IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

Formulation and Evaluation of Herbal Alum Roll-On Gel Using Alum and Natural Ingredients

Sumaiyya Rafik Shaikh[1], Shilpa Sheshmani Mishra[2], Mrs. Kavita S. Pawar[3]
Dr. Pravinkumar Sable[4]
Siddhi College of Pharmacy, Pimpri-Chinchwad, Maharashtra, India[1-4]
shaikhsumaiyya78610@gmail.com

Abstract: *Body odor is a common problem caused by the bacterial decomposition of sweat on the skin surface. Conventional deodorants often contain synthetic chemicals that may cause skin irritation and other adverse effects with prolonged use. Therefore, there is an increasing demand for natural and skin-friendly alternatives. The present study was aimed at the formulation and evaluation of a herbal alum-based roll-on gel using natural ingredients such as alum, aloe vera gel, Liquorice extract, peppermint oil, and lemon oil.*

Three formulations (F1, F2, and F3) were prepared using Carbomer 940 as the gelling agent and evaluated for various physicochemical parameters including physical appearance, pH, viscosity, spreadability, homogeneity, washability, drying time, skin irritation, after-feel, and stability. The prepared formulations showed acceptable colour, odour, texture, and consistency with no evidence of phase separation. The pH values were found within the range of 6.2–6.7, indicating suitability for topical application. All formulations exhibited satisfactory viscosity, spreadability, and homogeneity. The skin irritation study revealed that the formulations were non-irritant and safe for topical use. Stability studies conducted under room temperature and accelerated conditions demonstrated good physical stability throughout the study period.

Among all formulations, F3 showed superior performance in terms of viscosity, spreadability, stability, and sensory characteristics. The presence of alum provided deodorizing properties, while aloe vera gel, Liquorice extract, peppermint oil, and lemon oil contributed moisturizing, soothing, cooling, and refreshing effects.

The findings of the study suggest that the developed herbal alum-based roll-on gel is a promising natural alternative to conventional deodorants and may provide effective body odor control with improved skin compatibility.

Keywords: : Herbal roll-on gel, Alum, Aloe vera, Liquorice extract, Natural deodorant, Carbomer 940, Body odor control, Topical formulation.

I. INTRODUCTION

Personal hygiene products play an important role in maintaining cleanliness, freshness, and overall well-being. Among these products, deodorants are widely used to control body odor, which is primarily caused by the breakdown of sweat components by microorganisms present on the skin, particularly in the underarm region. The increasing awareness regarding the potential side effects of synthetic ingredients in cosmetic products has led to a growing demand for herbal and natural alternatives that are safer, environmentally friendly, and suitable for long-term use (S. K. Chaudhuri (Sudhir Kumar Chaudhuri)).

Herbal roll-on gels have gained popularity as an effective dosage form for deodorant applications due to their ease of use, non-greasy nature, quick-drying properties, and uniform distribution of active ingredients on the skin. The use of natural ingredients in roll-on formulations offers additional benefits such as skin-soothing effects, moisturization, and pleasant fragrance while minimizing the risk of skin irritation associated with synthetic chemicals (Alzomor, 2014)

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 4, June 2026 Impact Factor: 8.2

Potash alum (potassium aluminum sulfate) is a naturally occurring mineral salt that has been traditionally used for its antimicrobial and astringent properties. It helps control body odor by inhibiting the growth of odor-causing bacteria on the skin surface. Due to its natural origin and effectiveness, alum is considered a promising ingredient for herbal deodorant formulations. Several studies have demonstrated its ability to reduce microbial growth and provide long-lasting deodorizing effects (R. Gayathri).

Aloe vera is widely recognized for its moisturizing, soothing, anti-inflammatory, and skin-protective properties. It helps maintain skin hydration and improves the overall acceptability of topical formulations (Amit Surjushe, 2008). Liquorice (Glycyrrhiza glabra) extract possesses antioxidant, antimicrobial, and anti-inflammatory activities, making it beneficial for maintaining healthy skin and reducing irritation (Giorgia Pastorino) . Peppermint oil provides a cooling sensation and refreshing fragrance, while lemon oil contributes a pleasant citrus aroma and exhibits natural antimicrobial activity (Burt, 2004).

The present study focuses on the formulation and evaluation of a herbal roll-on gel containing alum and selected natural ingredients such as Aloe vera, Liquorice extract, peppermint oil, and lemon oil. The objective is to develop a safe, effective, and skin-friendly herbal deodorant formulation capable of controlling body odor while providing additional skin-care benefits. The prepared formulations are evaluated for various parameters including appearance, pH, viscosity, spreadability, homogeneity, stability, skin irritation properties to assess their quality, safety, and performance.

