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FORMULATION AND EVALUATION OF ANTIMICROBIAL HERBAL DEODORANT STICK: A STUDY ON *MORINGA OLEIFERA* AND *PSIDIUM GUAJAVA*

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ABSTRACT

The present study was undertaken to formulate and evaluate an antimicrobial herbal deodorant stick using extracts of *Moringa oleifera* and *Psidium guajava*. Body odour is caused by the growth of microorganisms on sweat, and herbal formulations offer a safer alternative to synthetic deodorants. The herbal deodorant stick was prepared using suitable excipients and evaluated for various parameters. Organoleptic evaluation was carried out to assess color, odour, appearance, and texture. Physicochemical evaluation included determination of pH, softening point, and spreadability to ensure suitability for topical application. The antimicrobial activity of the formulation was evaluated against selected microorganisms using standard microbiological methods. The optimized formulation showed acceptable organoleptic properties, suitable pH close to skin pH, adequate softening point, good spreadability, and significant antimicrobial activity. The study concludes that the formulated herbal deodorant stick is safe, effective, and has good potential as a natural antimicrobial deodorant for regular use.

KEYWORDS: Antimicrobial herbal deodorant stick, *Mentha piperita, Moringa oleifera, Psidium guajava.*

INTRODUCTION

A Deodorant stick is a solid deodorant product applied directly to the underarm area to control body odour. It typically contains fragrance and active ingredients that reduce sweat and odour while leaving the skin feeling fresh.[1]

Deodorants function primarily by employing antimicrobial agents that suppress the proliferation of odour causing skin microbiota, thereby reducing the production of malodorous compounds. Additionally, perfumes, essential oils, and other fragrance components are incorporated to mask any residual odour, enhancing the products overall efficacy and sensory appeal.[2]

Herbal antimicrobial deodorant stick contains *Moringa oleifera*, *Psidium guajava* (guava leaves), and *Mentha piperita*. Guava leaves treat acne by acting as an antimicrobial, antibacterial, antioxidant, and anti- inflammatory agent. Inflammatory acne, scars, age spots, pigmentation, and uneven skin tone can all be effectively treated with guava leaves. The key components of guava leaves include alkaloids, oils, lipids, glycosides, triterpenoids, flavonoids, and tannins, it has antibacterial, antioxidant, anti-inflammatory properties.[3]

MATERIALS AND METHODS

MORINGA LEAVES (*Moringa oleifera*)[4][5]

Moringa leaves consists of dried leaves of *Moringa oleifera,* belonging to the family Moringaceae. Each leaflet is small, around 1–2 cm long, green in color, slightly hairy, and nearly smooth on the top surface.

Uses: Antioxidant and reduce inflammation in cosmetic products

GUAVA LEAVES (*Psidium guajava*)[6][7]

Guava leaves consist of dried or fresh leaves of, *Psidium guajava* belonging to the Myrtaceae family. Guava leaves (*Psidium guajava* folium) are typically dark green, oval to elliptical in shape, and have a rounded or blunt tip. The surface appears dull green, firm, and leathery, with clearly visible veins.

Uses

- Anti-microbial
- Anti acne
- Anti-inflammatory
- Antioxidant actions in cosmetic products.

MINT LEAVES (*Mentha piperita*)[8][9]

Mint leaves are obtained from the dried or fresh leaves of various Mentha species (Family: Lamiaceae**).** It is widely valued for its characteristic flavor and aroma, and both its fresh or dried leaves as well as the essential oil distilled from them are commonly used in cosmetic, food, and pharmaceutical formulations. The plant has dark green leaves arranged oppositely, ranging from oblong to lanceolate in shape, often slightly downy, with sharply serrated margins.

Uses

- Skin cooling and refreshing
- Oil control

BEES WAX[10][11]

The purified wax obtained from honey comb of Apis mellifera linn and other species of Apis. Family Apidae.

Uses

- It is a thickening agent
- Bees wax helps to retain moisturizing the skin.
- Bees wax widely used in cosmetic product.

