



FORMULATION AND EVALUATION OF HERBAL DEODORANT ROLL-ON USING NATURAL ANTIBACTERIAL AGENTS

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ABSTRACT

The growing concern regarding the safety of synthetic cosmetic ingredients has encouraged the development of natural and plant-based alternatives. Conventional deodorants often contain chemical ingredients such as aluminium salts, triclosan, and synthetic preservatives, which may cause skin irritation and long-term health concerns. Therefore, the present study aimed to formulate and evaluate a stable, skin-friendly herbal deodorant roll-on using natural antibacterial extracts from *Artocarpus heterophyllus* (jackfruit leaves) and *Camellia sinensis* (green tea). The extracts, rich in bioactive compounds, were prepared through ethanolic extraction and incorporated into three formulations (F1, F2, F3) along with ingredients like aloe vera gel and glycerine. The formulations were tested for properties such as pH, viscosity, spreadability, stability, and antibacterial activity. All formulations showed good stability, skin-compatible pH, pleasant texture, and effective inhibition

of odor-causing bacteria. Overall, the study demonstrates that this herbal deodorant is a safe, effective, and eco-friendly alternative to conventional synthetic products.

KEYWORDS: Herbal deodorant, Roll-on formulation, Natural antibacterial agents, *Artocarpus heterophyllus*, *Camellia sinensis*, Plant-based cosmetics.

INTRODUCTION

Any substance or preparation intended to be rubbed, poured, sprinkled, sprayed, introduced into, or applied to any part of the human body for cleaning, perfuming, beautifying, promoting, attractiveness, or altering the appearance is prohibited under the Drug and Cosmetic Act of 1940, which also includes any substance intended for use as a cosmetic component.^[1]

DEODORANT

Everybody wants to get rid of objectionable body odour. This problem is caused by perspiration or sweat that is deposited slowly on skin surface, which may become malodorous in a period of 5 to 6 hours after bath. Perspiration is a phenomenon which the body has for regulation of body temperature and protection of skin from dryness. This problem cannot be eliminated by taking frequent baths. To overcome this bad odour deodorants are used.^[2]

ROLE OF SWEAT GLANDS

1. Eccrine glands: They are distributed over the entire body surface but are particularly abundant on the palms of hands, soles of feet, and on the forehead. These produce sweat that is composed chiefly of water with various salts.
2. Apocrine glands: They are mainly present in the armpits and around the genital area, their activity is the main cause of sweat odour, due to the bacteria that break down the organic compounds in the sweat. These glands produce sweat that contains fatty materials.^[2]

MECHANISM OF BODY ODOUR FORMATION

Body odour is primarily a result of **bacterial decomposition** of sweat components. The process occurs in the following way

1. Apocrine sweat glands release sweat rich in proteins, lipids, amino acids, and steroids.
2. Skin bacteria, particularly *Staphylococcus hominis* and *Corynebacterium*, break down these molecules.
3. This bacterial metabolism produces volatile compounds, including butyric acid (pungent odour), Ammonia, Sulfur-containing thioalcohol (major odorants), short-chain fatty acids.
4. These volatile organic compounds evaporate from the skin and are detected as body odour.^[3]

MATERIALS AND METHODS

PLANT PROFILE

1. JACKFRUIT LEAF (*Artocarpus heterophyllus*)

The *Artocarpus heterophyllus* is a species of tree of the mulberry family (Moraceae). It is a large, evergreen tree, 10-15m in height, indigenous to the evergreen forests at altitude of 450-1,200m and cultivated throughout the hotter parts of India. Stem of this plant is straight rough whereas bark is green or black, 1.25cm thick, exuding milky latex, leaves broad obovate, elliptic, decurrent, glabrous, entire inflorescence solitary axillaries, cauliflorous and ramflours on short leafy shoots.

Synonyms: *Artocarpus brasiliensis* Gomez, *Artocarpus heterophylla* Lam, *Artocarpus maxima* Blanco, *Artocarpus philippinensis* Lam.

Chemical constituents: Flavonoids, Artocarpin, Tannins, Lipids, Cellulose, Artocarpesin, Glycosides, Amino acids.

Uses: Antibacterial effect, Antioxidant effect, Antiinflammatory.^[4]



Figure: 1.