1.1: Advantages of Natural Deodorants over Synthetic Deodorants

- Natural ingredients derived from plants, microorganisms, insects, and marine sources have been utilized in traditional medicine for thousands of years due to their therapeutic and health-promoting properties. Historical evidence suggests that medicinal plants have been used by humans for at least 60,000 years. Owing to their natural origin and perceived safety, plant-based products continue to gain widespread acceptance in personal care applications.
- Natural deodorants have emerged as a popular choice in the cosmetics industry as consumers increasingly prefer products formulated with naturally derived ingredients. These products are valued for being free from many synthetic chemicals and are generally associated with a lower risk of adverse effects. In addition to controlling body odor, natural formulations may provide beneficial bioactive compounds that support skin health and overall well-being.
- Conventional deodorants commonly contain synthetic antibacterial agents, including triclosan, quaternary ammonium compounds, aluminum salts, and artificial fragrances. Although these ingredients are effective in reducing odor-causing microorganisms, concerns have been raised regarding their potential health risks and skin irritation. Furthermore, prolonged exposure to certain synthetic antibacterial agents may contribute to microbial resistance and sensitization.
- Natural deodorants offer a safer alternative by incorporating plant-derived antimicrobial compounds that effectively inhibit the growth of odor-producing bacteria such as *Staphylococcus* and *Corynebacterium* species. The increasing demand for products free from parabens, aluminum, alcohol, and artificial preservatives has further encouraged the development of natural deodorant formulations.
- Several studies have demonstrated the effectiveness of herbal extracts in deodorant preparations. Extracts obtained from curry leaves, fenugreek seeds, and neem leaves have shown significant deodorizing activity with prolonged efficacy. Similarly, *Terminalia ferdinandiana* leaf extracts possess notable antibacterial properties against microorganisms responsible for body odor while exhibiting low toxicity, making them suitable candidates for natural deodorant formulations.
- Research has also highlighted the antimicrobial potential of sage extracts against sweat-degrading bacteria. In vitro studies reported significant inhibition of *Corynebacterium* species and *Staphylococcus epidermidis*, supporting their use in deodorant products. Likewise, essential oils obtained from *Eugenia caryophyllus*

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

(clove) have demonstrated strong antibacterial activity and have been successfully incorporated into herbal deodorant formulations.

- Compared with synthetic deodorants, natural deodorants are generally considered more skin-friendly and environmentally sustainable. Their formulations avoid potentially harmful chemicals while effectively controlling body odor through naturally occurring antimicrobial compounds, making them an attractive option for health-conscious consumers. (HardikB. Bhatt) (Anjana P Sajeev, 2026)

Ideal Properties of Deodorant

- An ideal deodorant should effectively control body odor while ensuring user safety and comfort.
- It should be non-irritating to the skin and suitable for regular application without causing redness, itching, or other adverse reactions.
- The formulation should not stain, discolor, or damage clothing fabrics during use. Additionally, a deodorant must be safe, non-toxic, and free from harmful effects on human health, making it appropriate for long-term daily use. (Pakhare, 2023)

II. MECHANISM OF ACTION:

The herbal alum-based roll-on deodorant gel controls body odor mainly by inhibiting the growth of odor-causing microorganisms and providing cooling, soothing, moisturizing, and skin-brightening effects on the skin surface (Alzomor, 2014).

i. Antibacterial Action of Alum

Potash alum (Potassium Aluminium Sulfate) acts as the primary active ingredient in the formulation. It possesses antibacterial and antiseptic properties that inhibit the growth of bacteria such as Staphylococcus and Corynebacterium, which are responsible for decomposition of sweat and formation of unpleasant body odor. By reducing bacterial growth, alum helps prevent malodor formation.

ii. Astringent Action

Alum exhibits mild astringent activity that helps tighten skin pores and reduce excessive moisture on the underarm surface. Reduction in moisture creates an unfavorable environment for bacterial growth and helps maintain freshness for a longer period

iii. Cooling and Refreshing Effect

Peppermint oil present in the formulation contains menthol, which produces a cooling sensation after application. It provides freshness, reduces discomfort caused by sweating, and improves overall user acceptability.

iv. Antimicrobial and Fragrance Effect of Lemon Oil

Lemon oil acts as a natural antimicrobial and aromatic agent. It helps reduce microbial contamination on the skin surface and provides a pleasant citrus fragrance that masks unpleasant odor.

