

Development of a Sunshield Cream Formulation with Sandalwood Oil for Enhanced Skin Protection

Md. Rageeb Md. Usman^{*1}, Gautam P. Vadnere¹, Pratiksha B. Patil¹

^{*1}Department of Pharmacognosy, Smt. Sharadchandrika Suresh Patil College of Pharmacy, Chopda, Maharashtra, India

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ABSTRACT

The present study focuses on development and analysis of a sunshield cream containing sandalwood oil, celebrated for its natural antioxidant and calming qualities. Sandalwood oil is utilized as the core active ingredient in the formulation. By combining both natural and synthetic elements, the cream is designed to provide effective UV protection, hydration, and compatibility with various skin types. Different concentrations of sandalwood oil were systematically examined for their performance, stability, and user-friendliness. Extensive SPF testing validated the cream's broad-spectrum protection against both UVA and UVB rays. The findings revealed that the cream not only delivers significant sun-blocking properties but also enhances skin hydration and alleviates irritation. This study emphasizes the potential of integrating traditional botanical ingredients like sandalwood oil into contemporary skincare products, elevating their efficacy and appeal.

Keywords: Sandalwood oil, Sunshield cream, Photo protective, Broad-spectrum protection.

1. INTRODUCTION

Creams are semi-solid topical preparations intended for skin application. These formulations are described as emulsions of either oil-in-water (O/W) or water-in-oil (W/O) types, where the consistency depends on the oil-to-water ratio. They serve cosmetic purposes, such as cleansing, beautifying, protecting, or improving the skin's appearance, as well as therapeutic functions. Topical creams are designed for localized delivery of active ingredients to the underlying skin layers or mucosal membranes, making them effective for site-specific treatment of various skin conditions. Based on their emulsion type, creams can be classified as O/W, where oil droplets are dispersed in water, or W/O, in which water droplets are dispersed in oil. Traditionally, the term "cream" has referred to semi-solid emulsions, such as water-in-oil formulations like cold cream or oil-in-water formulations like vanishing cream. [1,2]

2. TYPES OF SKIN CREAMS [3]

They are divided into two types:

Oil-in-Water (O/W) creams consist of tiny oil droplets suspended within a continuous aqueous phase. This type of emulsion, where oil is uniformly distributed as droplets throughout the water-based phase, is referred to as an oil-in-water emulsion. Water-in-Oil (W/O) creams, on the other hand, are composed of minute water droplets dispersed in an oily phase. In these emulsions, water acts as the dispersed phase, while oil serves as the continuous medium, forming a water-in-oil emulsion.

3. CLASSIFICATION OF CREAMS [4,5]

All the skin creams can be classified on different basis:

1. According to function, e.g. cleansing, foundation, massage, etc.
2. According to characteristics properties, e.g. cold creams, vanishing creams, etc.
3. According to the nature or type of emulsion.

Types of creams according to function, characteristic properties and type of emulsion:

1. Make-up cream (o/w emulsion): a) Vanishing creams. b) Foundation creams.
2. Cleansing cream, Cleansing milk, Cleansing lotion (w/o emulsion)
3. Winter cream (w/o emulsion): a) Cold cream or moisturizing creams.
4. All-purpose cream and general creams.

5. Night cream and massage creams.

6. Skin protective cream.

7. Hand and body creams.

1. **Makeup Creams:** These are primarily oil-in-water (O/W) emulsions. They are cream-based products that create a smooth, hydrated finish on the skin, which can range from a matte to a luminous effect. Makeup creams nourish the skin, are generally resistant to sweat, and provide a radiant, dewy appearance.
 - a. **Vanishing Creams:** These creams are named for their ability to seemingly "vanish" upon application. Formulated with stearic acid, they leave a dry, slightly tacky film on the skin, which can have a mild drying effect. This makes them especially useful in hot climates where skin perspiration is more pronounced.
 - b. **Foundation Creams:** These serve as a base layer for makeup application. They work as an adherent layer for makeup powders, offering emollient properties while protecting the skin from environmental factors. Neither overly greasy nor overly dry, foundation creams aim to even out skin tone, cover imperfections, and provide a uniform complexion.
2. **Cleansing creams-** Designed for body cleaning, these creams are essential for personal hygiene and cosmetic purposes. They effectively remove makeup, surface grime, and oil, particularly from the face and neck, contributing to overall cleanliness and beautification.
3. **Winter creams-** These are water-in-oil (W/O) emulsions, where the oil content exceeds the water content. They are ideal for dry and chapped skin.
 - a. **Cold cream:** Known as moisturizing creams, these provide emollient effects and create a non-occlusive oil film on the skin. Cold creams offer a cooling sensation upon use, making them suitable for hydration and soothing.
4. **All-purpose creams and general creams-** These versatile creams are increasingly popular for their somewhat oily but non-greasy texture, allowing easy application on the skin. They function as night creams, nourishing creams, and protective creams to prevent or relieve sunburns and treat rough skin.
5. **Night cream or massage creams-** Night creams are designed to nourish the skin and address dryness, applied before sleep and left overnight. Massage creams, on the other hand, act as emollients, improving skin texture through application with massage.
6. **Skin protective creams-** These thick, smooth creams form an invisible protective film over the skin. They prevent irritation caused by contaminants, protecting against conditions such as contact or occupational dermatitis. Additionally, they support the skin's natural properties and maintain a healthy balance for normal to combination skin types.
7. **Hand and body creams-** Hands, often the first area to show signs of aging, can lose moisture due to frequent washing. Applying hand and body creams replenishes moisture, softens the skin, and helps maintain a youthful appearance.

