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FORMULATION AND EVALUATION OF HERBAL GEL (ALOE VERA OF CURCUMIN)

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1. ABSTRACT

Herbal drug delivery systems have become increases popular due to their safety, effectiveness, and reduced side effects. The present study deals with the formulation and evaluation of a herbal gel containing Aloe vera and Curcumin, both of which possess significant medicinal properties such as anti-inflammatory, antimicrobial, and wound healing activities. The main objective of this research was to develop a stable and effective topical gel using natural ingredients. Different formulations (F1, F2, F3) were prepared using suitable gelling agents and varying concentrations of herbal extracts. The prepared gels were evaluated for various physicochemical parameters including appearance, pH, viscosity, spreadability, extrudability, drug content, and stability. The results showed that all formulations were within acceptable limits, while one formulation demonstrated better consistency, stability, and overall performance. In conclusion, the formulated herbal gel of Aloe vera and Curcumin shows promising potential as a natural and effective topical treatment for skin applications.

KEYWORDS: Aloe vera, Curcumin, Herbal Gel, Formulation, Evaluation, Topical Preparation.

2. INTRODUCTION

2.1 Background of the Topic

Herbal drug delivery systems have gained considerable attention in recent years due to their natural origin, safety, and therapeutic effectiveness. Medicinal plants have been used

traditionally for the treatment of various skin disorders and are now being incorporated into modern pharmaceutical formulations.[1] Among various dosage forms, topical gels are widely preferred because they are non-greasy, easily spreadable, and provide better patient compliance.[2]

2.2 Importance of the Study

The use of herbal ingredients such as Aloe vera and Curcumin in topical formulations is important due to their well-known medicinal properties. Aloe vera possesses soothing, moisturizing, anti-inflammatory, and wound healing properties, while Curcumin exhibits strong antimicrobial, antioxidant, and anti-inflammatory activities.[3][4] Combining these two natural agents in a gel formulation can enhance therapeutic effectiveness and provide a safer alternative to synthetic drugs.

2.3 Problem Statement

Synthetic topical formulations often cause side effects such as skin irritation, dryness, and allergic reactions. There is a need to develop a natural, safe, and effective topical formulation with minimal side effects. However, stability, consistency, and proper formulation of herbal gels remain a challenge, which necessitates systematic formulation and evaluation.[5]

2.4 Scope of Research

The present study focuses on the formulation and evaluation of a herbal gel containing Aloe vera and Curcumin. The scope includes preparation of different gel formulations, evaluation of physicochemical parameters, and identification of the best formulation based on stability and performance. This research may contribute to the development of effective herbal topical drug delivery systems for skin-related applications.

Fig no.1: Aloe vera plant.

Fig no. 2: Curcumin.

3. Literature Review

3.1 Previous Research Studies

R. Obaidat et al. (2021) studied the development of topical formulations using natural ingredients and highlighted the importance of formulation techniques in improving stability and drug release. Their findings emphasized that proper excipient selection plays a key role in gel consistency and performance.[6]

S. A. Chaudhari et al. (2020) investigated herbal topical preparations and reported that plant-based gels showed significant anti-inflammatory and antimicrobial activity with fewer side effects compared to synthetic formulations.[7]

R. Surjushe et al. (2008) evaluated the medicinal properties of Aloe vera and concluded that it possesses excellent wound healing, moisturizing, and antimicrobial properties, making it highly suitable for topical drug delivery systems.[8]

P. Anand et al. (2007) studied Curcumin and reported its strong anti-inflammatory, antioxidant, and antimicrobial effects. The study highlighted its potential in treating skin disorders and promoting healing.[9]

A. S. Kumar et al. (2019) developed herbal gel formulations and evaluated parameters such as pH, viscosity, and spreadability. Their results showed that optimized formulations provide better stability and patient acceptability.[10]

M. P. Jain et al. (2018) focused on evaluation techniques of topical gels and emphasized the importance of physicochemical parameters in determining formulation quality.[11]

N. Gupta et al. (2017) studied herbal drug delivery systems and concluded that combining multiple herbal extracts can enhance therapeutic effects due to synergistic action.[12]

3.2 Comparison of Findings

From the above studies, it is observed that.