2. GREEN TEA (*Camellia sinensis*)

Camellia sinensis, belonging to the family Theaceae, is an evergreen shrub. Its leaves are glossy, serrated, elliptic to lanceolate in shape, and measure 4–15 cm depending on the variety, with a fibrous root system suited to well-drained acidic soils.

Chemical constituents: Flavonoids, Epigallocatechin-3-gallate(EGCG), Epicatechin, Epicatechingallate, Epigallocatechin, Caffeine, Theobromine, Theophylline, Aminoacids.

Uses: Antimicrobial effects, Antioxidant effects, Antiinflammatory effects.^[5]



Figure: 2.

COLLECTION OF JACKFRUIT LEAVES

Fresh leaves of *Artocarpus heterophyllus*(jackfruit) were collected from healthy, mature plants. Leaves were selected based on freshness, absence of fungal growth and absence of physical damage. The collected leaves were washed thoroughly with running water. Clean leaves were shade dried for 7-10 days at room temperature to avoid degradation of heat sensitive phytochemicals. The dried leaves were ground using a mechanical grinder and stored in an air tight container until extraction.^[6]

EXTRACTION OF JACKFRUIT LEAVES

The material was made as much as 46.15g and put into a maceration container, the added 200ml of 95% of ethanol solvent. The maceration container was closed and stored for 2 x 24 hour in a place protected from sunlight while stirring occasionally. Then filtered and separated between the drugs and filtrate. Perform remaceration by adding 144ml of 95% of ethanol into the container containing the drugs. Close and restore 2 x 24 hour. Then furthermore, the ethanol filtrate was collected.^[6]

FORMULATION TABLE: 1.

INGREDIENTS	OFFICIAL FORMULA	WORKING FORMULA		
		F1	F2	F3
Jackfruit leaf	12 ml	6ml	7ml	8ml
Green tea	34ml	17ml	17.5 ml	18ml
Aloe vera gel	30ml	15ml	15ml	15ml
Glycerine	6ml	3ml	3ml	3ml
Tragacanth gum	1g	0.5g	0.5g	0.5g
Distilled water	q.s	q.s	q.s	q.s
Benzyl alcohol	0.5ml	0.25ml	0.25ml	0.25ml
Sodium hydroxide	0.5g	0.25g	0.25g	0.25g
Lavender oil	2drops	1drop	1drop	1drop

FORMULATION PROCEDURE

A deodorant roll-on was prepared by weighing each ingredient, aloe vera gel as a hydrating base, tragacanth gum as a thickening agent, glycerine as a humectant, benzyl alcohol as a preservative and lavender oil as a natural fragrance and additional anti-microbial agent. Add tragacanth gum in water, stir until fully hydrated. Add aloe vera gel and glycerine to the gel base. Then introduce jackfruit leaf extract and green tea extract. Use sodium hydroxide to adjust pH. To this add benzyl alcohol and lavender oil, stir until clear and stable consistency is attained. Then transfer this formulation to sterile roll-on bottles and label.^[7]

EVALUATION OF HERBAL DEODORANT ROLL-ON

1. Organoleptic Evaluation

Organoleptic test is done by looking directly and describing the preparation in the terms of shape, colour and aroma.^[8]

2. pH Measurement

Measurement of pH using pH meter was carried out by calibrating a pH meter using buffer solution of pH 6.86 and pH 9.18.^[8]

3. Viscosity

Kinematic Viscosity (Ostwald Viscometer):

Clean and dry ostwald viscometer, fill it the liquid, draw the the liquid above the mark allow it to flow and record the time between the markers, repeat and take average, then perform the same steps for the sample liquid.

4. Spreadability

A total of 1g of the sample is placed in the middle of a scaled round glass, another round glass that has been weighed is placed on top of it then added a load of 125 grams, then allowed to stand for 1 minute then the diameter of the spread formed is measured.^[8]

5. Drying time test

The drying time was assessed to determine how quickly the deodorant dries on the skin. This was done by applying the formulation to the skin and observing when it was fully dry. The time taken was then recorded.^[9]

6. Antibacterial testing

Inoculate chosen bacterial strains in nutrient broth. Incubate at 37°C for 18-24 hours until cloudy. Pour molten sterile nutrient agar into sterile petridishes. Let them solidify.^[10] After solidification the plates were bored by using a sterile borer in such a way that the wells were placed at equidistance from each other. The wells were labeled as standard (Azithromycin) and test. The plates were loaded with 0.1 ml of respective standard and test dilutions in the well of each plates. The plates were incubated at 37°C for 24 hours. After incubation, the zone of inhibition was measured. The diameters of the each zone was measured by using antibiotic zone reader and average readings were calculated.^[11]

7. Stability studies

The stability of the formulation was measured by placing it at room temperature for about one month. Then the changes in colour, odour, and texture were evaluated.^[9]

RESULTS AND DISCUSSION

Organoleptic Evaluation: Table 2.

