ORIGINAL ARTICLE

Formulation and Evaluation of Herbal Antioxidant Cream from Papaya Latex and Banana Peel Extract

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Abstract

Background: There is a growing interest in developing natural skincare products with potent antioxidant properties to combat oxidative stress and premature aging. **Objective:** To formulate and evaluate an herbal antioxidant cream using papaya latex (*Carica papaya*) and banana peel extract (*Musa* spp.). **Methods:** Extraction of bioactive compounds from papaya latex and banana peel was performed, followed by antioxidant testing and cream formulation. The cream was evaluated for pH, viscosity, spreadability, phase separation, sensory qualities, and *in vitro* antioxidant activity. **Results:** Papaya latex exhibited greater antioxidant activity than banana peel extract. Creams demonstrated desirable physicochemical properties and increased antioxidant efficacy with higher extract concentrations. **Conclusion:** The herbal cream showed effective antioxidant potential, stability, and skin compatibility, offering a promising natural skincare alternative.

Key words: Natural skincare, Antioxidant activity, Papaya latex, Banana peel, Formulation development, Skin compatibility

INTRODUCTION

In recent years, there has been a growing interest in the development of herbal-based skincare products, driven by consumer demand for natural and sustainable alternatives to synthetic chemicals. This movement has been led by antioxidants, which are essential for shielding the skin from oxidative stress and environmental harm. Because they are sourced from plants, herbal antioxidants have the added advantages of being safe and effective, which makes them a great option to use in cosmetic formulations.[1] The fact that a herbal cosmetic is produced only of herbs and shrubs is the finest justification for using one. The body does not experience any negative effects from the natural composition of the herbs, but these herbal medicines provide the body with additional beneficial minerals and nutrients. However, more and more research indicates that plants offer a wide range of complex active components called antioxidants that can not only soothe or smooth the skin but also to restore actively, heal, and protect the skin.[2]

Since antioxidants neutralize or eliminate "reactive oxygen species" (ROS), also known as free radicals, before they cause cell harm, they have become an essential component of modern life. ROS-induced oxidation leads to DNA mutations, membrane protein damage, and disintegration of cell membranes. These processes cause aging and further trigger or exacerbate the development of numerous diseases, including arteriosclerosis, cancer, diabetes mellitus, liver injury, inflammation, skin damage, coronary heart disease, and arthritis.

Antioxidants are chemical substances that slow down the pace at which lipid oxidation reactions occur in food systems. Antioxidants are defined as chemicals that resist oxidation or obstruct processes induced by oxygen or peroxides; several of these molecules are utilized as preservatives in a variety of products.[3,4]

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Banana (*Musa* spp.) and papaya (*Carica papaya*) are two tropical fruits that are highly prized for their abundance of bioactive substances that have strong antioxidant qualities. The unripe fruit's milky sap, or latex, is full of vitamins and other phenolic compounds. Significant amounts of the proteolytic enzyme papain are also present.[5,6]

The skin is the organ most frequently exposed to external oxidative stressors such as ultraviolet (UV) rays, air pollution, and chemical oxidants. Premature skin aging can be caused by a variety of factors, including smoking, excessive dieting, dietary imbalances, mental stress, and external oxidative damage. Studies show that antioxidants control the indicators associated with early aging by reducing oxidative stress, which includes stress from the environment such as ozone and cigarette smoke.[7] Natural antioxidant topical and oral medications protect the skin from premature aging caused by oxidative damage. Natural fruits high in antioxidants may protect skin from premature aging by lowering oxidative stress and inflammation. Plants with vibrant red, blue, and purple hues are attributed to anthocyanins, which are commonly present in fruits and vegetables, particularly berries. Antioxidants referred to as anthocyanins are found in nature.[8]

Aim and objectives

The aim of the present study involves the formulation and evaluation of herbal antioxidant cream from papaya latex and banana peel extract. The prepared antioxidant cream evaluated different parameters within the acceptable limits. Suchas spreadability, phase separation, viscosity, antioxidant activity, and pH value performed, hence, antioxidant cream decreases the aging of skin, brighten the skin, providing protection against UV rays, nowadays increasing demand for herbal cream formulation. They have better safety and also fewer side effects. Antioxidant cream using Papaya (*C. papaya*) and banana (*Musa* spp.). Skin care products use as antioxidant, antiaging cream, and promotes overall skin health.[9]

Objectives

1. To conduct a pre-formulation study of the herbal cream.
2. To perform the extraction
3. To formulate the herbal cream
4. To evaluate the parameters of the herbal cream.

