

■ Epidermis

■ Superficial

■ Thinner

■ Epithelial tissue

■ Dermis

■ Deeper

■ Thicker

■ Connective tissue

■ Subcutaneous tissues

■ Adipose tissue

■ Artery, vein

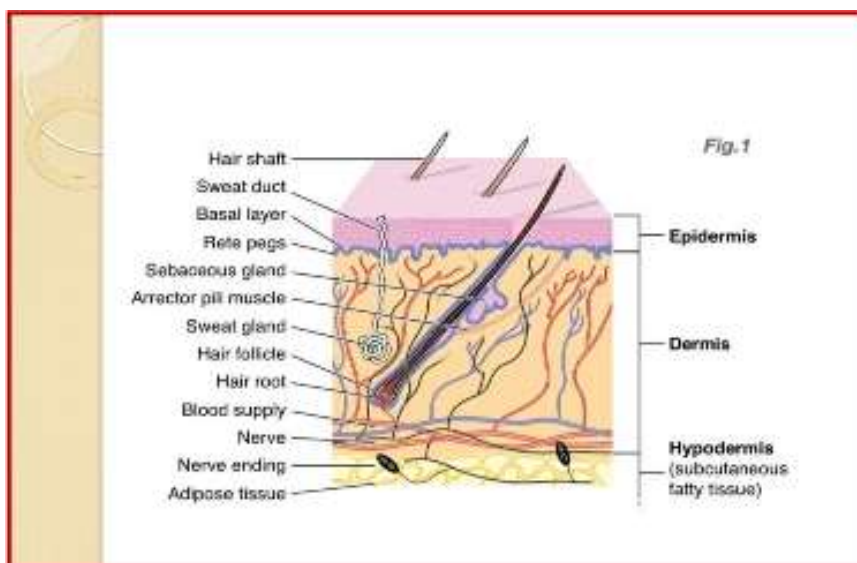


Fig 1 : Anatomy of skin

Epidermis^{5,6}

The epidermis is a squamous stratified epithelium layer that is made up of primarily of two kinds of cells: keratinocytes and dendritic cells. The keratinocytes are differ from as that of clear dendritic cells by owing intercellular cross and stainable cytoplasm. Keratinocyte cell type contains the majority of the cells. In general the epidermis divided into four layers according to morphology of keratinocyte and position as they differentiate into horny cells, including the basal cell layer (stratum germinativum), granular cell layer (stratum granulosum)the squamous cell layer (stratum spinosum), and the cornified or horny cell layer (stratum corneum). The lower three layers that constitute the living, nucleated cells of the epidermal layers are occasionally mentioned as the rete malpighii (Murphy) as well as stratum malpighii. The basal cells of the epidermal layers undertake multiplication cycles that supply for the renewal of the outer epidermis cell. The epidermal layer is a dynamic tissues in which cells are incessantly in infelicitous movement, as varying individual cell populations pass not only one another but also Langerhans cells and melanocytes as they proceed towards the surface of the skin.

Keratinocytes indicate major cell type of epidermis. They derive in the deepest layer of epidermis.. Bundles of these keratin filaments intersect on and close at the plasma membrane forming the intercellular attachment known as desmosomes. The cellular organelles during the degradative phase which are lost and the contents of the cell are converted into a mixture of filaments form and amorphous cell envelopes, and the cell finally is called as a horny cell or corneocyte. Maturation resulting in cell death.

The stratum germinativum also called basal layer, contains column-shaped keratinocytes that attach to the basement membrane area with their long axis perpendicular to the dermis. These basal cells form a single layer. Other distinguishing characteristics of the basal cells are their elongated oval nuclei or dark-staining and the presence of melanin pigments which are transferred from adjoining melanocyte cells. The basal layer is the primary zone of continuously dividing active cells. However, not all basal cells have the ability to divide. Conditions like wounding, can increase the number of cycling cells in the epidermis by stimulating multiplication of stem cells. DNA damage caused by carcinogenic may mutate cell proliferation machinery and can also affect the rate of cellular multiplication.

The other important layers Squamous Cell Layer, granular Layer and cornified Layer respectively.