4. GENERAL INGREDIENTS USED IN SKIN CREAMS:

The raw materials which are used in a manufacturing of skin creams include:

- 1) **Water:** Water is a vital and extensively used ingredient in cream formulations. Its role in forming emulsions depends on the proportion used. The formulation may result in oil-in-water (O/W) or water-in-oil (W/O) emulsions, depending on the relative amounts of the oil and water phases. [6,7]
- 2) **Oil, fates and waxes:** These components and their derivatives form a significant part of cream formulations. Waxes function as emulsifiers, fats as thickeners, and oils serve as perfuming agents or preservatives, among other roles. Oils can be categorized into two types: mineral oils and glyceride oils.[8]
- 3) **Mineral oil:** Mineral oils are composed of hydrocarbons derived from petroleum. These are transparent, odorless, and highly refined, making them a common choice in cosmetic formulations. Various types of mineral oils are utilized in cream manufacturing. Examples, [9]
 - I. Light liquid paraffin
 - II. Heavy liquid paraffin
 - III. Liquid petroleum
- 4) **Glyceride oil:** These are predominantly vegetable-based oils. Examples include almond oil, arachis oil, castor oil,

coconut oil, and olive oil. [10,11]

- 5) **Vegetable oil:** These oils create a protective barrier on the skin, reducing water loss and helping to retain skin's suppleness. They also contribute to increasing the lipid or oil component's thickness in creams or personal care products. Common examples include almond oil, wheat germ oil, avocado oil, and sunflower oil. [12]
- 6) **Waxes:** Commonly used waxes in cream formulations include beeswax, carnauba wax, ceresin, and spermaceti. These waxes stabilize emulsions by preventing the separation of oil and liquid components, increase the lipid portion's thickness, and adhere to the skin's surface. [13]
- 7) **Fats:** Various fats are utilized in cream preparation, sourced from animal, plant, or mineral origins. Both glyceride oils and fats can be of animal or vegetable origin. Common fatty acids include lauric, margaric, palmitic, stearic (saturated fatty acids), and oleic acid, the latter being a popular unsaturated fatty acid in liquid form. [14]
- 8) **Lanolin:** Extracted from sheep's wool, lanolin is available in two forms. Hydrous lanolin contains 25%-30% water, while anhydrous lanolin has a melting point of 38°C-42°C and a slight odor. [15,16]
- 9) **Colours:** Historically, colors were derived from natural sources such as turmeric, saffron, and indigo. Advances in technology during the 19th century led to laboratory-synthesized colors, which are more stable, have greater intensity, and no longer require wild-harvested plants. [17]
- 10) **Emollients:** These are moisturizers that soften and hydrate the skin, addressing dryness. Commonly used emollients include mineral oil, squalene, and lanolin. [18]
- 11) **Humectants:** These multifunctional ingredients are vital in skincare formulations, offering benefits like moisturization and exfoliation. Examples include glycerin, hydroxyethyl urea, betaine, sodium PCA, and sodium L-lactate. [19]
- 12) **Perfumes:** Perfumes add pleasant scents to creams. Examples of natural perfumes often used include, [20]
 - I. White Blossoms:
 - II. Rosy Dreams
 - III. Orange Blossom
- 13) **Vitamins:** Vitamins are essential for maintaining both overall physiological health and skin health. Frequently used vitamins in cream formulations include vitamins A, B, C, and E. [21]
- 14) **Preservatives:** Preservatives are critical for preventing microbial growth and contamination during the product's formulation, storage, transportation, and usage. Antioxidants are also incorporated to prevent deterioration caused by oxygen exposure. Synthetic preservatives, when used in small amounts, are effective in maintaining product stability. [22]

