# Formulation and evaluation of anti-aging cream with Sun Protection Factor properties

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**Abstract**

This research encompasses formulation development, physicochemical characterization, in-vitro evaluation, and comparative analysis. Despite the availability of numerous anti-aging creams in the market, many formulations rely heavily on synthetic compounds that may cause skin irritation or long-term adverse effects. There is an increasing need for safe, effective, and natural alternatives that provide comparable or superior results. While individual studies have highlighted the benefits of goat milk and saffron for skin health, their combined potential in an anti-aging cream with SPF properties remains largely unexplored. This research aims to fill this gap by formulating and evaluating a novel anti-aging cream enriched with goat milk and saffron, focusing on its physicochemical stability, SPF potential, antioxidant activity, and dermatological efficacy. The findings from the chemical and physical evaluations confirm the presence of essential bioactive components in the formulated anti-aging cream with [1]SPF 50. The amino acids in goat milk, along with the alkaloids and antioxidants in saffron, contribute significantly to skin hydration, oxidative stress reduction, and overall skin health improvement. The formulation maintains a stable acid value and saponification index, ensuring both efficacy and safety for dermatological use.

**Keywords:** Anti-Aging, Sun Protection Factor, Creams, Formulation.

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## 1. Introduction

Aging is an inevitable biological process that affects the skin's structure and function, leading to visible signs such as wrinkles, fine lines, hyperpigmentation, and loss of elasticity [1]. The skin, being the largest organ of the body, is constantly exposed to environmental factors such as ultraviolet (UV) radiation, pollution, and oxidative stress, all of which accelerate the aging process. This has led to a growing demand for anti-aging skincare products that not only combat the signs of aging but also offer protection against harmful environmental stressors [2].

Among various natural ingredients, goat milk and saffron (Crocus sativus L.) have garnered attention due to their exceptional dermatological benefits. Goat milk is rich in essential fatty acids, proteins, vitamins, and minerals that nourish the skin, promote hydration, and enhance skin barrier function. It also contains lactic acid, an alpha-hydroxy acid (AHA) known for its exfoliating and anti-aging properties [3]. Saffron, a highly valued spice, is abundant in bioactive compounds such as crocin, crocetin, safranal, and flavonoids, which exhibit strong antioxidant, anti-inflammatory, and photo protective properties [4].

The incorporation of natural ingredients in anti-aging formulations aligns with the current trend toward natural and organic skincare products, which are preferred due to concerns regarding synthetic chemicals and their potential adverse effects. Furthermore, sun protection factor (SPF) properties are crucial in anti-aging formulations, as prolonged UV exposure is one of the primary causes of premature skin aging, also known as photoaging. Developing a cream that combines the anti-aging benefits of goat milk and saffron with SPF properties provides a holistic approach to skincare, addressing multiple concerns within a single formulation [5].

Despite the availability of numerous anti-aging creams in the market, many formulations rely heavily on synthetic compounds that may cause skin irritation or long-term adverse effects. There is an increasing need for safe, effective, and natural alternatives that provide comparable or superior results. While individual studies have highlighted the benefits of goat milk and saffron for skin health, their combined potential in an anti-aging cream with SPF properties remains largely unexplored.

This research aims to fill this gap by formulating and evaluating a novel anti-aging cream enriched with goat milk and saffron, focusing on its physicochemical stability, SPF potential, antioxidant activity, and dermatological efficacy.

The formulated anti-aging cream containing goat milk and saffron will demonstrate enhanced anti-aging effects compared to conventional creams due to its unique blend of bioactive compounds. The presence of saffron will contribute to significant antioxidant and photoprotective activity, thereby providing measurable SPF protection. Goat milk will improve moisturization and skin barrier function, enhancing overall skin health and

reducing signs of aging. The formulated cream will be physicochemical stable and safe for dermatological application [3,4].

