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Research Article

Formulation and Evaluation of Aloevera and Lycopene Based Sunscreen Lotion

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This research work was aimed to formulate a dosage form of Lycopene and Aloevera that introducing the increasing awareness of the harmful effects of ultraviolet (UV) radiation on skin health has spurred interest in developing effective and natural sunscreen formulations. This study investigates the potential of combining Aloevera and lycopene-rich tomato extract, known for their detaining, moisturizing, soothing, and antioxidant properties, to create a novel herbal sunscreen lotion. The research aims to evaluate the UV protection capabilities of this formulation, assessing its efficacy against both UVA and UVB rays. Furthermore, the study will explore the potential of this herbal sunscreen to offer a safer and more skin-friendly alternative to conventional sunscreens, while also investigating its moisturizing and anti-inflammatory benefits. The potent anti-inflammatory, hydrating, and wound-healing properties of Aloevera make it a valuable addition to sunscreen formulations, particularly for sensitive skin. It forms a protective barrier, boosts collagen and elastin production, and aids in soothing sunburn and reducing redness. Lycopene, a powerful antioxidant derived from tomatoes, offers significant photo protective effects by scavenging free radicals generated by UV radiation and reducing erythema. Studies suggest that Lycopene can protect against UVB-induced photo damage and potentially reduce the risk of skin cancer.

Keywords: Sunscreen, Aloe vera (Aloe barbadensis miller) and Lycopene (from Solanum lycopersicum) sunscreen herbal, natural, skin protection, SPF, UVA, UVB, sunburn, antioxidants, photo protection.

INTRODUCTION

Exposure to the sun's harsh ultraviolet (UV) radiation poses a significant risk to skin health, leading to premature aging, DNA damage, and an increased risk of skin cancer. While traditional sunscreens offer essential protection, many consumers are seeking natural alternatives with added benefits. This article explores the innovative combination of aloe vera and lycopene in a sunscreen lotion, highlighting their unique properties and synergistic effects in shielding the skin from sun damage and promoting overall skin health.

1.1 Advantages:

• Aloe vera: a naturally in sun protection

- **Soothing and healing:** Aloe vera, a succulent plant renowned for its thick, gel-filled leaves, offers soothing and healing benefits for the skin. It can calm irritation, reduce inflammation, and promote the repair of damaged skin tissues after sun exposure.
- **Hydration and moisture retention:** Aloe vera keeps the skin hydrated and prevents dryness and flakiness, often caused by prolonged sun exposure. Its natural compounds, including polysaccharides, help lock in moisture and maintain the skin's natural moisture balance.
- **Antioxidant properties:** Aloe vera contains antioxidants like vitamins A, C, and E, which help neutralize free radicals generated by UV exposure, preventing oxidative damage to the skin.

• Lycopene: nature's shield against sun damage

- **Powerful antioxidant:** Lycopene, a potent antioxidant found abundantly in tomatoes, watermelon, and other red or pink fruits, protects the skin from oxidative stress caused by UV radiation. It neutralizes free radicals, potentially reducing UV-induced damage and aiding in skin repair.

- **UV protection:** Lycopene has been shown to offer some protection against sunburn and reduce the intensity of skin redness after UV exposure. It may also help prevent the development of non-melanoma skin cancers.

- **Skin health and anti-aging:** Lycopene can help maintain skin hydration and may reduce signs of aging, such as fine lines and wrinkles.

• The synergistic power of aloe vera and lycopene in sunscreen

- When combined in a sunscreen lotion, aloe vera and lycopene create a powerful synergy, offering enhanced sun protection and skincare benefits. Aloe vera's soothing and hydrating properties complement lycopene's antioxidant and photo protective effects, resulting in a sunscreen that not only shields the skin from harmful UV rays but also nourishes, repairs, and protects it from premature aging. This combination allows for a gentler, more natural approach to sun protection, minimizing the risk of irritation while maximizing skin health and resilience.

