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Formulation of Anti-Perspirant Deodorant Stick using Moringa Oleifera

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ABSTRACT:
Sweating serves as the human body's primary thermoregulatory mechanism; however, it is often accompanied by malodour, which can negatively impact an individual's self-confidence. Ongoing research has focused on mitigating both perspiration and associated body odour. Perspiration is primarily attributed to increased sweat gland activity, whereas malodour results from microbial metabolism and is influenced by ecological factors such as diet. Deodorant research predominantly targets the inhibition of odour-causing microbial growth through the use of antimicrobial agents, while antiperspirant formulations aim to reduce sweat secretion, thereby indirectly minimizing body odour and enhancing aesthetic appeal. The underlying mechanism of antiperspirant action typically involves using Moringa extract physically blocking the emergence of sweat on the skin surface.

This study presents a systematic review of recent advancements in the formulation of novel antiperspirant and deodorant active ingredients, with a particular emphasis on alcohol- free, paraben-free, and naturally derived compounds. Emerging classes of actives, including antimicrobial plant extracts, deodorizing textiles, and bacterial derivatives, have been investigated for their potential application in personal care products. Nonetheless, key challenges remain in elucidating the physicochemical formation of gel plugs by antiperspirant agents within eccrine sweat pores and in developing delivery systems that provide prolonged efficacy.

Additionally, herbal deodorant sticks were formulated and evaluated through various physicochemical and functional tests, including pH determination, softening point analysis, breaking load assessment, spreadability, stability studies, and antibacterial efficacy. The results indicate that the formulated herbal deodorant sticks exhibit comparable stability

KEYWORDS: Herbal deodorant, Antiperspirant stick, Natural ingredients, Body odour, Thermoregulation, Antibacterial activity, Plant-based actives, Personal care formulation, Stability testing, Moringa Extract, Paraben-free, Alcohol-free cosmetics.

I. INTRODUCTION

Deodorant sticks are utilized to manage body odor. These items are created by combining active components with waxes, oils, and silicones and shaping the blend into stick form. Body odor mainly arises in the underarm region where there is a high density of sweat glands. Although sweat from these glands is initially odorless, it contains natural oils, known as lipids, that offer a growth environment for bacteria residing on the skin. These bacteria interact with the lipids, transforming them into substances that have a distinctive sweaty scent. Isovaleric acid, for instance, is one chemical compound responsible for the smell of sweat. Odor control can be achieved through various methods—basic hygiene (washing with soap and water) is the most crucial but also through antiperspirant, fragrances, or any combination of these. Essentially, deodorants and antiperspirants represent two different methods to prevent odor. Deodorants are fragrant formulations that mask but do not genuinely influence perspiration; they can also function by creating a more acidic, inhospitable environment for odor-producing bacteria, while antiperspirants obstruct or block the pores, reducing the amount of perspiration that exits the body, thus providing the bacteria with less to consume. Natural deodorants are the contemporary trend in the beauty and fashion industry. [1], [2]. These products are becoming more popular as most individuals nowadays favor

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natural items over synthetic materials for their personal care, to boost their beauty, as these products offer nutrients to the body, enhance health, and provide satisfaction since they are free from synthetic chemicals and have relatively fewer side effects compared to synthetic cosmetics. Natural deodorants are an excellent method to avoid parabens, aluminum, and neurotoxins found in commercial deodorants and antiperspirants. Sweat glands and their functions Eccrine, apocrine, and apoeccrine glands Skin is a component of the human integumentary system that constitutes the outermost layer of the human body. Skin is the body's largest organ, which affords a mechanical barrier, safeguarding the body from the external environment. Additionally, skin also contributes to both the endocrine and exocrine functions of the human body.

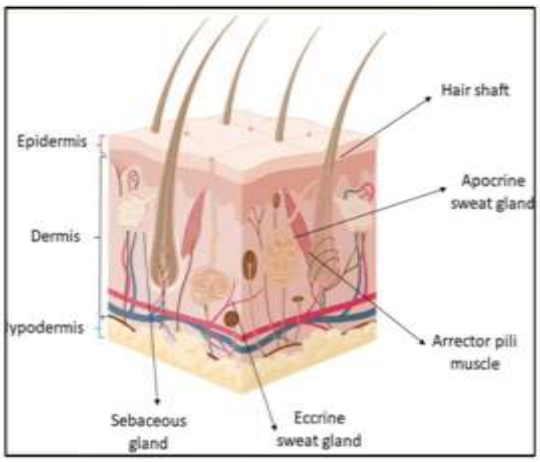

Fig.1. Structure of Skin

Examples of an exocrine function of the skin include the secretion of sebum and sweat fluid. There are three primary compartments of human skin: the epidermis, dermis, and subcutaneous fascia. Sweat glands are skin appendages located within the dermis compartment of the human skin. It was estimated that there exists a total of 2,380,000 glands distributed throughout the body. An early morphological study conducted in 1917 revealed that there are two varieties of sweat glands, eccrine and apocrine sweat glands.

