PROJECT

RESEARCH ON THE DEVELOPMENT OF SHOWER GEL CONTAINING ALOE VERA EXTRACT

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INTRODUCTION

RATIONALE FOR CHOOSING THE TOPIC

12%

EMERING TREND
Natural product

ALOE VERA

Grand View Research, 2022

ALOE VERA EXTRACT SHOWER GEL

100 compound
- 60-70 nutrients (polysaccharides, amino acids),
- 20 organic acids
- 20 minerals.

95 - 98% water content
- pH ~4.7
- Safe (WHO),
- Ideal for skincare products.

Bioactive compounds
- Lignin: deep penetration.
- Glucomannan: moisturizes, stimulates collagen and elastin production for anti-aging.
- Salicylic acid: antibacterial.

RESEARCH OBJECTIVES

01 Formulation

A **skin-cleansing product** containing **aloe vera** extract

02 Evaluation

Evaluate the product in terms of **cleansing efficiency, foaming ability, viscosity, pH stability,** and **skin safety.**

Research Hypothesis

It is **viable** to develop a **mild and nourishing** shower gel **containing aloe vera extract** by optimizing the ratio of surfactants and the concentration of aloe vera extract

RESEARCH METHODOLOGY

01 Aloe vera extraction method

Pest → Wash (Pure water + NaOH (0.01N)) → 6.5 - 6.0 → Crush it (Overnight | 0 - 2°C) → Raw material handling (20 minutes | 10,000 rpm) → Extraction → Refining and preserving (Membrane (0.45 µm)) → 2 - 8°C → Pure aloe vera extract

02 Formulation Procedure

Weigh ingredients

Prepare the base phase (Beaker 1)

Citric acid, Sodium citrate, Sodium benzoate, PEG-120 methyl glucose dioleate, Glycerol PEG-7 esters, Polyquaternium 73, Glycerin, Aloe vera extract

Prepare the base phase (Beaker 2)

Sodium laureth sulfate, Water, Sodium Lauroyl Sarcosinate

Dissolve

Avoid foaming

RESULTS AND DISCUSSION

SURVEY ON COCAMIDOPROPYL BETAINE CONCENTRATION

No.	Ingredients(g)	Weight(g)				
		F6	F9	F8	F10	F11
1	**Cocamidopropyl Betaine**	**2,0**	**2,4**	**3**	**3,6**	**4,0**
2	Sodium Laureth Sulfate	0,75	0,75	0,75	0,75	0,75
3	Sodium Lauroyl Sarcosinate	1	1	1	1	1
4	PEG-120 Methyl Glucose Dioleate	0,4	0,4	0,4	0,4	0,4
5	Polyquaternium 73	0,2	0,2	0,2	0,2	0,2
6	Olive oil PEG-7 esters	0,2	0,2	0,2	0,2	0,2
7	Glycerin	0,6	0,6	0,6	0,6	0,6
8	Sodium benzoate	0,04	0,04	0,04	0,04	0,04
9	Citric acid	0,02	0,02	0,02	0,02	0,02
10	Sodium citrate	0,1	0,1	0,1	0,1	0,1
11	Purified water	20	20	20	20	20

Table. Formulations for Surveying Cocamidopropyl Betaine Concentration

Sensory Evaluation
- Transparent appearance
- F8 and F9 were liquid and slightly fluid
- F10 and F11 were thicker and less fluid

Cleansing Performance
- Effective dirt removal.
- Moderate cleansing efficiency comparable to SLES

All formulations showed good cleansing ability

pH: *At 1% and 10% dilution: pH 6.04-6.27.*

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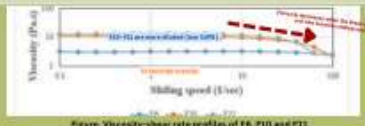

Figure. Viscosity-shear rate profiles of F6, F10 and F11

Viscosity ↑ ← CAPB content

- CAPB - anion interactions cause micelles to transition from spherical to rod-like or worm-like structures
- NaCl naturally present in CAPB reduces the surface charge of micelles, promoting micellar aggregation and growth, which leads to a transformation into rod-shaped micelles

F10 and F11 exhibited the highest viscosity

Figure . Foam volume over time of F6 and F8 to F11

Foam volume ↑ ← CAPB concentration

CAPB is a surfactant that enhances foam formation

Foam stability is very good in all formulations.

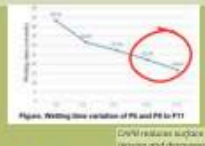

Figure. Wetting time variation of F6 and F8 to F11

Wetting time ↓ ← CAPB concentration

CAPB reduces surface tension and decreases the contact angle between water and velvet fabric. → This leads to a faster spreading process.