Plan of work

- Literature survey
- Collection of herbs
- Materials and methods
- Formulation of cream
- Physical parameter of cream
    1. Color
    2. Odor
    3. Texture
    4. State
- Evaluation of cream
    1. Spreadability
    2. Phase separation
    3. Content uniformity
    4. Viscosity
    5. pH value
    6. Antioxidant test.

EXPERIMENTAL

Materials

Formulation of cream

Papaya latex, banana peel extract, menthol, sodium benzoate, glycerin, propylene glycol, bees wax, white soft paraffin, methyl paraben.

Antioxidant test

0.6 M sulfuric acid, 28 mM sodium phosphate, and 4 mM ammonium molybdate.

Collection of herbs

Extraction and collection of papaya latex

Early in the morning, unripe, mature fruit was tapped, and by mid-morning, the latex from the fruit was gathered and removed. An 1–2 mm deep vertical cut was created with a stainless-steel knife. The latex was gathered in a plastic dish. Next, the latex was scraped into a box with a close-fitting cover that was lined with polythene. Using a plastic spoon, the latex that had stuck to the fruit was carefully scraped off and placed in the collecting box.[10]

Drying of latex

The recovered latex was placed in aluminum trays and dried for 2 h at 40°C in a hot air oven. As shown in Figure 1 once it had dried, the latex was put into a plastic bottle and kept at 20°C until it was needed for formulation.[11]

Extraction and collection of banana peel extract

We bought fully ripe and mature banana fruits from the Seloo local market. Fruits were washed to get rid of any dust, grime, or pesticide residue. For both fruits, the peels were scraped from the pulp, chopped into tiny pieces, and dried in a "Hot Air Oven" set at 50°C for 48 h. The peels were dried and processed into a fine powder with a moisture level of <10%. After that, the peel powder was placed in a beaker and stored at a temperature of 4–6°C while covered with silver foil.

Drying of extract

Banana peel powder was extracted using the maceration method at specific concentrations of 75% ethanol. Solution

of hydro alcoholics. The temperature for the maceration process was set at 40°C, and the sample to solvent ratio was set to 1:15. Peels were kept separately in 250 mL conical flasks for three days, whereas the solvent was evaporating in a water bath. The filtered extract was then dried in a hot air oven.[12] as shown in Figure 2.

MATERIALS AND METHODS

Papaya latex

- Kingdom: Plantae
- Species: Carica
- Family: Caricaceae.
- Scientific name: (*C. papaya* Linn.)
- Biological source: It is obtained from the white fluid of the raw fruit of the tropical papaya plant *C. papaya* Linn
- Geographical source: It is grown in tropical locations throughout various countries. India, Tiwan, Mexico, and Central America are where it was originally domesticated.[13]
- Use: Papaya Latex is a creamy, whitish to pale yellow substance that resembles milk in its consistency as shown in Figure 3. It is sticky and thick, with a distinct odor that is often described as unpleasant or pungent. The latex contains a variety of biologically active compounds, including enzymes, proteases, and secondary metabolites. Certain compounds in papaya latex, such as chymopapain, exhibit anti-inflammatory properties and may be used in pharmaceutical products.[14]

The exfoliating and proteolytic properties of papaya latex make it a popular ingredient in cosmetic products like facial masks, scrubs, and creams. It helps remove dead skin cells and promotes a smoother complexion. Papaya latex is often used in traditional medicine for its potential wound-healing properties. It may be applied topically to wounds to promote healing and reduce inflammation. Some commercial wound-care products contain papaya latex or its derivatives.

Bananapeel extract

- Kingdom: Plantae
- Species: *Musa balbisiana*
- Family: Musaceae
- Scientific name: **(***Musaparadisiaca)*
- Biological source: It is obtained from the dried peel hydroalcoholic extract of banana fruit. Plant of genus *Musa*
- Geographical source: It is grown in tropical locations of India and Africa.[15]
- Use: Because banana peels have strong antibacterial, anti-inflammatory, and antioxidant qualities, using them in a variety of industries—especially skincare and cosmetics—can have a number of advantages. Key applications for banana peels are listed below. The potent antioxidant qualities of carotenoids, flavonoids, and phenolic chemicals found in banana peels are well-known. By aiding in the neutralization of free radicals, these substances shield the skin from oxidative stress and early aging. Banana peel extracts can be added to skincare formulas to increase the antioxidant content of creams, lotions, and serums.[16] Banana peels' anti-inflammatory qualities can relieve irritated skin, lessen redness, and help with ailments including psoriasis and acne. Using banana peel extracts in topical formulations, inflammatory skin disorders can be naturally treated, leading to healthier skin. Essential fatty acids and polysaccharides found in banana peels support skin hydration and enhance the function of the skin barrier. To increase the effectiveness of moisturizers and hydrating creams in avoiding dry skin and preserving a healthy moisture balance, these ingredients can be added.[13] Using exfoliants, banana peels have mild exfoliating qualities that can help remove dead skin cells from the skin, leaving the complexion smoother and more vibrant. Exfoliating scrubs and masks containing banana peel extracts can be used to gently cleanse and revitalize the skin as shown in Figure 4.[17]