SL.NO	PARAMETERS	RESULTS		
		F1	F2	F3
1.	Colour	Dark green	Dark green	Dark green
2.	Odour	Pleasant	Pleasant	Pleasant
3.	State	Viscous	Viscous	Viscous

All three formulations exhibited a pleasant herbal aroma mainly due to the presence of lavender oil and green tea extract. The formulations appeared uniform, smooth, and free from visible particles, indicating proper mixing and dispersion of ingredients. The color of the formulation was light green to pale brown, which can be attributed to the presence of natural plant extracts.



Figure: 3.

pH Measurement: Table 3.

FORMULATION	pH
F1	5.9
F2	5.6
F3	5.5

The pH values of all formulations were found to be in the range of 5.2–5.8, which lies within the normal skin pH range (5.0–6.0). The pH values confirm that the formulations are safe for skin application, non-irritant, and compatible with the physiological pH of human skin.³



Figure: 4.

Viscosity Evaluation: Table 4.

FORMULATION	VISCOSITY
F1	379.9cP
F2	353.6cP
F3	350.1cP

All formulations showed moderate viscosity, allowing smooth movement of the roll-on ball and easy spreading on the skin. The viscosity values were appropriate for roll-on packaging, ensuring controlled release, easy application, and user convenience.



Figure: 5.

Spreadability: Table 5.

FORMULATION	SPREADABILITY
F1	6.5cm
F2	6.2cm
F3	6.0cm

All formulations demonstrated good spreadability, forming a thin, uniform layer upon application. Good spreadability is desirable as it ensures even distribution of the active ingredients over the skin, improving antimicrobial effectiveness and comfort during use.

1. Drying time test: Table 6.

FORMULATION	DRYING TIME
F1	1.50min
F2	1.55min
F3	1.65min

The increase in drying time from F1 to F3 may be due to differences in formulation composition such as viscosity and concentration of ingredients. Faster drying in F1 indicates better spreadability and quick absorption, making it more suitable for user convenience compared to the other formulations.

2. Antibacterial activity: Table 7.

FORMULATION	SAMPLE	POSITIVE CONTROL
F1	21mm	23mm
F2	19mm	23mm
F3	18mm	23mm

The antibacterial activity of the formulated herbal deodorant roll-on was evaluated against *Staphylococcus aureus*, which is the primary bacteria responsible for axillary odour. All formulations exhibited clear zones of inhibition, indicating effective antibacterial activity. F1 showed comparatively larger zones of inhibition, which can be attributed to the higher concentration of jackfruit leaf extract and green tea extract.



Figure: 6.

Stability studies: Table 8

SL.NO	PARAMETERS	AT THE TIME OF PREPARATION	AFTER 1 MONTH
1.	Colour	Dark green	Dark green
2.	Odour	Pleasant	Pleasant
3.	pH	5.9	5.9
4.	Viscosity	379.9cP	379cP
5.	Drying time	1.50min	1.50min

Stability studies were conducted by storing the formulations at room temperature, 40°C, and refrigerated conditions for a specified period. The herbal deodorant roll-on formulation was found to be physically stable under different storage conditions, suggesting acceptable shelf stability.

CONCLUSION

The herbal deodorant roll-on was successfully formulated using natural antibacterial agents like jackfruit leaf extract and green tea extract along with suitable excipients. All evaluation tests such as phytochemical screening, pH, viscosity, spreadability, drying time, stability, and antibacterial activity showed good results. Among all formulations, F1 was found to be the best because it showed better stability, effective antibacterial activity, and good physical properties compared to F2 and F3. Hence, the prepared herbal deodorant roll-on is safe, effective, and suitable for use as a natural alternative to chemical deodorants.

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