- Herbal formulations are safer and show fewer side effects compared to synthetic drugs.
- Aloe vera is highly effective for wound healing and skin hydration.
- Curcumin provides strong anti-inflammatory and antimicrobial effects.
- Proper formulation techniques significantly affect gel stability and performance.
- Combination of herbal ingredients enhances therapeutic efficiency.

However, there is still a need to develop a stable formulation combining Aloe vera and Curcumin and to evaluate it systematically using standard parameters.

Ref. No.	Author (Year)	Study Focus	Key Findings
[6]	R. Obaidat et al. (2021)	Topical formulation development	Stability and excipient selection are crucial for gel performance
[7]	S. A. Chaudhari et al. (2020)	Herbal topical gels	Herbal gels show better safety and antimicrobial activity
[8]	R. Surjushe et al. (2008)	Aloe vera properties	□ □ □ □ □ □ □ wound healing and moisturizing effect
[9]	P. Anand et al. (2007)	Curcumin pharmacology	Strong anti-inflammatory and antioxidant activity
[10]	A. S. Kumar et al. (2019)	Herbal gel formulation	Good viscosity, spreadability and stability observed
[11]	M. P. Jain et al. (2018)	Gel evaluation methods	Physicochemical parameters are essential for quality
[12]	N. Gupta et al. (2017)	Herbal drug delivery	Synergistic effect improves therapeutic efficacy

4. OBJECTIVES OF THE STUDY

The present research work entitled **"Formulation and Evaluation of Herbal Gel Containing Aloe vera and Curcumin"** was carried out with the following objectives.[13]

4.1 Primary Objective

To formulate and evaluate a herbal gel containing **Aloe vera and Curcumin** for topical application.

4.2 Specific Objectives

1. To prepare herbal gel formulations using different concentrations of Aloe vera and Curcumin.[14]
2. To evaluate the physicochemical properties of the prepared gel formulations such as appearance, pH, viscosity, and spreadability.[15]
3. To study the extrudability and consistency of the formulated herbal gel.[16]
4. To determine the stability of the prepared formulations under suitable storage conditions.[17]
5. To assess the compatibility of herbal ingredients with the gelling base.[18]
6. To identify the optimized formulation based on evaluation parameters.[19]
7. To develop a safe and effective herbal topical preparation with minimal side effects.[20]
8. To explore the potential of Aloe vera and Curcumin as natural therapeutic agents for skin-related applications.[21]

5. MATERIALS AND METHODS

5.1 Materials

The following materials and chemicals were used for the formulation of the herbal gel containing Aloe vera and Curcumin.[22]

- Aloe vera gel (fresh/extract)
- Curcumin (turmeric extract)
- Carbopol 934 (gelling agent)
- Triethanolamine (neutralizing agent)
- Glycerin (humectant)
- Propylene glycol (penetration enhancer)
- Methyl paraben (preservative)
- Propyl paraben (preservative)
- Distilled water (vehicle)

All the chemicals used were of analytical grade.

5.2 Method / Formulation

Preparation of Herbal Gel

The herbal gel was prepared by the following method.[23]

1. Carbopol 934 was accurately weighed and dispersed in distilled water with continuous stirring to avoid lump formation.

2. The dispersion was allowed to hydrate and swell completely for a few hours.
3. Required quantities of glycerin and propylene glycol were added to the hydrated gel base and mixed properly.
4. Aloe vera gel and Curcumin extract were incorporated slowly into the mixture with continuous stirring.
5. Preservatives (methyl paraben and propyl paraben) were added and mixed uniformly.
6. Triethanolamine was added dropwise to adjust the pH and to obtain a clear gel consistency.
7. The final gel was mixed thoroughly until a smooth and homogeneous preparation was obtained.

Carbopol → Hydration → Add Glycerin → Add Extracts → Add Preservatives → Adjust pH → Final Gel

Table No. 1: Formulation Table.