MATERIALS AND METHOD

MATERIALS:

Lycopene extracted from the laboratory extraction process. Aloevera used as gel from natural source, Sodium lauryl sulphate, Stearic acid, Lecithin, Propylparaben, Rosewater, Lanolin, Vitamin E, Titanium Dioxide, Glycerin, Acetylalcohol, Methylparaben used were of analytical grade. All the ingredients and their uses in formulation of tablet were shown in Table no. 1.

Table no. 1: Ingredients used in formulation of tablet

S. No.	Ingredient	Uses
1.	Aloevera juice	Soothing, Healing, Moisturising
2.	Lycopene	Detaining, UV protection, Skin health, Antiaging
3.	Sodium lauryl sulphate	Spreadability
4.	Stearic acid	Emulsifier, Emollient, and Thickener
5.	Lecithin	penetration enhancer,
6.	Propylparaben	Preservative
7.	Rosewater	Fragrance/Vehicle
8.	Lanolin	Emollient
9.	Vitamin E	Antioxidant
10.	Titanium Dioxide	Mineral UV filter
11.	Glycerin	Humectant
12.	Acetylalcohol	Emulsion Stabilizer
13.	Methylparaben	Preservative

METHOD

2.1.1 Formulation of sunscreen lotion

- **Procedure for formulation of sunscreen lotion-**

Step I: Water phase was prepared by mixing water soluble components. Aloevera juice, Tomato extract (Lycopene), Sodium lauryl sulphate, Stearic acid, Lecithin, and Propyl paraben was mixed properly and volume was made with rosewater. Heated the mixture at 80°C.

Step II: Oil phase was prepared by minxing oil soluble components. Lanolin, Acetyl alcohol, Sodium lauryl sulphate, and Methylparaben was properly mixed and heated the mixture at 80°C.

Step III: Oil phase was added in water phase at 80°C with continuous stirring for 20- 25 min and then it was homogenized till uniform emulsion is formed. The

finished product has half white color. It was then poured into the wide mouth container and stored at temperature not exceeding 37°C.

- **Water phase:**

Table: 2 Formulation of Water Phase

S.NO.	Ingredients	Quantity(20gm) F (1)	Quantity(20gm) F (2)	Quantity(20gm) F (3)
1.	Aloevera juice	0.300 ml (SPF)	0.500 ml	0.600 ml
2.	Lycopene	0.400gm	0.400gm	0.400gm
3.	Sodium lauryl sulphate	0.030gm	0.030gm	0.030gm
4.	Stearic acid	0.350gm	0.150gm	0.050gm
5.	Lecithin	0.200gm	0.200gm	0.200gm
6.	Propylparaben	0.02gm	0.02gm	0.02gm
7.	Rosewater	q.s.	q.s.	q.s.

- **Oil phase:**

Table: 3 Formulation of Oil Phase

S.NO.	Ingredients	Quantity(20gm) F (1)	Quantity(20gm) F (2)	Quantity(20gm) F (3)
1	Lanolin	0.30gm	-	0.30gm
2.	Vitamin E	-	0.500gm	0.200gm
3.	Titanium Dioxide	0.400gm	0.200gm	0.200gm
4	Glycerin	-	0.600gm	0.600gm
5.	Acetylalcohol	0.24gm	0.24gm	0.24gm
6.	Sodium lauryl sulphate	0.61gm	0.01gm	0.01gm
7.	Methylparaben	0.04gm	0.04gm	0.04gm

- **SPF determination of Formulation of sunscreen lotion:**

- Procedure for SPF determination of Formulated sunscreen lotion

1. 1.0 gm of sample was accurately weighed and transferred into 100ml volumetric flask and 50 ml of ethanol added and sonicated for 15 minutes afterwards volume was made up to the mark with ethanol and then filtered through whatman filter paper(solution-A).

2. First 10 ml was discarded. Then 5.0 ml of aliquot from (solution-A) was transferred to 25 ml volumetric flask and diluted up to the mark with ethanol (Solution-B).

3. Then 2.5 ml of solution- B was transferred into 25 ml of volumetric flask and volume was made upto the mark with ethanol (Solution-C).

4. Solution-C was transferred into1cm cuvettes and test solution was exposed with UV Light and measured for the spectrum absorbance of the test solution.