v. Skin Soothing, Moisturizing, and Brightening Effect

Aloe vera gel and Liquorice extract possess anti-inflammatory, antioxidant, and soothing properties that help reduce irritation, redness, and dryness associated with topical application. Glycerine acts as a humectant that maintains skin hydration and softness. Liquorice extract contains glabridin and flavonoids, which help reduce melanin formation by inhibiting tyrosinase enzyme activity. Due to this mechanism, Liquorice extract helps improve underarm skin tone and provides mild skin-brightening effects with regular application. Aloe vera also supports skin healing and moisturization.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 4, June 2026 Impact Factor: 8.2

1. Formulation of Herbal Based Alum Roll-On Gel

The formulation was developed after reviewing published literature on alum-based deodorants, aloe vera deodorant preparations, and herbal deodorant formulations, and was optimized during preliminary laboratory trials. (Alzomor, 2014).

- **Formulation Table**

The following table outlines the quantitative composition required for preparing the herbal alum-based gel formulation across three distinct scale-up batch sizes: 10 mL, 20 mL, and 50 mL.

Ingredients	10 mL Batch(F1)	20 mL Batch(F2)	50 mL Batch(F3)
Alum	0.5 g	1 g	2.5 g
Liquorice Extract	0.2 g	0.4 g	1 g
Aloe Vera Gel	1 mL	2 mL	5 mL
Peppermint Oil	2 drops	4 drops	10 drops
Lemon Oil	2 drops	4 drops	10 drops
Sodium Benzoate	0.05 g	0.1 g	0.25 g
Triethanolamine	q.s.	q.s.	q.s.
Glycerine	0.5 mL	1 mL	2.5 mL
Rose Water	q.s. to 10 mL	q.s. to 20 mL	q.s. to 50 mL
Carbomer 940	0.1 g	0.2 g	0.5 g

Table 1: Formulation Table

Preparation Method

The herbal alum-based roll-on gel (50 ml) was prepared using a carbomer gel base technique with slight modifications from reported gel formulation methods (Alzomor, 2014) (Basha, 2011).

Carbomer Hydration

Sprinkle 0.5 g Carbomer 940 slowly into 25 mL rose water with continuous stirring.
Stir gently to avoid lump formation.
Allow the dispersion to stand for 30–40 minutes for proper hydration.

↓

Alum Solution Preparation

Dissolve 2 g alum in 5 mL warm distilled water.
Stir continuously until a clear solution is obtained.

↓

Water Phase Preparation

Add the following ingredients into the hydrated carbomer dispersion:
10 g Aloe vera gel
3 mL Glycerin
2 mL Liquorice extract

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

0.1 g Sodium benzoate
Mix thoroughly until a uniform mixture is formed.
↓
Oil Phase Preparation
Mix:
0.5 mL Lemon oil
0.5 mL Peppermint oil
Stir properly for uniform mixing.
↓
Combination of Phases
Add the prepared alum solution slowly into the water phase with continuous stirring.
Gradually incorporate this mixture into the hydrated carbomer gel base.
↓
Addition of Oil Phase
Add the oil phase dropwise into the gel mixture.
Stir continuously for proper dispersion of oils.
↓
pH Adjustment
Add Triethanolamine (q.s.) dropwise with continuous stirring.
Adjust the pH of the formulation to 4.5–6.0.
A clear and smooth gel is formed after neutralization.
↓
Final Volume Make-Up
Add sufficient quantity of rose water to make the final volume up to 50 mL.
Stir continuously until a homogeneous and lump-free gel is obtained.
↓
Filling and Storage
Transfer the prepared gel into clean and dry roll-on bottles.
Close the cap tightly and store at room temperature for further evaluation studies.
[Note: The same procedure was followed for 10 ml and 20 ml sample]

III. EVALUATION PARAMETERS

5.1: Physical Appearance

The prepared herbal based alum roll-on gel was visually examined for its color, clarity, texture, smoothness, and overall appearance. The formulation was checked for any phase separation, rough particles, or change in consistency. A good formulation should appear smooth, clear, and free from lumps.