STEARIC ACID[12]

IUPAC Name octadecanoic acid. Molecular Formula $C_{18}H_{36}O_2$, Appearance White, waxy, crystalline solid, Odour is Mild, faint fatty or oily.

Uses

- Emulsifiers
- Thickeners
- Surfactants in cosmetic formulations.

LIQUID PARAFFIN[13]

It is mixture of purified liquid saturated hydrocarbons obtained from petrolatum. Colour is colourless, Odour is odorless, Taste is tasteless.

Uses

- Cosmetically used in preparation of vanishing cream, cleansing cream, and all-purpose cream
- Used in cosmetic and food products

- Used as excipients in topical preparation.

TWEEN 80[14]

IUPAC Name: Polyoxyethylene (20) sorbitan monooleate, Molecular Formula $C_{64}H_{124}O_{26}$ Appearance Viscous liquid, Yellow to amber color, Odour Slight, characteristic

Uses

- Emulsifier
- Improves product texture and stability.

CLOVE OIL[15]

Clove oil is obtained from the dried flower buds**,** leaves**,** or stems of Syzygium aromaticum (L.) Merr. & Perry**,** family Myrtaceae**.** Colour Pale yellow to yellowish-brown essential oil, Odour Strong, warm, spicy aroma Characteristic eugenol-like smell.

Uses

- Antimicrobial
- Anti-inflammatory
- Fragrance
- Natural preservative in herbal cosmetics

LAVENDER OIL[13]

Lavender oil is the volatile oil obtained by steam distillation of fresh flowering tops of Lavandula officinalis Chaix. family: Labiatae, Colour is Colourless or yellow liquid, Odour Characteristic pleasant aroma.

Uses

- Flavouring agent in perfumery and cosmetics
- Aromatic
- Carminative

METHODOLOGY

A. Preparation of oil phase

In a China dish the bees wax, stearic acid, and liquid paraffin is taken then the China dish is place in water bath heat approximately at 70-75°C. Stirring the solid has completely dissolve.

B. Preparation of aqueous phase

In another beaker purified water, tween 80, moringa leaf extract, guava leaf extract and clove

oil is heated under water bath at 70°C stirring until homogenous.

C. Emulsify the phases

Slowly and gradually pour the aqueous phase into melted oil phase with continuous stirring until a uniform emulsion is formed.

D. Add heat sensitive ingredients

Once the emulsion is formed, remove it from heat and allow to mixture cool slightly (below 60°C), add the mint leaves extract and lavender oil, stirring to incorporate them evenly.

E. Cool and solidify

Pour the warm mixture in to deodorant stick container. Allow to cool and solidify completely at room temperature before capping and labelling.

FORMULATION

SL NO.	INGREDIENTS	F1	F2	F3
1.	Moringa leaves extract	2.5g	2g	1.5g
2.	Guava leaves extract	2g	2.5g	3g
3.	Mint leaves extract	0.5g	0.5g	0.5g
4.	Bees wax	8g	8g	8g
5.	Stearic acid	3.5g	3.5g	3.5g
6.	Liquid paraffin	8.5g	8.5g	8.5g
7.	Tween 80	1g	1g	1g
8.	Clove oil	0.5g	0.5g	0.5g
9.	Lavender oil	0.5g	0.5g	0.5g
10.	Distilled water	3g	3g	3g
	TOTAL	**30g**	**30g**	**30g**

EVALUATION[16],[17],[18]

1. Organoleptic evaluation

The antimicrobial herbal deodorant stick was evaluated for its colour, odour, texture consistency and appearance.

2. pH measurement

A 1% solution was prepared by dissolving 0.5 g of the sample in 49.4 g of distilled water. The pH of this solution was then determined using a pH meter while maintaining the temperature between 21°C and 24°C.

3. Softening point

It refers to the temperature at which the stick loses its shape and can no longer be used. For this

test, the stick was cut longitudinally into two halves and placed vertically in Petridishes. These were kept in an incubator, and the temperature was gradually increased. The softening point was noted at the temperature where the sharp edges of the stick tip and sides started to melt or become rounded.

