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Formulation Development and Evaluation of Herbal Toner of Red Bell Pepper, Carrot and Green Tea

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ABSTRACT: This study developed and tested herbal skin toners using Red Bell Pepper, Green Tea and Carrot each known for their skin-nourishing properties. The toners showed good antioxidant activity, skin compatibility, and user acceptance. All three were found to be effective, natural alternatives to synthetic skincare, offering moisturizing, soothing and protective benefits. Future research could explore combining these extracts for enhanced effects.

KEYWORDS: Toner, Red Bell Pepper, Carrot, Green Tea and Herbal, Skincare.

I. INTRODUCTION:

The skin is the largest organ of the human body, serving as a protective barrier against environmental aggressors, pathogens and physical damage. It plays a crucial role in thermoregulation, sensation, and immune response. The skin is composed of three primary layers: [1]

Epidermis – The outermost layer, primarily made up of keratinocytes, which provide structural integrity. It also contains melanocytes responsible for skin pigmentation and Langerhans cells involved in immune defence. The stratum corneum, the outermost part of the epidermis, consists of dead skin cells that act as a protective shield.

Dermis – The middle layer, rich in collagen, elastin fibres and connective tissues, providing skin strength, elasticity, and hydration. It contains blood vessels, sebaceous glands, sweat glands, and hair follicles that contribute to skin health.

Hypodermis (**SubcutaneousTissue**) – The innermost layer composed mainly of fat cells (**adiposetissue**) that serve as insulation and cushioning for the body. [1]

Toners are water-based skincare products, infused with essential nutrients for the skin. They help unclog the pores, deeply cleansing them of any residue like dirt, oil and grime left behind after cleansing. Toners also help maintain the skin's pH level, tighten the pores, and provide hydration. Many toners contain alcohol that can make your skin dry and cause problems for people with sensitive skin.

There are various kinds of toners, infused with a host of ingredients to cater to different skin issues. Broadly they can be classified as:[2]

Hydrating Toners

A boon for people with dry and dehydrated skin, hydrating toners moisturise, refresh, and rehydrate the skin, making it soft and plump.

Exfoliating Toners

These toners help exfoliate your skin, removing dead skin cells, unclogging the pores, and improving the skin texture. They are recommended for people with dull and uneven skin tone and those with acne-prone skin.

Balancing Toners

These toners help calm and soothe the skin, reducing redness and irritation and leaving it completely refreshed. They generally contain mild ingredients so they are best suited for people with sensitive or irritated skin.

Astringent Toners

These toners are best for controlling excess oil production and tightening open pores. They are ideal for people with oily and acne-prone skin but can be extremely drying so must be used with caution.

Where to incorporate a Face Toner in your Skincare routine?

Here's how you can add a toner to your daily skincare routine. It should be applied after

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cleansing and followed by a serum or a day/night cream.[3]
Step 1: Cleanser
Step 2: Toner
Step 3: Serum
Step 4: Moisturiser

Conventional Toner

Conventional toners often contain alcohol, fragrances, and preservatives that can strip the skin of its natural moisture. While they aim to cleanse and tighten pores, they may cause dryness, irritation, or breakouts—especially for sensitive skin. Modern skincare favors gentler, alcohol-free toners that hydrate and soothe without damaging the skin barrier.[4]

Side effects for Conventional Toner:[5]
Dryness – Alcohol-based toners can strip away natural oils.
Irritation – Fragrances, dyes, or strong ingredients may cause redness or stinging.
Breakouts – Harsh formulas can clog pores or trigger acne.
Allergic reactions – Some synthetic chemicals may cause itching, rashes, or swelling.
Increased sun sensitivity – Toners with exfoliating acids or alcohol can make skin more prone to sunburn.

II. MATERIALS USED:

1. Red Bell Pepper [6]
Biological Source: Macerate the fruitof **Capsicum annuum L.**
Scientific name: Capsicum annuum L
Synonym: Capsicum annuum var. acuminata, sweet pepper
Family: Solanaceae

Chemical Constituents: capsanthin, capsorubin, β-carotene, zeaxanthin and lutein.
Uses: Brighten skin, promote collagen production, and potentially reduce redness and inflammation.
Red Bell Pepper was procured from Market.

Figure 1: Red Bell Pepper

2. Carrot [7]
Biological Source: Macerate the fruit of**Daucus carota.**
Scientific name: Daucus carota.
Synonym: Carota, Carotte.
Family: Apiaceae.

Chemical Constituents: beta-carotene (a precursor to vitamin A), other carotenoids like lutein and zeaxanthin, and various vitamins like C and K
Uses: Brighten the complexion, hydrate the skin, and protect it from sun damage
Carrot was procured from Market.

Figure 2: Carrot

3. Green Tea [8]
Biological source: Dried Leaves of**Camellia sinensis**
Scientific Name: Camellia sinensis
Synonym: Herbal Tea, Green Tea
Family: Theaceae
Uses: Help combat acne, reduce redness, and soothe irritated skin Green Tea was procured from Unilever Lipton Green Tea Mumbai, Maharashtra.