Physical Appearance Evaluation Table for Herbal Alum Based Roll-On Gel

Sr. No.	Parameter	F1	F2	F3
1.	Colour	Light brown	Brown	Dark Brown
2.	Odour	Pleasant odor	Pleasant odor	Strong herbal and minty odor
3.	Appearance	Smooth gel	Smooth and homogeneous gel	Smooth and homogeneous gel
4.	Texture	Soft and non-gritty	Soft and non gritty	Soft and smooth gel
5.	Consistency	Semi-solid gel consistency	Flowable gel consistecy	Slightly viscous

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

				flowable gel
6.	Clarity	Brown translucent	Slightly opaque brown	Opaque dark brown
7.	Phase Separation	No phase separation observed	No phase separation observed	No phase separation observed
8.	Feel on Application	Non-sticky and cooling effect	Non-sticky and cooling effect	Non-sticky and cooling effect
9.	Washability	Easily washable with water	Easily washable with water	Easily washable with water
10.	Irritation	No irritation observed on skin	No irritation observed on skin	No irritation observed on skin

Table 2: Physical Appearance

All formulations (F1, F2, and F3) showed good physical appearance with smooth texture, pleasant odour, and semi-solid consistency. No phase separation or skin irritation was observed. The formulations were non-sticky, easily washable, and suitable for topical application.

5.2: pH Determination

The pH of the prepared roll-on gel was measured using a digital pH meter at room temperature. About 1 g of gel was dispersed in distilled water and the pH was recorded. The pH of topical formulations should be near skin pH to avoid irritation and ensure safe application on the skin (Garg, 2002).

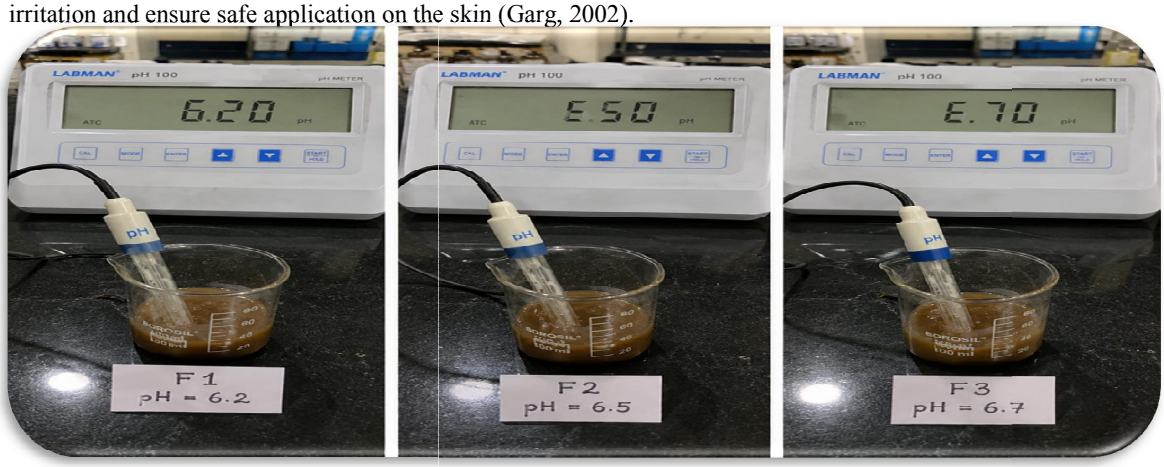

Figure 1: pH determination parameter

Sr no	Parameter	F1	F2	F3
1	pH	6.2	6.5	6.7

Table 3: pH determination observation

The pH values of formulations F1, F2, and F3 were found within the skin-friendly range (6.2–6.7). All formulations were suitable for topical application and showed no chances of skin irritation. Hence, the formulations were considered safe and stable for underarm use.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

5.3: Viscosity

The viscosity of the prepared herbal alum-based roll-on gel formulations was determined using an Ostwald viscometer at room temperature. The time required for the formulation to flow between the two marked points of the viscometer was recorded and compared with that of distilled water. The viscosity was calculated using the Ostwald viscometer equation. The measurements were performed in triplicate and the average value was recorded. (Garg, 2002)