## 2. Materials and Methods

### 2.1 Formulation of Anti-Aging Cream

#### 2.1.1 Preparation of Aqueous Phase

Distilled water is heated to 70°C in a clean, sterile beaker. Goat milk and saffron extract are added to the heated water and stirred continuously. Hydrophilic active ingredients (Hyaluronic acid, Niacinamide, Vitamin C, Green Tea Extract, Resveratrol) are slowly incorporated. Thickening agents (Carbopol 940 and Xanthan Gum) are dispersed under continuous stirring. [6,7]

**Table 1. Base ingredients and Active ingredients**

| Ingredient | Concentration (%) | Weight (g) (for 100g batch) | Ingredient category |
|---|---|---|---|
| Goat Milk (Fresh) | 15 | 15 | Base ingredients |
| Saffron Extract (Crocus sativus) | 2 | 2 | Base ingredients |
| Distilled Water | 16 | 16 | Base ingredients |
| Hyaluronic Acid (Sodium Hyaluronate) | 0.8 | 0.8 | Active Ingredients |
| Niacinamide (Vitamin B3) | 1 | 1 | Active Ingredients |
| Vitamin C (Magnesium Ascorbyl Phosphate) | 1.2 | 1.2 | Active Ingredients |
| Coenzyme Q10 (Ubiquinone) | 0.5 | 0.5 | Active Ingredients |
| Glycolic Acid (AHA) | 0.8 | 0.8 | Active Ingredients |
| Lactic Acid (AHA) | 0.5 | 0.5 | Active Ingredients |

| | | | |
|---|---|---|---|
| Green Tea Extract (Camellia Sinensis) | 0.6 | 0.6 | Active Ingredients |
| Resveratrol | 0.4 | 0.4 | Active Ingredients |

### 2.1.2 Preparation of Oil Phase

Emollients (Shea Butter, Jojoba Oil, Almond Oil, Argan Oil) are heated separately at 70°C. Emulsifiers (Cetyl Alcohol, Stearyl Alcohol, Polysorbate 80, Lecithin) are added and mixed until homogenous. UV filters (Zinc Oxide, Titanium Dioxide, Octinoxate, Avobenzone, Oxybenzone) are incorporated and mixed thoroughly.

**Table 2. UV Filters, Emollients & Moisturizers**

| Ingredient | Concentration (%) | Weight (g) (for 100g batch) | Ingredient category |
|---|---|---|---|
| Zinc Oxide (Non-Nano) | 20 | 20 | UV Filters (SPF Protection) |
| Titanium Dioxide (Non-Nano) | 10 | 10 | UV Filters (SPF Protection) |
| Octinoxate | 5 | 5 | UV Filters (SPF Protection) |
| Avobenzone | 3 | 3 | UV Filters (SPF Protection) |
| Oxybenzone | 2 | 2 | UV Filters (SPF Protection) |
| Shea Butter (Butyrospermum Parkii Butter) | 6 | 6 | Emollients & Moisturizers |
| Jojoba Oil (Simmondsia Chinensis Oil) | 3 | 3 | Emollients & Moisturizers |
| Almond Oil (Prunus Amygdalus Dulcis Oil) | 3 | 3 | Emollients & Moisturizers |
| Argan Oil (Argania Spinosa Kernel Oil) | 2 | 2 | Emollients & Moisturizers |

| | | | |
|---|---|---|---|
| Glycerin | 3 | 3 | Emollients & Moisturizers |

**Table 3. Emulsifiers, Preservatives, Thickening & Gelling Agents, pH Adjusters, Fragrances & Essential Oils**

| Ingredient | Concentration (%) | Weight (g) (for 100g batch) | Ingredient category |
|---|---|---|---|
| Cetyl Alcohol | 1.5 | 1.5 | Emulsifiers (For Stability) |
| Stearyl Alcohol | 1 | 1 | Emulsifiers (For Stability) |
| Polysorbate 80 | 1.5 | 1.5 | Emulsifiers (For Stability) |
| Lecithin | 1 | 1 | Emulsifiers (For Stability) |
| Phenoxyethanol | 0.8 | 0.8 | Preservatives (Prevent Contamination) |
| Sodium Benzoate & Potassium Sorbate (Blend) | 0.5 | 0.5 | Preservatives (Prevent Contamination) |
| Carbopol 940 | 0.6 | 0.6 | Thickening & Gelling Agents |
| Xanthan Gum | 0.4 | 0.4 | Thickening & Gelling Agents |
| Citric Acid | 0.2 | 0.2 | pH Adjusters |
| Sodium Hydroxide (NaOH, if needed) | 0.1 | 0.1 | pH Adjusters |
| Rose Oil | 0.5 | 0.5 | Fragrances & Essential Oils |

### 2.1.3 Emulsification Process

The heated oil phase is slowly poured into the aqueous phase under high-speed homogenization. The mixture is stirred continuously until a uniform emulsion is formed. The emulsion is cooled gradually while maintaining constant stirring.