Eccrine sweat glands are found all over the body, except for the glans of the penis and the lips. Eccrine glands are essential to the thermoregulation system of the human body. The sweat fluid produced by eccrine glands is a watery substance that contains inorganic salts, such as NaCl and KCl, as well as organic acids, including lactic acid and urea. [3]

Apocrine sweat glands are localized to specific areas of the body, such as the genital, plantar, and axillary regions. Unlike eccrine glands, apocrine glands begin to function at the onset of puberty.

Apocrine glands are approximately 800 µm larger than eccrine glands, and their ducts open into the hair follicle. The fluid secreted by apocrine glands is oily, comprising fatty acids, proteins, and steroids. However, this fluid is combined with sebum (which is secreted by the sebaceous gland), as both types of glands open into the hair follicle.

Hyperhidrosis:

Hyperhidrosis is defined as a disorder marked by excessive sweating beyond what is physiologically necessary, particularly in the axilla region. Around 2%–3% of the population experiences this condition. The potential cause of hyperhidrosis is an abnormality in the activities of the sympathetic and parasympathetic nervous systems, which overstimulates the sweat glands. Due to the excessive amounts of moisture, hyperhidrosis is often associated with bromhidrosis (unpleasant body odor). Hyperhidrosis can lead to inconveniences such as needing to change soaked clothing and shoes, and it may also impact the psychological wellbeing of the individual.

What is a Stick Deodorant?

A stick deodorant is a form of deodorant that is presented as a solid stick. It is applied directly to the skin, typically under the arms, to offer prolonged odor protection. Stick deodorants commonly contain a mix of sweat-absorbing ingredients, such as aluminium chloride, along with fragrance. Select a deodorant formula that glides on smoothly and does not leave white marks on clothing.

Fig.2.Deodorant Stick

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Advantages of Antiperspirant Deodorant Stick:

- It prevents the formation of the bacteria that causes body odour.
- Deodorants are fragranced to conceal the smell produced by bacteria.
- Deodorants often contain alcohol, and a few have anti-microbial components that assist in reducing bacteria.
- They effectively prevent sweating because the aluminium found in most deodorants interacts with sweat to form a blockage in the sweat glands.
- These blockages reduce moisture, which in turn decreases the likelihood of bacteria developing.
- **Disadvantages of deodorant stick:**
- Skin Sensitivity
- Residue and White Marks
- Skin Allergies

II. MATERIALS AND METHODS

Materials:

Moringa Extract purchased from, Beeswax white from Analab fine chemicals Mumbai India, Stearic Acid from Analab fine chemicals Mumbai India, Tween 80 from Chemdyes Corporation Rajkot Gujarat, Liquid Paraffin Light from Analab fine chemicals Mumbai India. [4], [5]

Method:

Procedure for Preparing Antiperspirant Stick:-

1. Phase A – Oil Phase Preparation:

In a clean beaker, measure and include Stearic acid, Bees wax, and Liquid paraffin.
Gently heat the mixture in a water bath at approximately 70–75°C until all solids completely dissolve and create a consistent oily phase.

2. Phase B – Aqueous Phase Preparation:

In another beaker, dissolve Moringa extract and clove Oil in purified water (preheated to around 70°C). Incorporate Tween 80 into this aqueous phase and mix thoroughly to achieve homogeneity.

3. Emulsification:

Gradually incorporate the aqueous phase (Phase B) into the oil phase (Phase A) while continuously stirring. Mix well to create a uniform emulsion.

4. Cooling and Solidification:

Transfer the hot emulsion into appropriate stick molds or containers. Let the formulation cool and solidify at room temperature.

5. Final Touch:

After solidification, securely cap and label the containers accordingly.

TABLE I. Formulation of Antiperspirant Deodorant Stick

Sr.No	Ingredients	Formulation Batches of Deodorant Stick		
		F1	F2	F3
..	Moringa extract	10ml	10ml	12ml
2.	Beeswax	3.0gm	2.5gm	2.5gm
3.	Stearic acid	4.0gm	4.0gm	4.0gm
4.	Liquids Paraffin	2.0ml	2.0ml	1.0ml
5.	Tween 80	5.0ml	5.0ml	5.0ml
6.	Clove Oil	1.0ml	1.5ml	0.5ml

EVALUATION OF THE DEODORANT STICK

1. Physical Properties:

Appearance and Texture: Examine the color, scent, and texture of the deodorant stick.

pH Measurement: Identify the pH level of the deodorant stick, which is vital for skin compatibility.

Softening Point: Record the temperature at which the deodorant stick begins to soften, important for storage and handling, particularly in warm environments.