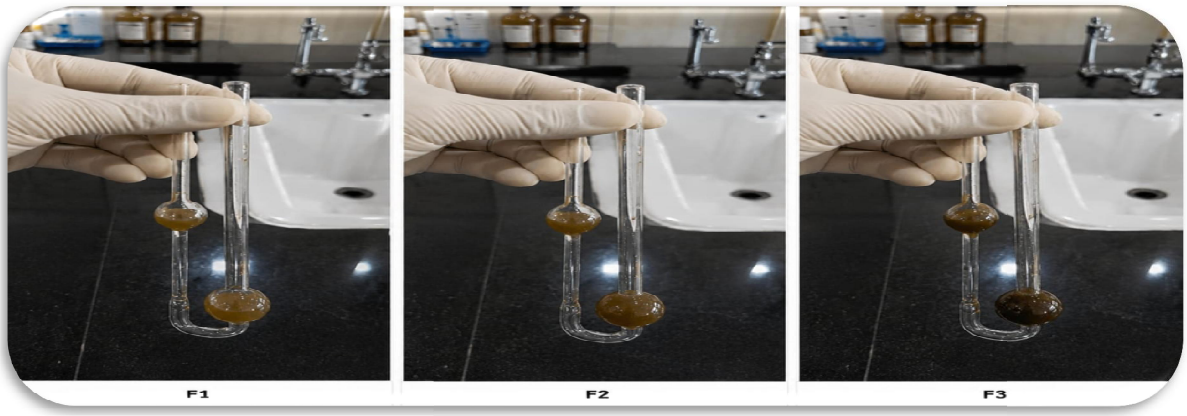

Figure 2: Viscosity parameter

Formulation	Viscosity Observation
F1	Low viscosity gel consistency
F2	Slightly viscous and smooth gel
F3	Moderate viscosity with uniform consistency

Table 4: viscosity observation

The viscosity of formulations F1, F2, and F3 was evaluated at room temperature. The formulations showed suitable viscosity for roll-on application. F1 showed low viscosity gel consistency, while F2 exhibited slightly viscous and smooth gel characteristics. F3 showed moderate viscosity with uniform consistency due to higher concentration of gelling agent. The increase in viscosity improved the consistency and retention of the formulation on the skin surface. All formulations showed smooth application and good spreadability suitable for topical use.

5.4: Spreadability

Spreadability of the gel was determined by placing a small amount of gel between two glass slides and applying weight on the upper slide. The ease with which the gel spreads was observed. Good spreadability ensures easy application and uniform distribution of the formulation on the skin surface (Garg, 2002).

DOI: 10.48175/IJARSCT-36543

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

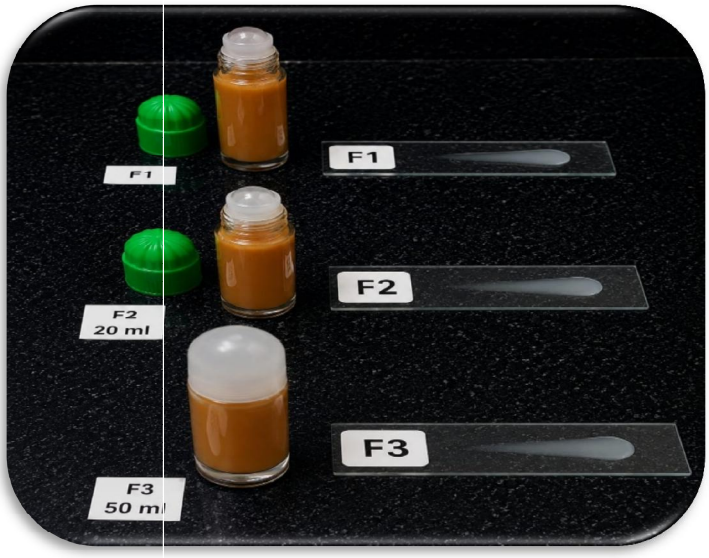

Figure 3: spreadability of formulation

S = (m × L) / t

Where:

- **S** = Spreadability (g·cm/s or N·cm/s depending on units)
- **m** = Mass or weight applied to the sample (g or N)
- **L** = Distance the sample spreads under the applied weight (cm)
- **t** = Time taken for the sample to spread (s)

Formulation	Spreadability (g·cm/s	Observation
F1	5.2	Easily spreadable due to low viscous nature
F2	6.4	Smooth spreading with slightly watery texture
F3	7.1	Uniform spreading with good flow property

Table 5: Spreadability observation

The formulations possessed low viscosity and slightly watery texture, which helped in easy spreading on the skin. Spreadability test showed uniform application of gel on glass slide. The formulations were non-sticky, easily washable and produced a mild cooling effect. No irritation or redness was observed during application. Overall, the formulations showed satisfactory physical characteristics suitable for topical use.

5.5: Homogeneity test

Homogeneity of the gel was evaluated by visual inspection after preparation. The formulation was checked to ensure that all ingredients were properly mixed and distributed uniformly throughout the gel without the presence of lumps or coarse particles (Garg, 2002).