Figure 3: Green Tea

4. Aloe Vera [9]
Biological Source: Dried latex from the leaves of **Aloe barbadensis miller**
Scientific Name: Aloe barbadensis miller
Synonym: Aloe, Aloe Vulgaris.

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Family: Liliaceae
Uses: Help calm irritated skin, reduce redness, and balance the skin's pHlevels, while also providing gentle exfoliation and refining pores.
Aloe vera was grown at our home.


Figure 4: Aloe Vera

5. Rice [10]
Biological Source: Grains of**Oryza sativa**
Scientific Name: Oryza sativa
Synonym: Lachkari Kolam, Wada Kolam.
Family: Poaceae
Uses: Hydrates skin, Minimizes pores, Balances pH**.**
Rice was procured from market.


Figure 5: Kolam Rice

6. Rose Water [11]
Biological Source: Steam distillation of petals of flower of **Rosa rubiginosa.**
Scientific Name: Rosa rubiginosa
Synonym: Damaskrose, French rose, Wild rose.
Family: Rosaceae
Uses: Natural Hydration, Soothing and Anti-inflammatory properties.
Rose Water was procured from Dabur Gulabari, Mumbai, Maharashtra.

Figure 6: Rose Water

7. Benzylalcohol [12]
Synonym: Phenylmethanol, Benzenemethanol.
Uses: Preservative, Viscosity Modifier, Solvent.
Benzyl Alcohol was procured from SD Fine Chemicals, Mumbai, Maharashtra.

8. Sodium Benzoate [13]
Synonym: Sodium salt of benzoic acid.
Uses: Preservative
Sodium Benzoate was procured from SD Fine Chemicals, Mumbai, Maharashtra.

III. METHOD OF PREPARATION:

Extraction of Rice Water [14]

Soak a 25gm of rice in 250 mL of distilled water overnight. The following day, filter the rice water using a muslin cloth to obtain a clear extract.

Extraction of Red Bell Pepper [15]

1. Cut fresh red bell peppers into small pieces.
2. Divide the chopped bell peppers into three portions:

Soak one portion in water.
Soak the second portion in alcohol.
Soak the third portion in a hydroalcoholic solution.

3. Allow all three mixtures to stand overnight to facilitate the extraction of Vitamin C, carotenoids, and phenolic compounds.
4. The next day, filter each extract using Whatman filter paper to obtain clear solutions.

Extraction from Carrot [16]

Fresh carrots were cut into small pieces and soaked separately in water, alcohol, and hydro alcoholic solutions to extract Vitamin C, carotenoids, and phenolic compounds. These mixtures were left to soak overnight. The following day, the extracts were filtered using Whatman filter paper to obtain a clear solution.

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Preparation of Green Tea Extract [17]

One green tea pouch was soaked overnight in 250 mL of distilled water at room temperature. The next day, the mixture was filtered to obtain a clear green tea extract.

Extraction of Aloe Vera Gel [18]

Harvest fresh aloe vera leaves and wash them thoroughly.

Carefully remove the outer skin to extract the inner gel.

Place the extracted gel into a mixer and blend until a uniform, thin paste is achieved.

Filter the blended gel using a muslin cloth to obtain a smooth aloe vera gel.

Formulation of the Herbal Toner [19]

In a clean mixing vessel, combine the following ingredients in the proportions specified in Formulation Table. Stir the mixture thoroughly until all components are uniformly blended.

Formulation Table:

Ingredients	Qty. Given			Uses
	F1	F2	F3	
Red Bell Pepper Extract	10 % w/v	0 % w/v	0 % w/v	Antioxidant, brightening
Carrot Extract	0 % w/v	10 % w/v	0 % w/v	Antioxidant, brightening
Green Tea Extract	0 pouches	0 pouches	4 pouches	Antioxidant, brightening
Aloe Vera Gel	5 % v/v	5 % v/v	5 % v/v	Hydration, soothing
Glycerine	1 % v/v	1 % v/v	1 % v/v	Humectant, moisturizing
Benzyl alcohol	2 % v/v	0 % v/v	0 % v/v	Preservative, antimicrobial
Sodium Benzoate	0 % w/v	0.1% w/v	0.1% w/v	Preservative, antimicrobial
Rose Water	10 % v/v	10 % v/v	10 % v/v	Cooling, toning
Rice Water	q.s.100 ml	q.s.100 ml	q.s.100 ml	Hydration, soothing

Formulation Table

IV. EVALUATION TEST:

1. Drying time:

The formulation was sprayed 2 times on a tile to check for calculation of time taken for the formulation to dry. Result: 55 sec.

2. Spray volume:

1 spray contains 0.180 ml.

3. Anti- Microbial Test:

Nutrient agar was transferred were sterilized at 121°c in autoclave about 15 min. The microbial strain was dispersed in medium and poured into the petri dish and allow to cool until it solidifies. Incubate the plates at 37°C for 24 hours.After incubation, count colony-forming units (CFU) manually or using a colony counter. Result: Bacteria: <100 CFU/ml

4. pH:

The formulation was tested with a pH paper and reading was matched with the pH meter scale.