F10 and F11 are the two formulations with the highest viscosity.

F6 is still the most optimal in all properties; therefore, the CAPB amount of 3.0 g was selected

SURVEY ON SODIUM LAUROYL SARCOSINATE CONCENTRATION

No.	Ingredients	Weight (g)				
		F12	F13	F6	F14	F15
1	Cocamidopropyl Betaine	3	3	3	3	3
2	Sodium Laureth Sulfate	0,75	0,75	0,75	0,75	0,75
3	**Sodium Lauroyl Sarcosinate**	**0,6**	**0,8**	**1,0**	**1,2**	**1,4**
4	PEG-120 Methyl Glucose Dioleate	0,4	0,4	0,4	0,4	0,4
5	Polyquaternium 73	0,2	0,2	0,2	0,2	0,2
6	Olive oil PEG-7 esters	0,2	0,2	0,2	0,2	0,2
7	Glycerin	0,6	0,6	0,6	0,6	0,6
8	Sodium benzoate	0,04	0,04	0,04	0,04	0,04
9	Citric acid	0,02	0,02	0,02	0,02	0,02
10	Sodium citrate	0,1	0,1	0,1	0,1	0,1
11	Purified water	20	20	20	20	20

Table. Formulations for Surveying Sodium Lauroyl Sarcosinate Concentration

Sensory Evaluation
- Transparent appearance
- F14 and F15 were liquid, thereby making samples more viscous
- F12 exhibited the highest viscosity.

Cleansing Performance
- Good cleansing efficiency.
- Moderate cleansing ability similar to SLES

All formulations demonstrated satisfactory cleansing

pH: *At 1% and 10% dilution: pH 6.09-6.29.*

Slightly acidic, compatible with skin pH

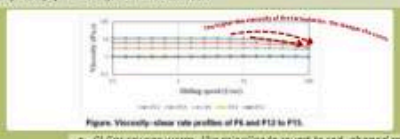

Figure. Viscosity-shear rate profiles of F6 and F12 to F15.

Viscosity ↓ ← SLSar concentration

- SLSar causes warm-like micelles to revert to rod-shaped and spherical micelles, leading to changes in the rheological behavior of the formulation.
- Sodium Lauroyl Sarcosinate (SLSar) is an amino acid-derived surfactant. It also reduces salt sensitivity, which further contributes to a decrease in viscosity.

Figure. Foam volume over time of F6 and F12 to F15

Foam volume ↑ ← SLSar concentration

(SLSar) provides good foam stability and maintains foam height over extended periods

Foam stability is consistent and comparable across formulations

Figure 4.10. Wetting time variation of F6 and F12 to F15

Wetting time ↓ ← SLSar concentration

- SLSar is an anionic surfactant.
- → It enhances cleansing interaction similarly to SLES
- Water penetrates faster, making the foam structure collapse earlier.

F6 and F14 exhibit the most optimal balance of all evaluated properties. SLSar concentrations of 1.0 g and 1.2 g are recommended.

SURVEY ON ALOE VERA EXTRACT CONCENTRATION

Ingredients	Mass (g)										
	F20	F21	F22	F23	F24	F25	F26	F27	F28	F29	F30
1. Cocamidopropyl Betaine	2	2	2	2	2	2	2	2	2	2	2
Sodium Laureth Sulfate	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75
Sodium Lauroyl Sarcosinate	1	1	1	1	1	1,2	1,2	1,2	1,2	1,2	1,2
Aloe vera extract	**5**	**6**	**7**	**8**	**9**	**5**	**6**	**7**	**8**	**9**	**10**
PEG-120 Methyl glucose dioleate	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
Olive oil PEG-7 esters	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Glycerin	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6
Polyquaternium 73	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Sodium benzoate	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04
Citric acid	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
Sodium citrate	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Purified water	20	20	20	20	20	20	20	20	20	20	20

Table 5. Aloe formulations containing aloe vera extract

Sensory Evaluation
- Cloudiness
- All formulations are viscous and flow well, except F30 which flows slightly poorly.

Cleansing Performance
- Produces abundant, fine-grained foam.
- The cleansing mechanism is similar to that of SLES

All formulations exhibit good cleansing performance

pH: pH of 1% dilution and 10% dilution pH ranges from 6.28 to 6.34

Mild acidity, suitable for physiological skin pH

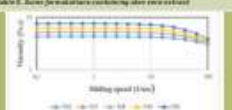

Figure 4.11. Viscosity profiles of the formulations (F18-F20) as a function of shear rate.