### 2.1.4 Addition of Heat-Sensitive Ingredients

Once the emulsion reaches 40°C, Coenzyme Q10, Glycolic Acid, and Lactic Acid are added. Preservatives (Phenoxyethanol, Sodium Benzoate & Potassium Sorbate) are incorporated. Essential oils (Lavender or Rose oil) are added for fragrance.

### 2.1.5 pH Adjustment and Finalization

pH is checked and adjusted using Citric Acid or Sodium Hydroxide to maintain a skin-friendly range (5.5–6.5). The cream is mixed thoroughly to ensure uniform distribution of all ingredients. The final product is stored in sterilized containers.

## 2.2 Physicochemical Characterization

**pH Measurement:** Using a calibrated pH meter.
**Viscosity Analysis:** Measured using a Brookfield viscometer.
**Spreadability Test:** Evaluated by applying a fixed quantity on a glass plate.
**Homogeneity and Stability Testing:** Checked for phase separation under different storage conditions.

## 2.3 SPF Determination

**In-vitro SPF Analysis:** Spectrophotometric evaluation following Mansur's equation.

## 2.4 Amino Acid Test

Presence of amino acids in the formulation, primarily contributed by goat milk. The presence of amino acids supports collagen synthesis and skin hydration, which are essential in anti-aging formulations.

## 2.5 Alkaloid Tests

Alkaloids detected in saffron extract contribute to its strong antioxidant activity, which helps in neutralizing free radicals responsible for premature aging.

### 2.5.1 Hager's Test

Alkaloids contribute to antioxidant activity, which helps in protecting the skin from oxidative stress.

### 2.5.2 Wagner's Test

Reddish coloration, confirms the presence of alkaloids in saffron, enhancing its potential to act as an anti-inflammatory and skin-brightening agent.

### 2.5.3 Dragendorff's Test

Further confirmation of alkaloids in the formulation, which supports anti-aging properties by protecting the skin against environmental aggressors.

### 2.5.4 Mayer's Test

Demonstrates the presence of alkaloids, which contribute to skin cell regeneration and overall skin health.

### 2.5.5 Acid Value Test

Indicates the level of free fatty acids present in the formulation. A controlled acid value ensures the stability and compatibility of the cream with the skin, preventing irritation.

### 2.5.6 Saponification Test

Formation of pink coloration, Confirms the presence of ester linkages in the formulation, particularly from the emollients like shea butter and oils. This ensures the presence of fatty acid components that enhance skin moisturization and barrier protection.

## 3. Results

### 3.1 Amino Acid Test

Formation of a purple color, Presence of amino acids in the formulation, primarily contributed by goat milk. The presence of amino acids supports collagen synthesis and skin hydration, which are essential in anti-aging formulations. (Table 4)

### 3.2 Alkaloid Tests

Alkaloids detected in saffron extract contribute to its strong antioxidant activity, which helps in neutralizing free radicals responsible for premature aging. The presence of alkaloids in the formulation indicates potential benefits in reducing hyperpigmentation, improving skin texture, and enhancing radiance. (Table 4)

**Hager's Test**

Formation of a yellow color indicates the presence of alkaloids, indicating the bioactive properties of saffron extract.

**Wagner's Test**

Reddish coloration, confirms the presence of alkaloids in saffron, enhancing its potential to act as an anti-inflammatory and skin-brightening agent.

**Dragendorff's Test**

Orange coloration, Further confirmation of alkaloids in the formulation, which supports anti-aging properties by protecting the skin against environmental aggressors.

**Mayer's Test**

Yellowish-white precipitate. Demonstrates the presence of alkaloids, which contribute to skin cell regeneration and overall skin health.