5. MATERIALS AND METHODS

Methods:

Selection of Active Ingredient:

Sandalwood oil contains 2-5% volatile oil, predominantly composed of sesquiterpene alcohols known as santalols, accounting for 90-97% of its composition. The oil primarily includes two isomeric forms, α -santalol and β -santalol, alongside other constituents such as sesquiterpene alcohol, aldehyde santalol (C₁₅H₂₂O), santene, and santenone. [23]

Collection and Authentication:

Ensuring the authenticity of raw materials is a vital step in maintaining the quality, safety, and efficacy of herbal medicines. Authentication processes verify the correct plant species and parts are used. For this study, sandalwood was procured from the local market and authenticated by a botanist in the botanical department. [24]

Extraction Method:

The Soxhlet extraction technique was employed, which facilitates continuous solid-liquid extraction. The material to be extracted is placed in a thimble, allowing efficient recovery of the desired compounds. [25,26]

6. EXPERIMENTAL WORK

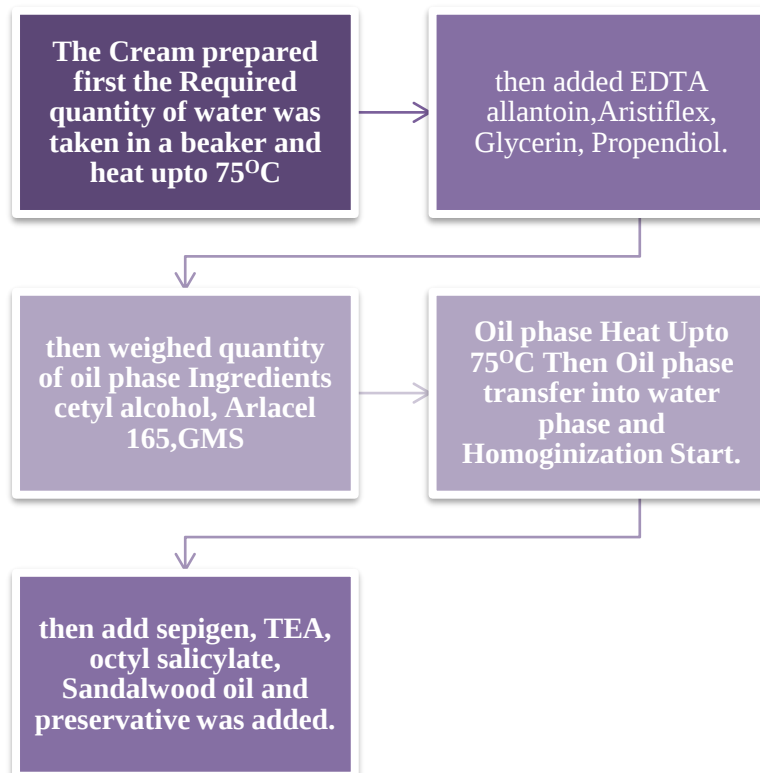
Extraction of Sandalwood oil using Soxhletion Methods:

Procedure



Fig. No. 1: Extraction Of Natural Oil By Soxhletion

Preparation of cream base:



Evaluation of Sandalwood Oil Containing Sunshield Cream.

a. pH: The pH of the cream was assessed using a digital pH meter. It was determined to be 6.5, which is considered suitable to minimize the risk of skin irritation. [27]

b. Spreadability: Spreadability is a crucial characteristic as it reflects how well the cream behaves during application. To evaluate this property, a small amount of cream was placed between two glass slides, with a 100 g weight applied on top. The spread diameter, measured after 5 minutes, was recorded as 6.5 cm. [28] Spreadability was calculated using the formula: [28]

$$S = m \times 1/t$$

S= Spreadability

m=Weight placed on the slide

l=Length of the glass slide

t=Time in seconds

c. Extrudability: The extrudability of the cream was determined by firmly pressing a collapsible tube containing the formulation at the crimped end. After removing the cap, the amount of pressure needed to extrude a 0.5 cm ribbon of cream within 10 seconds was measured. The average extrusion pressure was found to be 15.3 g/cm². [29]