Dermis

They are non-descriptive region lying in between epidermis and subcutaneous region. It is composed of mainly dense network of structural protein fibre fairly uniform package they are elastin, reticulum and collagen, embedded in the semi gel matrix of mucopolysaccharide also known as ground substances. The elasticity of skin is due to the network of gel structure of the cells. Beneath the dermis, the fibrous tissue open out and merges with that of the subcutaneous tissues.

Subcutaneous tissues

They are the bottom most layer of skin. This layer is consist of a sheet of fat rich areolar tissue; also known as superficial fascia, attaching the dermis to the underlying structure. Large arteries and vein are present only in this region. The occasion is to fix the skin to under lying muscles and bone as well as supplying it with nerves as well as blood vessels.

Functions of the skin^{7,8}

★ Regulation of Body temperature.

Two ways: ✘ Releases sweat onto the skin surface.

✘ Altering the blood flow through the blood vessels in the dermis.

★ Protection

✘ Keratin protects the underlying heat, tissues abrasion and microbes.

✘ Fats in the skin resist the loss of water.

✘ Melanin protects against UV radiation.

✘ Acidic pH of sweat slows the growth of some bacterias.

✘ Mechanical, physical and thermal injury.

✘ Excessive loss of protein and moisture.

✘ Harmful agents.

★ Sensation

✘ Touch, vibration, pressure, tickling, warmth and coolness, and pain can result from nerve endings in the skin.

✘ Referred to as cutaneous sensation.

★ Excretion

✘ Glands present in the skin excrete water, sweat, fatty substances urea and ions like sodium.

★ Absorption

✘ The skin does have the ability to absorb some fat-soluble vitamins (A, E and K) and hormones.

★ Synthesis of vitamin D

✘ Vitamin D is formed in the epidermis when exposed to UV light. It is then modified and transported to the digestive tract where it aids in the absorption of calcium.

★ Communication

Nurses can gain a lot of information about patients health simply by examining skin of patients. Physiological changes are seen in skin. When we are hot, the skin become redness and cause sweat break out. In pain case skin become pale. Yellow colour of skin is the sign of jaundice and blue colour is the sign of oxygen deficiency. The physiological health is indicated not only the changes but only the appearance, sensitivity and elasticity of the skin.

★ Nutrient and water storage

The water stored in the skin can be accessed in emergency cases when blood volume falls.

★ Water resistance

The skin act as water resistance barrier.

★ Other functions

✘ Protection against infection and chemicals.

✘ Response to increased temperature

✘ Response to fall in temperature

✘ An immune organ to detect infections

✱ Act as sensory organ (touch, defect, temperature)

Ointment^{9,10,11}

There are various dosage form are available in the market. To application on skin semi solid dosage form is preferred most. An ointments are homogenous, viscous semisolid preparation, most commonly a greasy, oily (Oil-80%, Water-20%) with high viscosity that is intended for external application to skin or mucous membranes. They are used as emollients or for the application of active ingredients to the skin for protective, therapeutic, or prophylactic purposes and where a degree of occlusion is desired. Ointments are used topically on a variety of body surfaces. These include the skin and the mucous membrane of the eye (an eye ointment), chest, vulva, anus and nose.[6,8] Ointment have very moisturizing characteristic and are effective for dry skin. They have very low risk of sensitization due to having few ingredients beyond the base oil or fat and also low irritation risk. They have more greasiness so mostly disliked by patients

Advantages^{12,13,14}

- 1) They have site specific application of drug on affected area, which avoids unnecessary non target exposure of drug thereby avoiding side effect i.e. site specific action with less side effect.
- 2) They avoid first pass metabolism of drug.
- 3) Convenient for unconscious patients having difficulty in oral administration.
- 4) Comparatively they are chemically more stable and easy to handle than liquid dosage forms.
- 5) They are suitable dosage forms for bitter taste drugs.