5. Absorbance of sample was taken for UV B range 290nm to 320nm every 5nm wavelength interval, and same was performed in triplicate for each sample. Determinations were made at each point, followed by the application of Mansur equation.

$$SPF\text{spectrophotometric} = \text{CF} \times \sum_{290}^{320} EE(\lambda) XI(\lambda) XAbs(\lambda)$$

In the above equation

EE(I)=Erythem a effect spectrum
I (I)= Solar intensity spectrum
Abs=Absorbance of sunscreen product
CF = Correction factor (=10).
The value of **EE x I** are constant

Table 4. SPF determination of formulated sunscreen lotion

S.No	Wavelenghth	EExI	Absorbance	EExI× Absorbance
1	290	.015	4	0.06
2	295	.0817	2.746	0.224348
3	300	.2834	1.752	0.496517
4	305	.3278	1.543	0.505795
5	310	.1864	1.484	0.276618
6	315	.0839	1.448	0.120763
7	320	.018	1.412	0.025416
Total		**1**		**1.709457**

$$\text{Spectrophotometric} = \text{CFX}\sum_{290}^{320} EE(\lambda)XI(\lambda)XAbs(\lambda)$$

SPF=10×1×1.709457
SPF= 17.09457

Table 5. SPF determination of formulated sunscreen lotion-1

S.No.	Wavelenghth	EExI	Absorbance	EExI× Absorbance
1	290	.015	3.99	0.05985
2	295	.0817	2.554	0.208662
3	300	.2834	1.666	0.472144
4	305	.3278	1.595	0.522841
5	310	.1864	1.338	0.249403
6	315	.0839	1.44	0.120096
7	320	.018	1.409	0.025362
Total		**1**		**1.658358**

$$SPF\text{spectrophotometric}=\text{CFX}\sum_{290}^{320} EE(\lambda)XI(\lambda)XAbs(\lambda)$$

SPF=10×1×1.658358
SPF= 16.58358

Table 6 – SPF determination of formulated sunscreen lotion-2

S. No.	Wavelenght	EExI	Absorbance	EExI× Absorbance
1	290	.015	4	0.06
2	295	.0817	2.74	0.223858
3	300	.2834	1.75	0.49595
4	305	.3278	1.542	0.505468
5	310	.1864	1.482	0.276245
6	315	.0839	1.45	0.12093
7	320	.018	1.415	0.02547
Total		**1**		**1.70792**

$$SPF\text{spectrophotometric} = \text{CFX}\sum_{290}^{320} EE(\lambda)XI(\lambda)XAbs(\lambda)$$

SPF=10×1×1.70792
SPF=10×1×1.70792

SPF= 17.0792

SPF Determination of Marketed Formulation VLCC Natural Sciences Glow +Sun Block Lotion SPF20|P++Sun Defense

Table 7. SPF Determination of Marketed Formulation

Wavelength(nm)	EE(λ)×I(λ)	Absorbance(λ)	EE(λ)×I(λ)× Abs(λ)
290	0.0150	3.324	0.05136
295	0.0817	3.675	0.30024
300	0.2874	1.0346	0.29734
305	0.3278	1.1393	0.37346
310	0.1864	2.8140	0.52452
315	0.0839	2.8033	0.23519
320	0.0180	2.6106	0.04699
	Total=1		Total=1.829
			SPF=18.29

2.1.2 Evaluation Of Sunscreen Lotion

i. pH of the Lotion

The pH of formulated sunscreen lotion was determined by using digital pH meter. About 1 g of the lotion was weighed and dissolved in 100 ml of distilled water and stored for two hours. The measurement of pH of each formulation was done in triplicate and average values were calculated.

Result - The pH of the formulated sunscreen lotion was found to be 5.62 ±0.01

ii. Viscosity

Viscosity of the formulated sunscreen lotion was determined by Brookfield Viscometer LVT model using T spindle no. A at 20 rpm at a temperature of 25° C and the determination were carried out in triplicate and the average of three readings was recorded.

iii. Stability studies

• Globule size

1 mL of formulated sunscreen lotion was diluted to 10 mL with glycerin. A few drops of this were transferred onto a glass slide and was focused in a microscope. By using eyepiece micrometer, the diameters of 200 particles were determined randomly.