Inference: pH was found to be 6

5. Anti- inflammatory Test:

1.Preparation of EA Solution: Separate yolk from egg white.Take 1.25 mL of egg albumin (EA) and dilute to 10 mL with distilled water 12.5% EA Solution (Solution A)

2. Reaction Mixtures to Prepare:All volumes measured using micropipettes:Control (C):2.8 mL PBS + 0.2 mL Solution A + 2 mL distilled water (DW)

1. Test (T)(with albumin & drug):2.8 mL PBS + 0.2 mL Solution A + 2 mL drug solution. Repeat for all concentrations (100–600 µg/mL). Order of addition must be followed.
2. Denaturation Control (D)(no albumin):2.8 mL PBS + 0.2 mL DW + 2 mL drug solution
3. Blank (B):2.8 mL PBS + 2.2 mL DW

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3. Incubation & Measurement
Incubate all tubes at 37°C for 25–30 mins. Heat in water bath at 70–80°C for 10–12 mins. Cool to room temperature. Observe turbidity. Measure absorbance at 600 nm using Blank as reference

4. Calculations:
% Inhibition =[$A_C - A_S / A_C$] * 100

A_C = Absorbance of Control
A_S = Absorbance of Sample

6. Stability testing:
The product was kept for 1 month

Accelerated studies:
Temperature: Store samples at **40°C ± 2°C**,
Relative Humidity: **75% RH ± 5%**.

4 Week Stability Studies		
Test	Room Temperature	Humidity chamber (40°C and 75%RH)
Quantity	25 ml	25 ml
pH	6	6
Microbial Test	<100 CFU/ml	<100 CFU/ml
Anti- inflammatory Test	Moderate activity	Moderate activity
Drying Time	55 sec	55 Sec
Leakage	0 %	0 %
Volume per spray	0.180 ml	0.180 ml

Table 1

7. CAM Assay (Irritancy test):

1. Select Eggs: Use clean, fertile White Leghorn eggs (≤7 days old, 50–60 g). Discard defective ones. Avoid shaking or damaging eggs.
2. Incubation: Still-air incubator: 38.3 ± 0.2°C, 58 ± 2% RH Forced-air incubator: 37.8 ± 0.3°C, 58 ± 2% RH Rotate eggs 5 times/day until day 8.
3. Day 8: Candle and discard nonviable eggs. Return viable ones upright (large end up) without rotating.
4. Day 9: Mark air cell and cut the egg shell with needle and forceps avoid damaging membrane, gently peel membrane with forceps.
5. Observe the reactions on the CAM over a period of 300 seconds. The time for the appearance of each of the noted endpoints should be monitored and recorded, in seconds. Endpoints that should be observed are:

a) Haemorrhage time (H) = observed start (in seconds) of haemorrhage reactions on CAM
b) Lysis time (L) = observed start (in seconds) of vessel lysis on CAM
c) Coagulation time (C) = observed start (in seconds) of coagulation formation on CAM.

Formula for Irritancy Score:

$$IS = \left(\frac{301 - Ht}{300}\right)5 + \left(\frac{301 - Lt}{300}\right)7 + \left(\frac{301 - Ct}{300}\right)9$$

Inference: The formulation showed no Irritancy as the score is0.07 for the Green Tea formulation.

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Figure 7 CAM Assay for Formulation of Green Tea

V. RESULT

Evaluation Test

Sr. No.	Tests	Inference
1.	Drying Time	55 sec
2.	Spray Angle	45°–60°
3.	pH	5-6
4.	Microbial Testing	<100 CFU/ml
5.	CAM Assay	No Irritancy (0.07)
6.	Anti- inflammatory testing	Moderate activity
7.	Stability Testing	Stable for 4 weeks

Table 2

Chemical Test

Sr. no.	Phytochemical Compound	Test	Inference
1.	Alkaloids	Mayer's Test	Cream-colored precipitate
2.	Flavonoids	Lead Acetate Test	Yellow precipitate
3.	Phenolics & Tannins	Ferric Chloride Test	Blue/Green colour
4.	Saponins	Foam Test	Stable froth formation
5.	Carotenoids	Carr-Price Test	Blue/blue-green colour
6.	Terpenoids	Salkowski's Test	Reddish-brown ring
7.	Reducing Sugars	Benedict's Test	Orange-red precipitate

Table 3

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VI. CONCLUSION:

The Green Tea toner formulation proved to be highly effective, utilizing fresh, affordable ingredients sourced from the local market. Designed to provide a cooling and toning effect, the toner successfully refreshed the skin without causing irritation or rashes, making it suitable for sensitive skin. Its spray form offered practical benefits, allowing for easy application and portability. The formulation showed a mild cleansing action and remained physico-chemically stable throughout the evaluation period, displaying characteristics comparable to conventional cosmeceutical skincare products. Compared to gel or lotion forms, the spray application was more efficient, enabling fine particles to penetrate skin pores more effectively and deliver active ingredients with greater precision.

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