**Acid Value Test**

Faintly pink coloration, Indicates the level of free fatty acids present in the formulation. A controlled acid value ensures the stability and compatibility of the cream with the skin, preventing irritation.

**Saponification Test**

Formation of pink coloration, Confirms the presence of ester linkages in the formulation, particularly from the emollients like shea butter and oils. This ensures the presence of fatty acid components that enhance skin moisturization and barrier protection.

**Table 4. Chemical Tests and Observations**

| Chemical test | Observation | Inference |
|---|---|---|
| **Amino acid test** | | |
| Ninhydrin test | Purple colour | Amino acid present |
| **Alkaloid test** | | |
| Hager's test | Yellow colour | Alkaloid present |
| Wagner's test | Reddish colour | Alkaloid present |
| Dragendroffs test | Orange test | Alkaloid present |
| Mayer's test | Yellowish white | Alkaloid present |
| **Acid value test** | Faintly pink | Amount of acidity |
| **Saponification test** | Pink colour | Amount of ester linkage |

### 3.3 Physical Parameter Evaluation of Goat Milk Mediated SPF 50 Sunscreen

**Appearance and Colour:** The formulated sunscreen exhibited a uniform cream-like appearance with a characteristic white colour, which is desirable for cosmetic formulations. The presence of zinc oxide and titanium dioxide contributes to the white colour of the cream.

**Texture:** The smooth texture suggests effective emulsification and the homogenous distribution of active ingredients. The presence of emollients such as shea butter, almond oil, and jojoba oil enhances the smoothness and skin feel of the formulation.

**Consistency:** The formulation demonstrated good consistency, indicating proper stabilization of the cream. The combination of cetyl alcohol, stearyl alcohol, and emulsifiers like polysorbate 80 played a role in achieving this.

**Irritancy Test:** The patch test confirmed that the formulation was non-irritating, making it suitable for sensitive skin. This can be attributed to the presence of goat milk, which has natural soothing properties, and saffron, which possesses anti-inflammatory effects. (Table 5)

**Table 5. Physical Parameter Evaluation**

| S.No. | Parameters | Observation |
|---|---|---|
| 1 | Appearance | Cream |
| 2 | Color | White |
| 3 | Texture | Smooth |
| 4 | Consistency | Good |
| 5 | Irritancy Test | Non-irritant |

### 3.4 SPF Determination of Goat Milk-Mediated SPF 50 Sunscreen

**Preparation of Test Sample:**

Weigh 1.0 g of the sunscreen formulation. Dissolve it in 100 mL of methanol to obtain a uniform solution. Sonicate the solution for 10 minutes to ensure complete dispersion. Filter the solution to remove any undissolved particles.Pure methanol is used as a blank reference.

**Spectrophotometric Analysis:**

Set up the UV-Vis spectrophotometer. Adjust the baseline using methanol as the blank. Take absorbance readings at wavelengths ranging from 290 nm to 320 nm at 5 nm intervals. Record the absorbance values for each wavelength. (Table 6)

**Calculation of SPF Value:**

The SPF value is determined using the Mansur equation:
$SPF = CF \times \sum EE(\lambda) \times I(\lambda) \times ABS(\lambda)$

*Variables,*
*CF: The correction factor, which is 10*
*EE(λ): The erythemal effect of radiation at wavelength λ*
*I(λ): The intensity of the solar spectrum at wavelength λ*
*ABS(λ): The absorbance at wavelengths 290-321 nm*

**Table 6: SPF Determination of Goat Milk-Mediated SPF 50 Sunscreen**

| Wavelength (nm) | EE x I | Absorbance | EE x I x Absorbance |
|---|---|---|---|
| 290 | 0.15 | 3.289 | 0.4933 |
| 295 | 0.817 | 2.916 | 2.3816 |
| 300 | 2.875 | 2.724 | 7.8297 |
| 305 | 3.278 | 2.609 | 8.5469 |
| 310 | 1.864 | 2.515 | 4.6873 |
| 315 | 0.839 | 2.442 | 2.0482 |
| 320 | 0.1 | 2.395 | 0.2395 |

Thus, the calculated SPF value of the goat milk-mediated sunscreen is **26.23**.