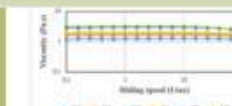

Figure 4.12. Viscosity profiles of the formulations (F21-F26) as a function of shear rate.

Viscosity ↑ ← Aloe vera extract ratio

- *Increases because aloe vera gel extract is inherently viscous.*
- *Viscosity changes are due to the natural viscosity of the extract, not due to changes in micelle structure.*

All formulations have good flowability except F20, which is slightly less flowable.

Figure 4.13. Foam volume measured over time for F20-F30.

Foam volume ↑ ← Aloe vera extract ratio

The ratio and types of surfactants remain unchanged. → No change in foaming ability.

Foam retention is very good in all formulations.

Figure. Wetting time variations of F20-F30 and F21-F26.

Wetting time ↑ ← Aloe vera extract ratio

- Increasing the ratio of aloe vera extract → Slight increase in viscosity, with minimal influence.
- → Water spreads more slowly, resulting in a longer wetting time.

EYE IRRITATION POTENTIAL ASSESSMENT

Concentration (%)	100	50	25	10	5	2,5	1,5
Score	8,0	7,3	5,0	4,3	1,0	0	0
Classification	Moderate	Moderate	Moderate	Mild	Mild	Non-irritant	Non-irritant

Table ocular irritation scores of formulation 19

Concentration (%)	100	50	25	10	5	2,5	1,5
Score	7,0	6,3	5,0	4,3	1,0	0	0
Classification	Moderate	Moderate	Moderate	Mild	Mild	Non-irritant	Non-

Table ocular irritation scores of formulation 26

Figure 12. HET-CAM images of Formulation 19 at 10% concentration

Concentration: Medium >25% | Mild <10% | 0 1,5 - 2,5%

All formulations fall within the mild irritation group

Physicochemical properties and irritation levels are comparable between products.

F26 is recommended due to its better viscosity and flow characteristics.

Eye irritation scores show no significant reduction across concentrations.

Concentration (%)	Johnson'n' Baby		F26	
	Score	Eye irritation Level	Score	Eye irritation Level
100	7,0	Moderate irritation	7,0	Moderate irritation
50	5,7	Moderate irritation	6,3	Moderate irritation
25	4,3	Mild irritation	5,0	Mild irritation
10	3,0	Mild irritation	4,3	Mild irritation
5	0	No irritation	1,0	Mild irritation
2,5	0	No irritation	0	No irritation
1,5	0	No irritation	0	No irritation

Figure 13. HET-CAM images of Johnson'n' Baby at 25% concentration

Mild <25% | 0 <5%

No major difference in ocular irritation severity.

CONCLUSION

CONCLUSION

A cleansing formulation containing aloe vera extract was successfully developed.

The formulation **determines appropriate concentrations of key surfactants**, including:
- Sodium Lauroyl Sarcosinate
- Cocamidopropyl Betaine
- Aloe vera extract

The product was evaluated for stability and safety using the HET-CAM method to assess eye irritation potential.

- The resting viscosity measured using the **Discovery HR-1 rheometer (UK)** was approximately **3.09 Pa·s**
- The formulation exhibited **good foaming ability and foam stability**.
- **pH value:** approximately **5.98-6.05.**
- The product demonstrated effective cleansing performance and an appropriate wetting time.
- Eye irritation potential of the formulation:
  - At concentrations of **100%, 50%, and 25%: moderate irritation.**
  - At concentrations of **10% and 5%: mild irritation.**
  - At concentrations of **2.5% and 1.5%: no irritation observed.**

FUTURE DIRECTIONS

- Further product development by incorporating **additional natural extracts** or **active ingredients**.
- **Conduct in vivo skin irritation and sensitization tests.**
- **Compare** the aloe vera shower gel with **similar commercial products currently available on the market**

PRACTICAL APPLICATION AND COMMERCIAL POTENTIAL

01 The product ensures **safety and gentleness**, meeting consumer demand for natural cleansing products.

02 High feasibility for real-world application, with reasonable production costs.

03 The aloe vera shower gel illustrates strong potential for development into a natural skin-care product with promising commercial prospects and scalable manufacturing.

NOVELTY

01 Systematic Optimization of Aloe Vera Concentration

Systematically investigated how different aloe vera concentrations affect key properties

02 Integrated Evaluation of Performance and Safety

The project evaluates both product performance and biological safety in a single study

The novelty of this project lies in the data-driven optimization of aloe vera concentration and the comprehensive evaluation of both product performance and safety

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