4. Spreadability

Weigh the small amount of herbal deodorant stick, about 1g then place on top of the glass and place another glass on top of the deodorant stick. Measure the diameter of the deodorant stick by measuring the length of several sides. The spreadability was calculated by using the formula.

Spreadability = M.L/T

Were,

M = Weight placed on the slide

L = Length of the glass slide in cm T = Time in sec

5. Antibacterial activity

Antibacterial activity was assessed by first inoculating the selected bacterial strains (Staphylococcus aureus and Escherichia coli) into nutrient broth and incubating them at 37°C for 18–24 hours until they reached the logarithmic growth phase. Sterile molten nutrient agar was poured into Petridishes and allowed to solidify, after which 100 µL of the bacterial culture was evenly spread on the agar surface. A small amount of the deodorant stick was then dissolved in a suitable solvent such as ethanol, DMSO, or sterile water depending on its solubility, and filtered if necessary to remove undissolved particles. Wells of 6–8 mm diameter were made in the agar using a sterile cork borer, and a fixed volume (50–100 µL) of the test sample was added to each well along with positive and negative controls. The plates were incubated at 37°C for 24 hours, and antibacterial activity was determined by measuring the diameter of the zone of inhibition around each well in millimeters.

RESULTS AND DISCUSSION

SL NO	EVALUATION PARAMETER	F1	F2	F3
1.	Appearance	Semisolid stick form	Semisolid stick form	Semisolid stick form
2.	Odour	Pleasant herbal, mildly minty	Pleasant herbal, mildly minty	Pleasant herbal, mildly minty
3.	Colour	Pale greenish	Pale greenish	Pale greenish-

				yellow
4.	consistency	Homogenous, smooth	Homogenous, smooth	Homogenous, smooth
5.	pH	4.3	5.3	5.4
6.	Softening point	40°C	55°C	52°C
7.	Spreadability	2.5g.cm/sec	2.9g.cm/sec	3.5g.cm/sec
8.	ANTIMICROBIAL ACTIVITY (Zone of inhibition)	5mm	3mm	10mm

DISCUSSION

This study focused on the formulation and evaluation of an antimicrobial herbal deodorant stick using natural plant extracts of Moringa oleifera, Psidium guajava, and Mentha piperita. These herbal ingredients were selected due to their reported antimicrobial, deodorizing, antioxidant, and skin-protective properties. The study demonstrates that herbal extracts, particularly guava leaf extract, can serve as effective natural antimicrobial agents in deodorant stick formulations. Based on the results of organoleptic evaluation, pH, softening point, spreadability, and antimicrobial activity, formulation F3 was found to be the most effective and stable formulation.

CONCLUSION

The present study successfully demonstrated the formulation and evaluation of a herbal antimicrobial deodorant stick using *Moringa oleifera*, *Psidium guajava* (guava leaves), and *Mentha piperita*. The use of natural plant extracts aimed to develop a safer and effective alternative to synthetic deodorant products while providing antimicrobial protection against odor-causing microorganisms.

All formulated batches were evaluated for organoleptic properties, pH, softening point, spreadability, and antimicrobial activity, and the results were found to be within acceptable limits for topical application. Among the prepared formulations, formulation F3 emerged as the optimized formulation, exhibiting superior organoleptic characteristics, skin-compatible pH, optimal softening point, good spreadability, and enhanced antimicrobial activity. The significant antimicrobial efficacy of formulation F3 can be attributed mainly to the presence of *Psidium guajava* leaf extract, which is rich in flavonoids, tannins, saponins and phenolic compounds known for their strong antibacterial activity. The combined and synergistic effects of *Moringa oleifera* and *Mentha piperita* further contributed to improved deodorant action, skin freshness, and user acceptability.

In conclusion, the study confirms that herbal extracts, particularly guava leaf extract, can be effectively utilized as natural antimicrobial agents in deodorant stick formulations. The optimized formulation (F3) offers a promising, safe, eco-friendly, and cost-effective herbal cosmetic product with potential for further development and commercial application.

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