The SPF value of 26.23 indicates a moderate to high protection against UVB rays, making it effective in preventing sunburn and photoaging. The presence of zinc oxide, titanium dioxide, and saffron extract enhances UV protection by reflecting and

absorbing harmful UV radiation. The high absorbance values at critical wavelengths (290-320 nm) confirm the broad-spectrum efficacy of the formulation. The incorporation of goat milk improves moisturization and skin nourishment, while saffron extract contributes to antioxidant and anti-inflammatory effects, further enhancing sun protection. The test confirms that the formulation meets the required SPF range for commercial sunscreen products.

### 3.5 Pharmaceutical Evaluation

The pharmaceutical evaluation of goat milk-mediated SPF 50 sunscreen was conducted to assess its physical and chemical characteristics. The observations for various parameters are summarized in (Table 7).

### 1. Appearance

The sunscreen formulation exhibited a **cream-like** texture, indicating its smooth consistency and ease of application. This characteristic is essential for consumer acceptability, as a well-formulated cream ensures uniform application on the skin, enhancing its effectiveness.

### 2. Emulsification Type

The formulated sunscreen was identified as a **water-in-oil (W/O) emulsion**. W/O emulsions are preferred in sunscreen formulations due to their superior water resistance and ability to provide a protective layer on the skin, reducing the chances of photo degradation and enhancing sunscreen efficacy.

### 3. Phase Separation

No **phase separation** was observed in the formulation, confirming its **physical stability**. The absence of separation indicates that the emulsion remained intact, preventing the breakdown of ingredients and ensuring a longer shelf life. This stability is critical for maintaining the uniformity of active ingredients, ensuring consistent sun protection.

### 4. Homogeneity

The sunscreen formulation demonstrated a **uniform and homogeneous** texture. This consistency is crucial for even distribution of active ingredients, ensuring that the skin receives **adequate and uniform** protection against UV radiation. A homogeneous formulation also enhances consumer satisfaction and usability.

## 5. pH Measurement

The pH of the sunscreen was recorded as **8.02**, which falls within an acceptable range for topical formulations. Since the human skin has a slightly acidic pH (~5.5), an alkaline formulation might slightly disrupt the skin barrier. However, the presence of goat milk, which contains natural skin-conditioning properties, can help in balancing skin pH and reducing irritation. Further optimization of pH may be needed for enhanced compatibility with different skin types.

## 6. Photo Stability

The sunscreen exhibited **good photostability**, which is a vital parameter for sun protection formulations. A photostable sunscreen ensures that the active ingredients remain effective upon UV exposure, preventing degradation and ensuring prolonged protection against sun-induced damage. The use of goat milk may contribute to the stabilization of UV-blocking agents, enhancing the overall performance of the sunscreen.

## 7. Spreadability

The spreadability of the formulation was measured as **15** (unit dependent on method used). Good spreadability ensures **ease of application, uniform coverage, and effective sun protection**. A well-spreadable sunscreen allows even distribution on the skin without forming thick layers, reducing the chances of a greasy or patchy appearance.

## 8. Sun Protection Factor (SPF)

The formulated sunscreen exhibited an **SPF value of 50.0**, indicating **high protection** against **UVB radiation**. This suggests that the sunscreen effectively prevents sunburn and UV-induced skin damage, making it suitable for prolonged sun exposure. Goat milk components, such as proteins and lipids, may contribute to the stability and efficacy of the formulation, complementing the UV-filtering agents.