Formulation of cream

Procedure

1. Every item was used in the amounts specified in Table 1. In the first beaker, propylene glycol and beeswax were added. After that, heat in a water bath to ensure even mixing. A little while later, the oil phase developed
2. Papaya dry latex with banana extract, In the second beaker, ingredients were distilled water, white soft paraffin, glycerin, zinc oxide, and sodium benzoate
3. The aqueous phase was created by boiling all of the components together in a water bath. The aqueous phase was supplemented with the oil phase. As shown in Figure 5 then, combined for 5 min at 500 RPM using a homogenizer
4. The ready-made cream was transferred into a plastic container that was airtight.[18]

Formulation Composition

The herbal antioxidant cream was formulated using varying concentrations of papaya latex and banana peel extract across three different formulations (F1, F2, and F3). Each formulation was designed to evaluate the optimal combination for maximum antioxidant efficacy, physical stability, and user acceptability. Table 1 lists the individual ingredients used in each formulation, along with their quantities and respective functional roles.

In all three formulations, papaya latex and banana extract served as the primary antioxidant agents. Their

Table 1: Quantity and ingredients

S. No.	Ingredients	Uses	F1	F2	F3
1	papaya latex	Antioxidant activity	1 g	1.2 gm	1.5 gm
2	banana extract	Antioxidant activity	1.5 g	1.8 g	2 g
3	Menthol	Soothing agent	0.2 mL	0.2 mL	0.2 mL
4	Sodium benzoate	Preservative	0.5 g	0.7 g	0.9 g
5	Glycerin	Hydration	1 mL	1 mL	1 mL
6	Propylene glycol	Humectant	1 mL	1 mL	1 mL
7	Bees wax	Base	2.5 g	2.5g	2.7 g
8	White soft paraffin	Emollient	7 mL	6.5 mL	5.5 mL
9	Methyl paraben	Preservative	0.3 mL	0.3mL	0.3 mL
10	Distilled water	Vehicle	Q. S	Q. S	Q. S

concentrations were varied incrementally across F1 to F3 to study their effect on the cream's physicochemical and antioxidant properties. Menthol was included as a soothing agent to enhance the sensory profile of the cream, while sodium benzoate and methyl paraben acted as preservatives to ensure microbial stability. Glycerin and propylene glycol served as humectants and moisturizers, improving the hydration and skin-feel of the final product. Beeswax functioned as the structural base, providing consistency and creaminess, while white soft paraffin was used as an emollient to support spreadability and occlusivity. Distilled water was used as the vehicle in all three formulations to dissolve water-soluble components and ensure even distribution of actives. The compositional variations across F1, F2, and F3 allowed for a comparative evaluation of how ingredient concentration influences the overall performance of the herbal cream.

Evaluation of cream

Spreadability

By placing a sample between two slides and compressing it to a consistent thickness with a specific weight for a predetermined amount of time, the spreadability of the prepared cream was determined. Spreadability was defined as the amount of time needed to divide the two slides into independent portions. A shorter time required to separate the two slides produced better spreadability findings. The formula used to calculate spreadability was as follows.[19] The outcome is displayed in Table 3.

$$S = M \times L/T.$$

Phase separation

The made cream was poured into a wide-mouth container that was appropriate. After 24 h, the oil phase and aqueous phase separation were visible and were put aside for storage. Result shown in Table 3.

Table 2: Physical parameter of cream

S. No.	Parameters	Observation
1.	State	Semisolid
2.	Color	Off white
3.	Odour	Pleasant
4.	Texture	Smooth

Table 3: Evaluation test result

S. No.	Parameters	Result
1.	pH	6.4
2.	Spreadability	11.49 g.cm/s
3.	Viscosity	39115 cp
4.	Phase separation	Not appear

Drug content uniformity

Quality control majors should apply to guarantee that the composition of the medication remains constant throughout the production process. To ensure that the drug content requirements are fulfilled, batches must be tested and sampled. Checking for consistency: Samples from different batches are taken for uniformity testing, and the drug content of those samples is examined. To ensure that the drug content is consistent throughout the batch, the findings are compared.