Disadvantages^{15,16,17}

- ◆ These oily semisolid preparations are staining and cosmetically less aesthetic.
 - ◆ Application with finger tip may contaminate the formulation or cause irritation when applied.
 - ◆ As compared to solid dosage forms, semisolid preparation are more bulky to handle.
 - ◆ Though semisolid allow more flexibility in dose, dose accuracy is determined by
 - ◆ Uniformity in the quantity to be applied.
 - ◆ Physico-chemically less stable than solid dosage form.
 - ◆ Gel may initiate various allergic reactions.

Types of Ointment^{18,19,20}

Ointment may be medicated or non-medicated.

- ◆ Medicated ointment: For the application of API to skin for protective, therapeutic, or prophylactic purpose.
- ◆ Non-medicated ointment: These are used for physical effect. They are use as protectant, emollients, or lubricants.

Characteristics of an ideal ointment^{21,22,23}

- 1) It should be physically and chemically stable.
- 2) In ointment base, finely divided active ingredients should be uniformly distributed.
- 3) The base of ointment should not possess any therapeutic action.
- 4) The ointment should be smooth and free from grittiness.

OINTMENT BASES^{24,25,26,27}

The vehicle or carrier of an ointment is known as ointment base. The choice of ointment base depends upon the nature of medicament, stability of ointment and clinical indication of the Ointment.

Ointment base with Example:-

Type of Ointment bases (according to USP)

Mainly ointment bases are of following types:

1) Oleaginous ointment base or hydrocarbon ointment base

2) Absorption ointment bases

3) Water removable bases or water washable base

4) Water soluble base

1) Oleaginous ointment base or hydrocarbon ointment base (water in Oil)

These bases have following properties

- a) Small amount of aqueous component can be incorporated into these bases.
- b) These bases have emollient effect.
- c) These bases are difficult to wash off as these are w/o type of bases.
- d) These base do not dry out.
- e) These base keep the medicament in prolonged contact with skin.
- f) These bases act as occlusive dressing.

Examples: white petrolatum, yellow ointment, white ointment.

2) Absorption ointment bases

These bases categorize into two groups:

- a) Permit the incorporation of aqueous solution with the formation of water in oil type of bases.

Example: Hydrophilic petrolatum Lanolin

- b) These are already w/o type of bases and permit the additional amount of aqueous solution. Example: Anhydrous lanolin

These bases have following properties:

- a) Useful as emollients
- b) Difficult to remove from skin

3) Water removable bases or water washable base

These bases are also called as emulsifying bases or oil in water type of emulsion bases. These are water washable bases. Mostly these bases are preferred for cosmetic purpose.

Advantages of these base are:

- a) Some medicament are more effective in these bases.
- b) These bases may be diluted with water.

Example: Hydrophilic ointment, Vanishing cream.

4) Water soluble base

These bases are greaseless bases containing water soluble constituents

Advantages of these bases are:

- a) These are completely water washable

BASES	PROPERTIES	EXAMPLE
Oleagenous bases	Occlusive , hydrophobic, greasy, non-washable	White petroleum, white ointment
Absorption bases	Occlusive , water absorbent, anhydrous, greasy	Anhydrous lanolin, hydrophilic petroleum
w/o type emulsion bases	Occlusive , hydrous, greasy, hydrophilic , non-washable	Lanolin, cold cream
o/w type emulsion bases	Washable , non-greasy , can be diluted with water, non occlusive	Hydrophilic ointment
Water-soluble bases	water-soluble, washable, non-greasy, non-occlusive, lipid free	Polyethylene glycol ointment

Properties of ointment base

SELECTION OF THE APPROPRIATE BASE^{28,29,30}

Selection of the base to use in the formulation of an ointment depend on number of factors,

Including the following:

- 1) Desired release rate of the drug substance from the ointment base.
- 2) Desirability of topical or percutaneous drug absorption.
- 3) Desirability of occlusion of moisture from skin.
- 4) Stability of the drug in the ointment base.
- 5) Effect, if any, of the drug on the consistency or other features of the ointment base.
- 6) Desirability for easy removal of base by washing with water.
- 7) Characteristics of the surface to which it is applied.