Formulation	Homogeneity Observation
F1	Homogeneous formulation with smooth appearance
F2	Homogeneous formulation with smooth appearance
F3	Homogeneous formulation with smooth appearance

Table 6: homogeneity observation

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

The homogeneity of formulations F1, F2, and F3 was evaluated by visual inspection. All formulations showed uniform distribution of ingredients without the presence of lumps, aggregates, or phase separation. F1 showed smooth homogeneous appearance, while F2 exhibited better uniformity and smoothness. F3 showed excellent homogeneity due to proper mixing and suitable concentration of gelling agent. The results indicated good formulation stability and consistency suitable for topical roll-on application.

5.6: Washability test

Washability of the formulation was evaluated by applying the gel on the skin and washing it with water to determine ease of removal.

Formulation	Washability test Observation
F1	Easily Washable with Water
F2	Easily Washable with Water
F3	Easily Washable with Water

Table 7: Washability observation

All the formulations (F1, F2, and F3) showed good washability and were easily removed with normal water. No sticky residue or stain was observed after washing. This indicates that the prepared herbal alum-based roll-on gel is suitable for convenient daily use.

5.7: Drying Time

Drying time was determined by applying a small amount of the gel on the skin surface and recording the time required for complete drying. The test was performed to evaluate the quick absorption and non-sticky nature of the formulation.

Formulation	Drying time Observation
F1	Dried rapidly within few seconds
F2	Showed quick drying on application
F3	Dried uniformly without stickiness

Table 8:Drying time observation

The drying time test was performed to check how quickly the herbal roll-on gel dries after application. All formulations showed satisfactory drying behavior. F3 exhibited the fastest drying and smooth finish, while F1 and F2 also dried within acceptable time without leaving excessive stickiness on the skin.

5.8: Skin Irritation test:

The skin irritation test was performed by applying a small quantity of the formulation on the skin surface and observing for redness, itching, irritation, or allergic reaction for a specified period of time. This test was carried out to evaluate the safety and skin compatibility of the formulation (Draize, 1944).

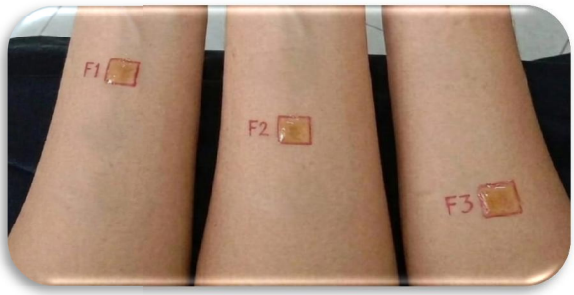

Figure 4: Skin irritation test parameter

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 4, June 2026 Impact Factor: 8.2

Formulation	Skin Irritation Observation
F1	No redness or irritation observed
F2	No skin irritation observed after application
F3	Non-irritant and safe for topical application

Table 9: Skin irritation test observation

The skin irritation test was performed by applying the formulations on the skin and observing for redness, itching, swelling, or irritation. All formulations (F1, F2, and F3) showed no signs of irritation or sensitivity during the study period. The formulations were found to be safe and suitable for topical underarm application due to the use of skin-friendly herbal ingredients.

5.9: Stability Studies

A preliminary stability study was conducted for a period of 15 days to evaluate the physical stability of the prepared herbal alum-based roll-on formulation under different temperature conditions. The formulations were stored at room temperature (25 ± 2°C) and accelerated temperature condition (40 ± 2°C) and observed for changes in colour, odour, appearance and phase separation (International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH), 2003).

- **Stability studies at room Temperature (25 ± 2°C)**

Parameter	F1	F2	F3
Colour	No Change	Slight Change	No Change
Odour	Pleasant	Pleasant	Pleasant
Appearance	Stable and Smooth	Stable and Homogenous	Stable, Smooth and Homogenous
Phase Separation	Absent	Absent	Absent
Homogeneity	Uniform	Uniform	Uniform
Irritation	No irritation observed	No irritation observed	No irritation observed

Table 10: Stability study at room temperature

- **Stability Studies at Accelerated Temperature (40 ± 2°C)**

Parameter	F1	F2	F3
Colour	Slight color Change	Slight Change	No Change
Odour	Mild Reduction	Pleasant	Pleasant
Appearance	Slight watery texture	Absent	Absent
Phase Separation	Absent	Absent	Absent
Homogeneity	Uniform	Uniform	Uniform
Irritation	No irritation observed	No irritation observed	No irritation observed

Table 11: Stability studies at accelerated temperature

The stability study results showed that the herbal alum based roll-on formulations remained stable during the 15 days storage period. At room temperature (25 ± 2°C), no significant changes were observed in colour, odour, appearance or phase separation. At accelerated temperature condition (40 ± 2°C), slight changes in odour and consistency were observed in some formulations, but the formulations remained physically stable. No irritation or phase separation was observed during the study. Overall, the formulations exhibited satisfactory stability under different storage conditions.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

5.10: After Feel

After feel evaluation was carried out to determine the sensory feel of the herbal alum based roll-on formulations after application on the skin. The formulation were evaluated for smoothness, stickiness, cooling sensation and overall skin feel after drying.