Viscosity

Viscosity plays a vital role in assessing the quality and performance of herbal cream. The resistance of a substance to flow is referred to, and in the case of cream, it determines how easy it is to apply, spread, and stable the product. Brookfield viscometer the Brookfield viscometer is widely used to measure the viscosity of fluids, including cream. It operates on the principle of rotational viscometry, where the resistance to the rotation of a spindle immersed in the fluid is measured to determine its viscosity. Here's a detailed explanation of how the Brookfield viscometer works and its

Table 4: Antioxidant test result

Sample	Range nm	absorbance	Sample 1 (10)%	Sample 2 (20)%	Sample 3 (30)%
Banana peel	695 nm	Con.%	61.93	65.84	69.20
Papaya latex	695 nm	Con.%	58.41	60.20	66.02

Figure 1: Dried papaya latex

Figure 3: Papaya latex

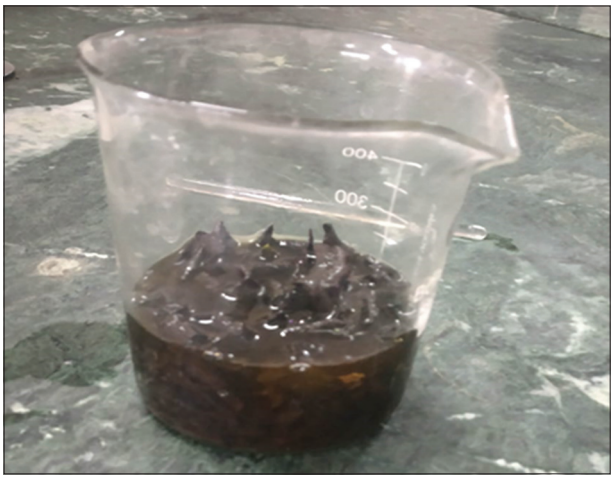

Figure 2: Banana peel extract

Figure 4: Banana peel

significance in viscosity evaluation. Procedure: Viscosity of cream was done by using Brooke field viscometer at the temp of 25°C., using spindle no 63.at 10–100 rpm. Results are shown in Table 3.

pH

The pH of the cream formulation was ascertained using the digital pH meter. After precisely weighing 2.5 g of cream, it was mixed with 25 mL of purified water and kept for 2 h. Three separate measurements of the formulation's pH were made. Results are shown in Table 3.[20]

Antioxidant test: Phosphomolybdate method

The fractions' total antioxidant capacity was ascertained by use of the phosphomolybdate procedure, which employed

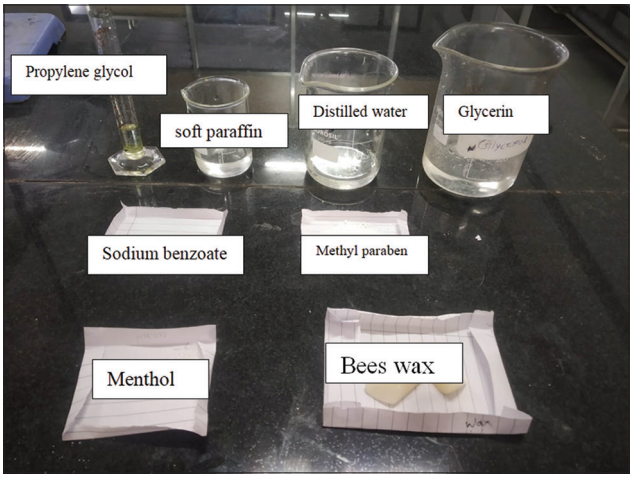

Figure 5: Ingredient

ascorbic acid as a standard to test for total antioxidant capability. An aliquot of 0.1 mL of the sample solution was mixed with one milliliter of the reagent solution (0.6 M sulfuric acid, 28 mM sodium phosphate, and 4 mM ammonium molybdate). The tubes were sealed and then incubated in a water bath at 95°C for 90 min. After allowing the samples to reach room temperature, the absorbance of the mixture at 695 nm was measured and compared to a reference value. Under identical conditions, a standard blank was cultured with 1 mL of the reagent solution and the appropriate amount of solvent. Ascorbic acid was the benchmark. The capacity the ability of antioxidants capacity was estimated using the following formula.