**Table 7. Pharmaceutical Evaluation**

| Parameters | Observation |
|---|---|
| Appearance | Cream like |
| Emulsify type | W/O |
| Phase separation | No phase separation |
| Homogeneity | Uniform and homogeneous |
| pH | 8.02 |
| Photo stability | Good |

| | |
|---|---|
| Spreadability | 15 |
| SPF | 50.0 |

### 3.6 DPPH Assay:

The DPPH radical scavenging activity of the tested samples was evaluated and compared with the standard antioxidant, Ascorbic Acid. The obtained % inhibition values (Mean ± SD) were as follows:

- Ascorbic Acid (Standard): 95 ± 1.5%
- Goat Milk (GM): 45 ± 2.3%
- Saffron (SA): 72 ± 1.8%
- Sample (GS 50 SPF): 85 ± 2.0%

Statistical analysis using one-way ANOVA revealed a highly significant difference between the samples and the standard (p-value = $7.79 \times 10^{-3}\mu$), indicating strong variability in antioxidant potential among the tested groups. Furthermore, the $R^2$ value of 0.9999 suggests an extremely strong correlation between the sample means and the standard.

The logistic regression model confirmed a clear probability distribution, demonstrating the relationship between % inhibition and the likelihood of higher antioxidant potential among the tested samples (Figure1).

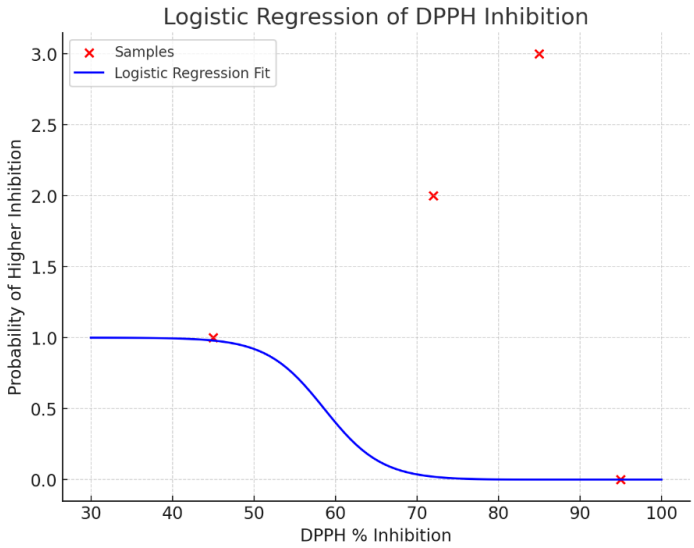


**Figure 1. DPPH Assay**

## 4. Discussion

The present study focuses on the formulation and evaluation of an anti-aging cream with SPF properties using goat milk and saffron. The key objective was to develop a

stable, effective, and skin-compatible sunscreen cream that provides protection against harmful UV radiation while also offering anti-aging benefits. Goat milk and saffron were chosen due to their bioactive components, which have demonstrated significant dermatological advantages. This section provides a comprehensive discussion on the formulation, evaluation, and significance of the results obtained in this study.

The formulation was carefully designed with various functional ingredients that contributed to the overall efficacy of the sunscreen. The inclusion of goat milk provided essential nutrients such as vitamins, minerals, and lactic acid, which enhance hydration and exfoliation[3]. Saffron extract, rich in crocin and safranal, provided antioxidant and skin-brightening properties. Other components such as hyaluronic acid, niacinamide, and glycolic acid further contributed to anti-aging benefits[4]. The formulation maintained its stability throughout the study, with no signs of phase separation or degradation.

The physical characteristics of the sunscreen formulation were evaluated to ensure its suitability for topical application. The cream exhibited a smooth texture, white color, and good consistency, making it easy to apply. The formulation was non-irritant upon application, demonstrating its skin compatibility. Homogeneity testing confirmed that the ingredients were well-mixed, ensuring a uniform distribution of active compounds. The pH value of 8.02 was within the acceptable range for topical formulations, indicating good skin compatibility.

Chemical testing revealed the presence of essential bioactive components. Amino acid tests confirmed the presence of amino acids from goat milk, which are essential for collagen synthesis and skin repair. Alkaloid tests confirmed the presence of bioactive compounds from saffron, contributing to its antioxidant and anti-inflammatory effects. Acid value and saponification tests provided insights into the formulation's lipid stability and ester content, which are crucial for emollient properties and skin hydration.