IDEAL PROPERTIES OF OINTMENT BASES^{31,32}

- 1) Should not retard wound healing,
- 2) Have a low sensitization index,
- 3) Pharmaceutically elegant,
- 4) Release the medicament efficiently at the site of application,
- 5) Have a low index of irritation,
- 6) Non-dehydrating, non-greasy and neutral in reaction,
- 7) Compatible with common medicaments and also with the skin,
- 8) Easily washable with water,
- 9) Have minimum number of ingredients,
- 10) Easy to compound and remain stable on storage and
- 11) Economic and easy to transport,

12) Should be inert, odourless, smooth,

13) Should be physically and chemically stable.

METHOD OF PREPARATION OF OINTMENT

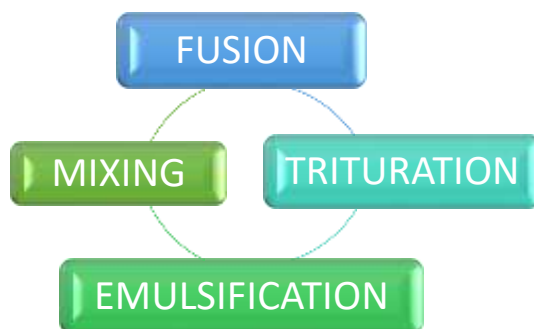


Fig No 2: Method of preparation of ointment

MATERIALS AND METHODS

Materials^{33,34}

These are the following chemicals used for the formulations and evaluation of Sulphur ointment

SL.NO	INGREDIENTS	ROLES
1	Wool fat	It act as base
2	Hard paraffin	Used to increase hardness of the formulation
3	Cetostearyl alcohol	Maintain the consistency of the formulation
4	White soft paraffin	Emollient and protective
5	Sublimed sulphur	scabicial agent

Table No 2: Ingredients used in the preparation of ointment and their use n

◆ Wool fat

: - It act as base for the formulation also act as emollient in the preparation



Fig 3: wool fat

◆ Hard paraffin

: - Used to increase hardness of the formulation



Fig 4: Hard paraffin

◆ Cetostearyl alcohol

:-It is used to maintain the consistency of the formulation.



Fig 5: Cetostearyl alcohol

◆ White soft paraffin

:-It act as both emollient and protective in the formulation



Fig 6: White soft paraffin

◆ Sublimed sulphur

:-Act as scabicial agent



Fig 7: Sublimed sulphur

•Preparation of Simple ointment

Table No 3: Formulation of simple ointment

SL.NO	Ingredients	Quantity
1	Wool fat	5 g
2	Hard paraffin	5 g
3	Cetostearyl alcohol	5 g
4	White soft paraffin	85 g

★Melt the hard paraffin and cetostearyl alcohol on a water bath.

★To this add wool fat and white soft paraffin and stir well till the completion of the melting of all the ingredients.

★Examine the contents for any foreign particles and decant if required.

★Stir the mixture thoroughly until becomes cool

★Pack the preparation, label and dispense it.

Category:- Protective, Emollient

•Preparation of Sulphur ointment

Table No 4: Formulation of sulphur ointment

SL.NO	Ingredient	Quantity
1	Sublimed sulphur	10 g
2	Simple ointment	90 g

★Triturate the sublimed sulphur, finely sifted with small amount of simple ointment over an ointment slab.

★Gradually add the remaining quantity of simple ointment with thorough trituration until a homogenous mass is obtained.

★Pack, label and dispense the preparation.

Simple ointment?

Hard paraffin & soft paraffin are hydrocarbon bases. They form an occlusive film on the skin, absorb less water but are stable to heat and resist rancidification and microbial growth. Wool fat is an anhydrous type of absorptive base that absorbs twice its weight of water to produce W/O emulsion. Long-chain alcohols like Cetostearyl alcohols are used in combination with other bases to improve emollient and water absorption capacity or as well as W/O emulsion stabilizer.

Storage:

Store in a closed container at room temperature, away from heat, moisture, and direct light. Keep from freezing.

Dose:

Use the 5 to 10% ointment one or two times a day. Use as required.

Direction:

Do not apply on broken skin and near the eye.