Formulation	After Feel Observation
F1	Smooth and Refreshing effect
F2	Non sticky and Cooling effect
F3	Soft Pleasant and long lasting cooling effect

Table 12: After Feel observation

The after feel evaluation showed that all formulation provided a pleasant feel after application. F1 showed a smooth and refreshing feel, while F2 exhibited a mild cooling and non-sticky effect. F3 showed the best after feel with soft, pleasant and long-lasting cooling sensation on the skin. Overall, the formulations were comfortable and suitable for topical application

VI. DISCUSSION

The present study was carried out to formulate and evaluate a herbal alum-based roll-on gel using natural ingredients such as alum, aloe vera gel, Liquorice extract, peppermint oil, and lemon oil. Three formulations (F1, F2, and F3) were prepared and evaluated for various physicochemical and stability parameters.

The physical appearance study showed that all formulations possessed acceptable colour, odour, texture, and consistency. No phase separation, lump formation, or visible instability was observed, indicating successful formulation of a homogeneous gel system. The increase in concentration of ingredients in F3 resulted in a darker colour and slightly higher viscosity compared to F1 and F2.

The pH values of all formulations were found within the acceptable range for topical application (6.2–6.7), suggesting good skin compatibility and minimal risk of irritation. The viscosity study demonstrated that the concentration of Carbomer 940 influenced the consistency of the formulations. F3 exhibited comparatively higher viscosity, which contributed to better retention of the formulation on the skin surface.

Spreadability is an important parameter for topical formulations as it affects ease of application. All formulations showed satisfactory spreadability, with F3 exhibiting the highest spreadability value. This indicates that the gel could be uniformly distributed over the application area without excessive rubbing.

The homogeneity test confirmed uniform distribution of ingredients throughout the gel matrix. No coarse particles, aggregates, or phase separation were observed in any formulation. Similarly, all formulations showed excellent washability and could be easily removed with water without leaving any sticky residue.

Drying time and after-feel evaluation indicated good user acceptability of the prepared formulations. The presence of peppermint oil provided a pleasant cooling sensation, while aloe vera and glycerine contributed to skin smoothness and comfort after application. F3 demonstrated the most desirable sensory characteristics with a long-lasting cooling effect and non-sticky feel.

The skin irritation study revealed that none of the formulations produced redness, itching, or irritation during the observation period, indicating good safety and skin compatibility. Stability studies conducted under room temperature

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 4, June 2026 Impact Factor: 8.2

and accelerated conditions showed that the formulations remained physically stable throughout the study period. Although minor changes in colour and consistency were observed in some samples under accelerated conditions, no phase separation or significant instability was detected.

Overall, among the three formulations, F3 demonstrated comparatively better viscosity, spreadability, stability, and sensory characteristics, making it the most promising formulation for further development as a herbal roll-on deodorant gel.

VII. CONCLUSION

The present study successfully formulated and evaluated a herbal alum-based roll-on gel containing alum, aloe vera gel, Liquorice extract, peppermint oil, and lemon oil. All prepared formulations exhibited satisfactory physicochemical properties, good homogeneity, acceptable pH, suitable viscosity, excellent spreadability, and good washability characteristics.

The formulations were found to be non-irritant, skin-friendly, and showed satisfactory stability during the 15-day preliminary stability study under different storage conditions. The incorporation of natural ingredients provided additional benefits such as moisturization, soothing action, cooling sensation, and pleasant fragrance. The antimicrobial and astringent properties of alum may contribute to effective control of body odor while maintaining skin comfort.

Among the developed formulations, F3 showed the most favourable overall performance with better viscosity, spreadability, stability, and after-feel characteristics. Therefore, F3 can be considered the optimized formulation for the preparation of a herbal alum-based roll-on deodorant gel.

The study demonstrates that herbal ingredients can be successfully utilized in deodorant formulations as a safer and more natural alternative to conventional products. Further studies involving long-term stability evaluation and antimicrobial efficacy testing may be carried out to establish the commercial potential of the formulation.

ACKNOWLEDGEMENT

It gives me immense pleasure to acknowledge everyone who has supported and helped me during the course of my project work.