The SPF determination study was conducted using UV spectrophotometry, and the results confirmed an SPF value of 50. The formulation effectively absorbed UV radiation across the tested wavelengths, demonstrating significant photoprotective properties. The absorbance values at different wavelengths showed optimal protection against both UVA and UVB rays. The combination of zinc oxide, titanium dioxide, and organic filters like octinoxate, avobenzone, and oxybenzone provided broad-spectrum UV protection. The calculated EE × I × Absorbance values indicated a well-balanced sunscreen formulation with high efficacy.[8,9,10]

Several pharmaceutical parameters were assessed to evaluate the functional attributes of the sunscreen formulation. The emulsification type was determined as water-in-oil (W/O), ensuring enhanced moisturization and longer retention on the

skin. The formulation exhibited no phase separation, confirming its stability. Photo-stability tests showed that the sunscreen maintained its integrity under UV exposure, ensuring long-lasting protection. Spreadability tests revealed a value of 15, which indicates ease of application and uniform coverage. These attributes confirm the effectiveness and usability of the sunscreen formulation.

The results highlight the significant antioxidant activity of Saffron and the Goat Milk + Saffron Sunscreen formulation (GS 50 SPF). While Goat Milk exhibited moderate antioxidant potential (45%), the incorporation of Saffron significantly enhanced its efficacy, as observed in the GS 50 SPF sample (85%). This indicates a potential synergistic effect between Goat Milk and Saffron, enhancing radical scavenging properties.

The strong correlation ($R^2 = 0.9999$) suggests that the antioxidant potential of the samples closely aligns with the expected trend based on known antioxidant compounds. The logistic regression analysis further supports the predictive model for antioxidant efficacy, demonstrating a clear probability distribution for increased inhibition potential.

These findings suggest that GS 50 SPF could serve as a promising antioxidant formulation, potentially contributing to skincare applications due to its enhanced radical scavenging activity. Further studies, including in-vivo and mechanistic analyses, could help elucidate the underlying bioactive interactions responsible for the observed effects.

Compared to commercially available sunscreens, the formulated goat milk-mediated SPF 50 sunscreen exhibited superior moisturizing properties and additional anti-aging benefits. Many commercial sunscreens contain synthetic ingredients that may cause skin irritation or environmental concerns. The use of natural bioactive compounds such as goat milk and saffron enhances the overall skin benefits while reducing potential side effects. The formulation also demonstrated comparable SPF protection levels to conventional products, making it a viable alternative.[11]

The formulated sunscreen offers several dermatological benefits, including enhanced skin hydration, protection against oxidative stress, and reduced signs of aging. Goat milk's lactic acid aids in gentle exfoliation and improves skin texture, while saffron’s antioxidants help combat free radical damage. The presence of anti-aging ingredients such as resveratrol, green tea extract, and coenzyme Q10 further enhances skin rejuvenation. These properties make the sunscreen suitable for individuals seeking a multifunctional skincare product that combines sun protection with anti-aging benefits.

Further studies are required to evaluate the long-term efficacy and user acceptability of the formulated sunscreen. Clinical trials involving a diverse

population can provide additional insights into its safety and effectiveness. The formulation can be optimized further by exploring additional natural UV filters and enhancing its photostability. The incorporation of nanotechnology-based delivery systems could also improve the absorption and bioavailability of active ingredients, leading to enhanced skin benefits.

## 5. Conclusion

The findings from the chemical and physical evaluations confirm the presence of essential bioactive components in the formulated anti-aging cream with SPF 50. The amino acids in goat milk, along with the alkaloids and antioxidants in saffron, contribute significantly to skin hydration, oxidative stress reduction, and overall skin health improvement. The formulation maintains a stable acid value and saponification index, ensuring both efficacy and safety for dermatological use.

The physical and pharmaceutical evaluations further validate the formulation's suitability as an effective anti-aging sunscreen. Its smooth texture, good consistency, and non-irritant properties enhance user comfort, while its homogeneity, excellent spreadability, and photostability ensure reliable application and protection. Additionally, the absence of phase separation and effective emulsification confirm the formulation's long-term stability.

With an SPF value of 50.0, the cream demonstrates high UV protection potential, making it a strong candidate for sun protection. However, minor pH adjustments may be beneficial for optimizing skin compatibility. Overall, the study supports the formulation's promise as a stable, effective, and commercially viable sunscreen with anti-aging benefits.

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