Precautions:

Avoid getting this medicine in your eyes, nose, mouth, or on your lips. O Rinse with water if contact does occur.

Do not use on open wounds or on sunburned, wind burned, dry or irritated skin.

Keep away from children.

Category:- Scabicedal agent

Evaluation of ointment

☞Physical Appearance

Physical parameter of ointment such as colour and appearance were evaluated

☞Determination of viscosity

The viscosity of gel was determined using a Brook field viscometer. Viscosity was measured by spindle No 10 immersed in the sample. The test was carried out at 25^oc, and spindle was rotated at 10 rpm. The reading was recorded for the formulation.

Viscosity is one of the important parameter of semisolid preparation. It should be such that the product can be easily removed from the container and easily applied to the skin. Cone and plate viscometer or Brookfield viscometer is used to determine the viscosity of the preparation.

☞Determination of pH

The accurately weighed amount of ointment (2.5g) was dispersed in 25 ml distilled water. The pH was recorded by using digital pH meter at room temperature.

☞Homogeneity

The homogeneity of ointment was confirmed by visual inspection after the ointment has been set in a container for their appearance and presence of any aggregates.

☞Extrudability

The ointment formulation was filled in standard capped collapsible aluminium tube and sealed by crimping to the end. After recording the weight of the tube it was then placed between two glass slides and were clamped.500gm were placed over the slides and then the cap was removed. The amount of the extruded gel was collected and record the weight. The percentage of extruded ointment was calculated as,

- * When it is greater than 90%, then the extrudability is excellent.
- * When it is greater than 80%, then the extrudability is good.
- * When it is 70%, then the extrudability is fair.

☞Washability

The ointment was applied on hand and was observed under running tap water.

☞Presence of foreign particles

Here we are checking if the developed product containing presence of any particles.

RESUL AND DISCUSSION

Evaluation of Ointment

Prepared ointment was inspected visually for their characters like colour, consistency and appearance.

☞Physical Appearance

The formulated ointment showed good physical characteristics like good consistency and absence of air bubbles. Post Application feel was found to be Smooth and comfortable on application.

colour	White,light yellow
odour	Pungent,distinct,aromatic
consistency	smooth

Table No 5: Physical appearance of sulphur ointment

☞Determination of viscosity

The viscosity of the ointment formulation refer to its consistency, and was measured by using Brookfield viscometer with spindle number 6 at 10 rpm at room temperature.

	viscosity			Average Viscosity (cp) ± SD (n=3)
	Trials			
	1	2	3	
	12200	12500	12800	12500 ±0.45

Table No 6 : Viscosity of ointment



Fig 5: Viscosity of ointment

☞Determination of pH

The pH of the formulation was measured using digital pH meter, which is given in the table. The value lies in the normal pH range of the skin.

Table No 7: pH of ointment

	pH			Average pH ± SD (n=3)
	Trials			
	1	2	3	
	5.5	6.8	6.7	6.4 ± 0.12

☞Homogeneity

The optimized ointment was tested for homogeneity by visual inspection after setting the ointment in a suitable container and checked the presence of any aggregates. The ointment showed good homogeneity devoid of lumps. And also possesses uniform distribution.

☞Extrudability

In extrudability studies, about 80% of the ointment was extruded from the collapsible aluminium tube. This indicated that the extrudability characters of the optimized gel was good.

☞Washability

The ointment when applied on skin, it was easily removed by washing with tap water.

Parameters	Observations
• Homogeneity	•homogeneous
• Extrudability	•good
• Washability	•good

Table No 8: showing homogeneity, extrudability, washability

☞Presence of foreign particles

The developed ointment is free from any foreign particles.

CONCLUSION

Ointment are getting popularity now a day. They are viscous semisolid preparation mainly for external application. The main advantage of ointment is which allow incorporation of drug and are chemically stable and easy to handle than liquid dosage. Here in this article by using ingredients like wool fat, hard paraffin, cetostearyl alcohol and white soft paraffin simple ointment was prepared and by adding sulphur to the above preparation sulphur ointment was prepared, packed labelled and dispensed. The clinical evidence show that ointment are safe and efficient way of treatment for diseases.

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