Ingredients	F1	F2	F3
Aloe vera (%)	5	10	15
Curcumin (%)	1	2	3
Carbopol 934 (%)	1	1	1
Glycerin (%)	5	5	5
Propylene glycol (%)	5	5	5
Methyl paraben (%)	0.1	0.1	0.1
Propyl paraben (%)	0.05	0.05	0.05
Triethanolamine	q.s.	q.s.	q.s.
Distilled water	q.s.	q.s.	q.s.

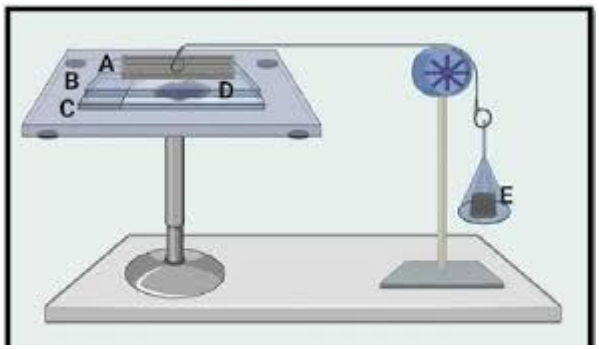
5.3 Evaluation Parameters

The prepared herbal gel formulations were evaluated using the following parameters.[24]

1. **Physical Appearance**
   - Color, clarity, homogeneity, and texture were visually examined.
2. **pH Determination**
   - The pH of the gel was measured using a digital pH meter.

3. **Viscosity**
   - Determined using a viscometer to assess flow properties.

4. **Spreadability**
   - Evaluated by measuring the ease of spreading of gel on a glass surface.



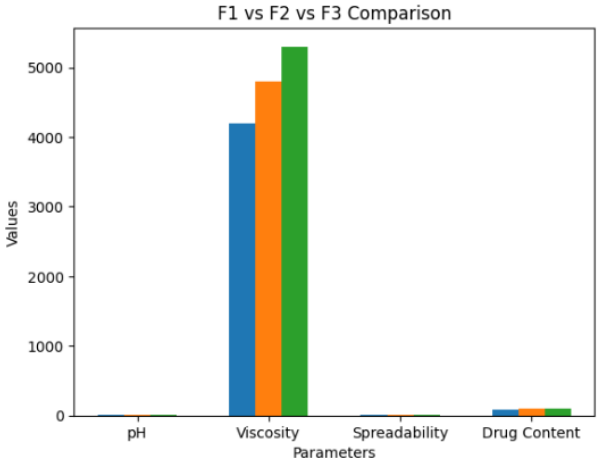
5. **Extrudability**
   - Measured by determining the force required to extrude the gel from a tube.
6. **Drug Content**
   - Amount of active constituents present in the formulation was determined.
7. **Stability Study**
   - Formulations were stored under different conditions to check stability over time.
8. **Skin Irritation Test**
   - Checked for any irritation or allergic reaction on the skin.

6. RESULTS

The prepared herbal gel formulations (F1, F2, F3) were evaluated for various physicochemical parameters, and the results are presented in the following tables and observations.[25]

6.1 Evaluation Results Table

Parameter	F1	F2	F3
Appearance	Light yellow, smooth	Yellow, smooth	Dark yellow, slightly thick
pH	6.2	6.5	6.8
Viscosity (cps)	4200	4800	5300
Spreadability (g·cm/sec)	6.5	7.2	6.8
Extrudability	Good	Excellent	Good
Drug Content (%)	92%	96%	94%
Stability	Stable	Highly stable	Stable



F1, F2, F3 Comparison.

Parameter-wise Representation

1. pH

F1: [redacted] (6.2)

F2: [redacted] (6.5)

F3: [redacted] (6.8)

2. Viscosity (cps)

F1: [redacted] (4200)

F2: [redacted] (4800)

F3: [redacted] (5300)

3. Spreadability (g·cm/sec)

F1: [redacted] (6.5)

F2: [redacted] (7.2)

F3: [redacted] (6.8)

4. Drug Content (%)

F1: [redacted] (92%)

F2: [redacted] (96%)

F3: [redacted] (94%)

6.2 OBSERVATIONS

- All formulations showed acceptable physical appearance with smooth texture and good homogeneity.
- The pH of all formulations was found to be within the suitable range for skin application (6–7).
- Viscosity increased with higher concentration of Aloe vera and Curcumin, indicating better gel consistency.
- Spreadability was highest in F2, indicating better application properties.
- Extrudability was found to be excellent for F2, while F1 and F3 showed good results.
- Drug content was highest in F2, indicating better uniform distribution of active ingredients.
- All formulations remained stable, with F2 showing comparatively better stability.