• Phase separation

The formulated sunscreen lotion was kept intact in a closed container at 25 - 30°C not exposed to light. Phase separation was observed carefully every 24 hrs for 7 days. Any change in phase separation was checked.

• Moisture absorption studies

About 50 mg of formulated sunscreen lotion was taken on a watch glass. A beaker was taken with full of water and was kept in a desiccators without adsorbents and allowed to get saturated. Watch glass with lotion was introduced into the desiccator. It was left for 24 hrs.

iv. Extrudability

It is useful empirical test to measure the force required to extrude the material from bottle. The formulations were filled in standard round neck bottle and sealed. The bottle was weighed and recorded. The bottle was placed between two glass slides and was clamped. A 500-gm weight was placed over the glass slide and cap was opened. The amount of formulated sunscreen lotion extruded were collected and weighed. The percent of cream extruded was calculated and grades were allotted:

90% Extrudability = ++++ Excellent
80% Extrudability = +++ Good
70% Extrudability = ++ Fair
50% Extrudability = +Poor

v. Spreadability

Two glass slides of standard dimensions (20 cm × 5 cm) were selected. The formulation was poured onto one of the slide. The other slide placed on the top of the formulation such a that the formulation sandwiched between the two slides in an area

occupied by a distance of 7.5 cm, alongside 100 gm weight was placed uniformly to form a thin layer. The weight was removed and the excess of formulation adhering to the slides was scrapped off. The two slides in a position were fixed to stand (45°angle) without slightest disturbance and in such a way that only the lower slide held firmly by the opposite fangs of the clamps allowing the upper slide to slip off freely by the force of weight tied to it. 60 gm of weight was tied to the upper slide carefully. The time taken for the upper slide to travel the distance of 5 cm and separate away from the lower slide under the direction of weight was noted. The experiment repeated for 3 times and the mean taken for three such dimensions was calculated. The results were recorded. The spreadability is calculated by using formula:

$$S = \frac{M \times L}{T}$$

Where,

S= Spreadability,
L= Length of glass slide,
M= Weight tied to the upper slide and
T=Time in present experiment

Table 8. Evaluation parameters

S.No.	Parameters	Observation
1.	Color	Pale white
2.	Visual appearance	Smooth lotion
3.	Odor	Pleasant odor
4.	Ph	5.62 ± 0.01
5.	Viscosity(cps)	Good
6.	Extrudability	Good
7.	Spreadability	Easily spreadable

CONCLUSION

This research is carried out to develop herbal Sunscreen lotion with de-taining, moisturizing action using Lycopene and Aloevera. The process of preparing Lycopene was performed. The lycopene content is calculated using a spectrophotometer at 470 nm and the lycopene content is measured in ppm. The sunscreen lotion is then formed by mixing water and oil components, heating the mixture at 80°C. The oil phase is added to the water phase and homogenized until a uniform emulsion forms. As per first trial obtained a product with less SPF value, unstable under the sunlight. After that take second trail and prepared a new formula for the preparation of sunscreen lotion and then observed moisturizing effect was very less and also obtained a less SPF value lotion. Now the results of the last two trails, prepared a final formulation with specific moisturizing effect, stable, spreadable and at specific SPF value lotion. The finished product has a half-white color and is stored at a temperature not exceeding 37°C. The procedure for determining the SPF was performed. The SPF determination of the formulated sunscreen lotion is then applied using the Mansur equation. The results are compared to the marketed formula VLCC Natural Sciences Glow + Sun Block Lotion SPF 20| P++ Sun Defence. The study aimed to determine the SPF of a sunscreen lotion using various parameters such as wavelength, absorbance, and viscosity. The formulated sunscreen lotion had a pH of 5.62 ± 0.01 and a viscosity of 20 rpm at 25°C. Stability studies included globule size, phase separation, and moisture absorption. The evaluation parameters included color, visual appearance, odor, pH, viscosity, extrudability, and spreadability. The results showed that the sunscreen lotion had a SPF of 18.29. The study concluded that the sunscreen lotion was effective in preventing skin damage and providing a protective barrier.

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