I express my deepest sense of gratitude from the bottom of my heart to my respected and beloved guide, **Mrs. Kavita S. Pawar, Assistant Professor, Department of Pharmacognosy, Siddhi College of Pharmacy, Chikhali**, for her excellent guidance, critical supervision, keen interest, and continuous encouragement throughout this study. Her valuable suggestions and active guidance helped me develop skills and insight into research and scientific presentation.

I would also like to express my profound gratitude and sincere thanks to **Dr. P. N. Sable, Principal, Siddhi College of Pharmacy, Chikhali**, for providing the necessary facilities, valuable guidance, and moral support throughout the course of this work.

I am thankful to all the teaching and non-teaching staff members of Siddhi College of Pharmacy for their cooperation and assistance during the project.

It is indeed difficult to acknowledge individually all those who have directly or indirectly extended their valuable suggestions, support, and encouragement during the completion of this project.

Finally, I express my heartfelt gratitude to my parents, family members, and friends for their constant motivation, understanding, and support throughout my academic journey.

Besides this, I am thankful to all those who have knowingly and unknowingly helped me in the successful completion of this project work.

REFERENCES

1. Alzomor, A. K. (2014). Formulation and evaluation of potash alum as deodorant lotion and after shaving astringent as cream and gel. International Current Pharmaceutical Journal, 2(3), 228–233. Retrieved from https://doi.org/10.3329/icpj.v3i2.17512

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, June 2026
Impact Factor: 8.2

2. Amit Surjushe, R. V. (2008). Aloe Vera: A Short Review. Indian Journal of Dermatology, 53(4), 163-166. doi: https://doi.org/10.4103/0019-5154.44785
3. Anjana P Sajeev, A. S. (2026). Formulation and Evaluation of a Natural Deodorant. INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES, 4(2), 2198-2204. Retrieved from https://doi.org/10.5281/zenodo.18635523
4. Basha, B. N. (2011). Formulation and evaluation of gel containing fluconazole-antifungal agent. International Journal of Drug Development and Research,. International Journal of Drug Development and Research, 3(4), 109-128. Retrieved from https://www.ijddr.in/drug-development/formulation-and-evaluation-of-gel-containing-fluconazoleantifungal-agent.php?aid=5436
5. Burt, S. (2004). Essential Oils: Their Antibacterial Properties and Potential Applications in Foods—A Review. International Journal of Food Microbiology. Retrieved from https://doi.org/10.1016/j.ijfoodmicro.2004.03.022
6. Draize, J. H. (1944). Methods for the study of irritation and toxicity of substances applied topically to the skin and mucous membranes. Journal of Pharmacology and Experimental Therapeutics, 82(3), 377–390. Retrieved from https://jpet.aspetjournals.org/content/82/3/377
7. Garg, A. A. (2002). Spreading of semisolid formulations: An update. Pharmaceutical Technology, 26(9), 84–105. Retrieved from https://www.pharmtech.com/view/spreading-semisolid-formulations-update
8. Giorgia Pastorino, L. C. (n.d.). Liquorice (Glycyrrhiza glabra): A Phytochemical and Pharmacological Review. Phytotherapy Research, 32(12). Retrieved from https://doi.org/10.1002/ptr.6178
9. HardikB. Bhatt, D. N. (n.d.). Natural Deodorants: A way towards sustainable cosmetics. International Journal of Pharmaceutical Science and Health Care , 3(11). doi: https://dx.doi.org/10.26808/rs.ph.i11v3.01
10. International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH). (2003). ICH Q1A(R2): Stability Testing of New Drug Substances and Products. (International Council for Harmonisation (ICH)) Retrieved from https://database.ich.org/sites/default/files/Q1A%28R2%29%20Guideline.pdf
11. Pakhare, A. (2023). Formulation and Evaluation of Herbal Antimicrobial Deodorant Stick. World Journal of Biology Pharmacy and Health Sciences, 14(1), 045–051.
12. R. Gayathri, S. M. (n.d.). Potash Alum as a Natural Deodorant: Comprehensive Review of Formulation, Efficacy, and Safety. International Journal of Pharmacy and Industrial Research (IJPIR), 15(4), 732–738. doi:https://doi.org/10.61096/ijpir.v15.iss4.2025.732-738
13. S. K. Chaudhuri (Sudhir Kumar Chaudhuri), N. K. (n.d.). History of Cosmetics: Ancient Times to Modern Era. Asian Journal of Pharmaceutics, 1(1), 165–167.