%Antioxidant effect = ([Absorbances control−Absorbances ample]/Absorbances control) ×100. Ascorbic acid was used as a standard result is shown in Table 4.[21]

DISCUSSION

The results obtained from the formulation and evaluation of the herbal antioxidant cream demonstrate the successful integration of bioactive compounds from papaya latex (*Carica papaya*) and banana peel extract (*Musa spp.*) into a stable and effective topical formulation. The selected natural ingredients are rich in polyphenols, flavonoids, and enzymatic antioxidants, contributing to their pronounced efficacy in countering oxidative stress—a major cause of skin aging, inflammation, and dermal degradation.

The physicochemical characteristics of the cream, such as pH (6.4), viscosity (39115 cp), and spreadability (11.49 g•cm/s), were found within acceptable dermatological limits, indicating that the cream is safe for topical application and user-friendly. The pH being close to the skin's natural pH (4.5–6.5) minimizes the risk of irritation or barrier disruption, which is critical for formulating cosmetics intended for prolonged skin contact.

The absence of phase separation and the consistent drug content uniformity highlight the physical and chemical stability of the cream, which can be attributed to the appropriate emulsification of hydrophilic and lipophilic components using agents like beeswax and propylene glycol. The synergistic interaction between humectants (glycerin, propylene glycol), emollients (white soft paraffin), and stabilizers ensured a homogenous, smooth, and spreadable base that supports even distribution of active ingredients.

The antioxidant assay using the phosphomolybdate method revealed that both papaya latex and banana peel extract exhibited concentration-dependent antioxidant activities, with banana peel extract demonstrating slightly higher activity at all tested concentrations. This is consistent with previous literature suggesting banana peels are rich in bioactive phenolics like gallocatechin, dopamine, and epigallocatechin gallate (EGCG), which are potent free radical scavengers. In contrast, papaya latex is abundant in enzymatic antioxidants like papain and chymopapain, which have additional benefits such as proteolysis and skin regeneration. The combination of enzymatic and non-enzymatic antioxidants appears to enhance the overall oxidative defense mechanism of the formulation.

Interestingly, among the three formulations (F1, F2, and F3), the progressive increase in antioxidant concentration improved the measured antioxidant activity without compromising the cream's physical stability. This suggests that the bioactive compounds retained their functionality during the cream preparation process, even when subjected to thermal emulsification steps.

The observed antioxidant efficacy of the cream supports its potential application as a natural anti-aging and photoprotective cosmetic. This is particularly relevant in an era where synthetic antioxidants such as BHT and BHA are under scrutiny for their potential toxicological impacts. The integration of plant-derived compounds that provide both therapeutic and cosmetic benefits fits well within the growing cosmeceutical industry trend toward "green formulations."

From a formulation science perspective, the balance of oil and water phases, combined with the choice of non-irritant preservatives and stabilizers, contributes to product safety and consumer acceptability. Menthol inclusion added a mild cooling effect and further enhanced the sensory appeal, making the formulation more appealing for consumers seeking freshness and soothing effects in skincare products.

The lack of microbial instability or visible degradation, along with favorable viscosity and pH, indicates that the formulated cream could be suitable for longer-term storage under appropriate conditions. However, future studies should focus on accelerated stability testing and microbial preservation efficacy over a prolonged period.

Moreover, the successful extraction using hydroalcoholic maceration (75% ethanol) is noteworthy, as it ensured efficient solubilization of both polar and non-polar antioxidant constituents from banana peel. Similarly, the method of collecting and drying papaya latex at controlled temperatures preserved its enzymatic activity, which is crucial for its exfoliative and rejuvenating properties.

CONCLUSION

The formulation and assessment of a herbal antioxidant cream made from papaya latex and banana peel extract were the main objectives of the study. The goal was to use these plant sources' strong antioxidant capabilities to create a natural, efficient skincare product. While banana peel is recognized for its high level of vitamins, minerals, and phenolic compounds,

which contribute to its antioxidant action, papaya latex is rich in papain, an enzyme that has the ability to exfoliate and regenerate skin. In this work, these bioactive components were extracted using established procedures and then mixed into a cream baseformulating an antioxidant cream from banana peel and papaya latex has been carried out successfully, all parameters of formulation and evaluation. Through experimentation and analysis, the efficacy and feasibility of this antioxidant skincare product have been demonstrated. The comprehensive evaluation of various parameters has provided value into its potential benefits and applications in skincare. This research significance of exploring natural sources for skincare solutions and highlights the promising role of antioxidants in promoting skin health. Moving forward, the outcomes of this study lay a solid foundation for further development and optimization of antioxidant creams derived papaya latex and banana peel extract.

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