Breaking Load: Ascertain the force necessary to fracture the deodorant stick, reflecting its structural integrity. [6], [7]

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2. Spreadability: Analyze how effortlessly the deodorant stick glides on the skin.
3. Stability Test: Examine how the deodorant stick behaves over time, including variations in color, scent, and texture.

4. Antibacterial Activity:
Procedure:
a) Preparation of Bacterial Culture:
Inoculate chosen bacterial strains in nutrient broth. Incubate at 37°C for 18–24 hours until cloudy (log phase).

b) Preparation of Agar Plates:
Pour molten sterile nutrient agar into sterile Petri dishes. Let the agar solidify. Disperse 100 µL of the bacterial culture uniformly over the surface.

c) Preparation of Deodorant Extract (if needed):
Remove a small portion of the deodorant stick. Dissolve in an appropriate solvent (e. g. , ethanol, DMSO, or sterile water based on solubility). Filter if needed to eliminate solid particles. [8], [9]
d) Agar Well Diffusion Assay:
Employ a sterile cork borer to create wells in the agar plate (6–8 mm diameter). Fill each well with a constant volume (50–100 µL) of the test sample. Incorporate wells for positive and negative controls.

e) Incubation:
Place the plates in an incubator at 37°C for 24 hours.

f) Measurement of Zone of Inhibition:
After incubation, gauge the diameter of the clear zone surrounding each well in millimeters. [10]

III. RESULTS

1. Physical Properties

Colour: Off-White to beige (depending on Moringa extract concentration & purity)
Odour: Mild herbal scent (from Moringa) + added fragrance (optional)
Texture: Smooth, slightly waxy but glides easily
pH: The pH of the deodorant stick was found to be 5.7-5.8, which is within the skin-compatible range.
Softening Point: The deodorant exhibited a softening point of 57°C -72°C, making it suitable for use in typical environmental conditions without excessive melting.

2. Spreadability: The deodorant showed good spreadability, with easy application and smooth texture upon contact with the skin.

3. Stability

The deodorant demonstrated excellent stability over a 1- month period, with no significant changes in appearance, texture, or fragrance under standard storage conditions. The product also maintained its consistency after exposure to high humidity and temperature fluctuations, indicating good shelf- life stability.

4. Antibacterial Activity

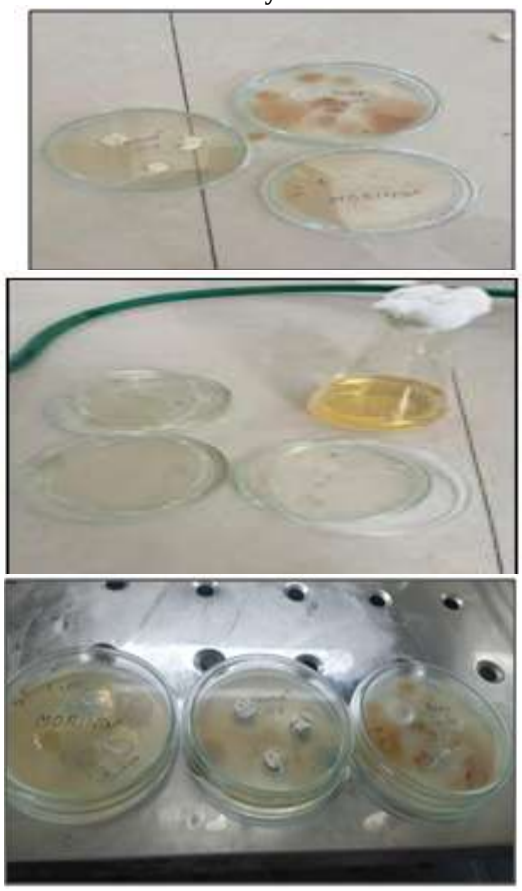

Fig 3: Antibacterial Activity

IV. CONCLUSION:

The formulation 3 of a deodorant stick based on Moringa extract has shown encouraging results as a viable, natural substitute for conventional antiperspirants and deodorants. The Moringa extract, containing a rich array of antimicrobial and antioxidant substances, plays a crucial role in inhibiting odour-producing bacteria, thus tackling one of the primary contributors to body odour.

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Formulation 3 demonstrated appropriate physicochemical attributes, such as a suitable pH level, an ideal softening point, and excellent spreadability, ensuring both effectiveness and user satisfaction.

The mechanical characteristics, assessed through breaking load and stability assessments, verified that the Moringa deodorant stick preserves its structural firmness under standard storage conditions and usage. Moreover, the antibacterial effectiveness of the formulation was similar to that of commercially available deodorants, suggesting its viability as a natural, efficient option for controlling body odour.

In light of the rising demand for alcohol-free, Paraben-free, and naturally derived personal care items, the Moringa extract deodorant stick provides a promising answer within the expanding market for eco-friendly and skin-safe alternatives. Additional research, incorporating in vivo trials and long-term stability evaluations, is recommended to fully confirm its effectiveness and market viability.

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