d. Viscosity: Viscosity was measured using a Brookfield viscometer (DV2T model) at 25°C. A 5 g sample of cream was placed in the viscometer's sample holder and left to stabilize for 5 minutes. At a rotational speed of 50 rpm and room temperature (25–27°C), the viscosity was found to be 1050 centipoise. [30]

e. Irritation Test: A small amount of cream was applied to the skin and observed for any adverse reactions. The formulation was found to be non-irritating. [31,32]

f. Washability: To determine washability, a small amount of cream was applied to the skin and subsequently rinsed with running water. The cream was found to be easily washable. [33]

g. Loss on Drying (LOD): A 1 g sample of cream was placed in a porcelain dish and dried in a hot air oven at 100°C for 30 minutes. Successive weights, recorded at 30-minute intervals until a consistent value was obtained, [34] were used to calculate the LOD. The sample was then stored in a desiccator for 15 minutes before final measurements. [35]

7. RESULTS AND DISCUSSION

Evaluation of Extract:

Preliminary Phytochemical Screening:

Table No.1: Preliminary Phytochemical Screening

Sr. no.	Alkaloids	Flavonoids	Phenols	glycosides	Tannins	Lipids
1	Essential Oils	+	+	+	+	+

Here, + = Present, - = Absent

Soxhletion Method

Result obtained by Soxhlet extraction is shown in Table below

Table. No.2: Weight of Oil with Respect to Time

Weight of oil (g)	Time (mins)
0.4	250
0.5	500

0.6	750
0.80	1000
0.90	1200

The extraction method yielded 3.2 g of pure essential sandalwood oil from 100 g of sandalwood, corresponding to a 3.02% oil yield. The oil volume was recorded at 4-hour intervals to observe variations in yield over time. As time progressed, the ethanol solvent evaporated, leaving behind the essential oil in the mixture.

Table. No. 3: Result of Essential Oils Extraction

Method of extraction	% yield
Soxhletion Method	3.02

Calculation of Percentage Yield of Volatile Oil.

Material Balance for Soxhletion Method

- Weight of Sandalwood = 120g
- Quantity of Olive oil used= 600ml, Quantity of Ethanol used= 140ml
- Weight of beaker= 97.86g
- Weight ethanol and essential oil= 100.86g
- The total weight= 3.02g
- %yield = $ME/Mg \times 100$
- Where
- ME = Mass of essential oil, MG = Mass of Sandalwood Powder Sample
- ME = 3.02g
- MC = 120g
- By substituting values
- %yield = $3.02/120 \times 100 = 2.51\%$
- Therefore % yield= 2.51%
- Graph of the weight (g) of essential oil to the time (mins) for extraction method.

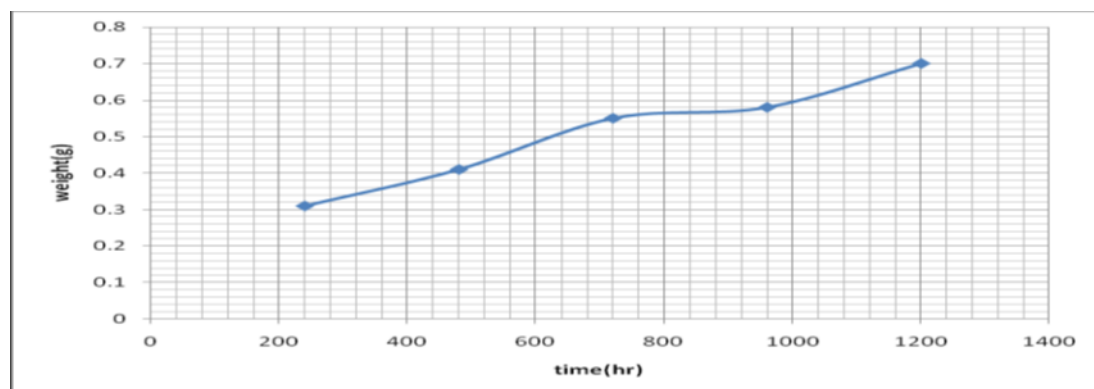


Fig. No. 2: Graph of The Weight of Essential Oil To The Time (Mins) For Soxhletion Method

CONCLUSION: The development of a sandalwood oil-containing sunshield cream successfully combines the natural benefits of sandalwood oil with effective sun protection. The cream provides a pleasant sensory experience, enhances skin health, and offers broad-spectrum UV protection. This formulation can be a valuable addition to the market, catering to consumers seeking natural and effective sun protection solutions.

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