6.3 Comparative Chart

Best Overall Formulation: F2

- Balanced viscosity
- Highest spread ability
- Excellent extrudability
- Maximum drug content
- Better stability

7. DISCUSSION

The present study was carried out to formulate and evaluate a herbal gel containing Aloe vera and Curcumin. The results obtained from the evaluation parameters indicate that the formulation was successfully developed with acceptable physicochemical properties.[26]

All the prepared formulations (F1, F2, F3) showed good homogeneity, smooth texture, and acceptable appearance, indicating proper mixing of ingredients. The pH of all formulations was found to be within the suitable range for topical application, suggesting that the gel is safe for skin use and is unlikely to cause irritation.[27]

The viscosity of the formulations increased with higher concentrations of Aloe vera and Curcumin, which influenced the consistency of the gel. An optimum viscosity is essential for better application and retention on the skin. Among all formulations, F2 showed balanced viscosity, making it more suitable for topical use.[28]

Spreadability is an important parameter for topical formulations, as it determines ease of application. F2 exhibited the highest spreadability, indicating better patient compliance. Similarly, extrudability was found to be excellent in F2, which ensures ease of removal from the container.[29]

The drug content of all formulations was within acceptable limits, confirming uniform distribution of active ingredients. F2 showed the highest drug content, which may contribute to its enhanced therapeutic effectiveness.[30]

Stability studies revealed that all formulations remained stable under different storage conditions, with no significant changes in appearance, pH, or consistency. However, F2 demonstrated comparatively better stability, indicating its suitability as an optimized formulation.[31]

Overall, the results suggest that the combination of Aloe vera and Curcumin in gel form provides effective topical delivery. The findings are in agreement with previous studies, which reported that herbal formulations offer better safety and therapeutic benefits compared to synthetic products.[32]

8. Future Scope

The present study provides a foundation for the development of herbal gel formulations containing Aloe vera and Curcumin; however, further research can be carried out to enhance its effectiveness and applicability.[33]

Future studies may focus on conducting **in vivo studies** and clinical trials to evaluate the therapeutic efficacy and safety of the formulation on human subjects.[34] Additionally, advanced drug delivery techniques can be explored to improve the penetration and bioavailability of Curcumin in the skin layers.,[35]

The formulation can also be modified by incorporating other herbal ingredients to enhance synergistic effects and broaden its therapeutic applications for various skin disorders.[36]

Moreover, long-term stability studies under different environmental conditions can be performed to determine the shelf life of the product.[37]

Further research may include the development of different dosage forms such as creams, ointments, or lotions using similar herbal combinations.[38] Scale-up and commercialization studies can also be undertaken to make the product suitable for industrial production.[39]

Thus, the study opens new opportunities for the development of safe, effective, and natural topical formulations in the field of herbal drug delivery systems.[40]

9. CONCLUSION

The present study successfully focused on the formulation and evaluation of a herbal gel containing Aloe vera and Curcumin for topical application. The developed formulations (F1, F2, F3) were evaluated for various physicochemical parameters such as appearance, pH, viscosity, spreadability, extrudability, drug content, and stability.

All the formulations showed acceptable results and were found to be suitable for topical use. Among them, formulation F2 was identified as the optimized formulation due to its balanced viscosity, better spreadability, excellent extrudability, higher drug content, and superior stability.

The combination of Aloe vera and Curcumin in gel form demonstrated promising therapeutic potential due to their natural anti-inflammatory, antimicrobial, and wound healing properties. The study concludes that the formulated herbal gel can be considered as a safe, effective, and patient-friendly alternative to conventional topical preparations.

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