Formulation and Evaluation of Poly Herbal Face Cream

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ABSTRACT

This study describes the formulation, physicochemical evaluation, and in vitro/in vivo testing plan for a topical herbal cream containing banana peel powder, papaya pulp and avocado oil intended to reduce facial fine lines and skin aging. A stable oil-in-water (O/W) emulsion is provided with 2 to 5% w/w banana peel powder and 1 to 3% w/w papaya pulp and 8 to 12% w/w avocado oil as the primary lipid phase. The evaluations include organoleptic properties, pH, viscosity, spreadability, percentage of cream consistency (centrifuged / accelerated), microbial limits, DPPH antioxidant dose, total phenol content, in vitro analysis of collagenase and elastase, and a short human skin test, followed by a small controlled clinical evaluation of instrumental skin aging images. The results will demonstrate whether the natural active ingredients provide measurable antioxidant and anti-wrinkle benefits while meeting safety and stability criteria.

1. INTRODUCTION

Skin aging is caused by both intrinsic and extrinsic factors, with oxidative stress and collagen degradation being the main contributors. Natural plant materials with antioxidant, proteolytic (exfoliating) and lipid properties are attractive for cosmetics. Banana skin contains polyphenols and flavonoids with antioxidant activity; Papaya contains papain (a proteolytic enzyme) and carotenoids useful for exfoliating and antiaging effects; Avocado oil is rich in polyunsaturated fatty acids and vitamins that promote hydration and skin barrier repair, all desirable for anti-wrinkle products. Previous studies have formulated creams based on banana and papaya peel extracts and have shown antioxidant/beneficial skin effects; avocado oil has also been used in anti-wrinkle topical formulations.

Fig.1.1 SKIN ANATOMY

2. MATERIALS

Activities: Dried banana (Musa spp.) Peel powder (60-80 mesh sieve), papaya (Carica papaya) pulp powder (freeze-dried or spray-dried), cold-pressed avocado oil (Persea americana).

Emulsifier / Oil phase: Emulsifier wax (eg Polawax or cetostearyl alcohol + polysorbate 60), glyceryl monostearate, stearic acid (if necessary).

Humectants is aqueous phase: Glycerin, propylene glycol (optional), distilled water, aloe vera gel (optional).

Preservatives: Phenoxyethanol ± ethylhexylglycerin or an acceptable paraben-free preservative system.

Co-emollients / stabilizers: caprylic / capric triglycerides (optional), tocopherol (vitamin E) as antioxidant.
pH adjusters: Triethanolamine (TEA) or citric acid (if needed).

Analytical reagents: Folin-Ciocalteu reagent, DPPH radical, methanol, standard (gallic acid), collagenase/elastase kits (for enzyme inhibition screening), microbial media.

BANANA PEEL POWDER

1. Banana peel powder is rich in antioxidants that protect the skin from damage.
2. It helps reduce wrinkles by fighting free radicals.
3. Vitamins A, C, and E in banana peel boost collagen production.
4. It naturally tightens the skin due to its tannin content.
5. The peel has moisturizing compounds that keep skin soft and hydrated.
6. It reduces inflammation and helps repair damaged skin.

Fig. 2.1 BANANA PEEL POWDER

PAPAYA PULP POWDER

1. Papaya pulp powder is rich in vitamin C and antioxidants, which slow down skin aging.
2. It contains the enzyme papain that removes dead cells and smoothens the skin.
3. It boosts collagen production, helping reduce fine lines and wrinkles.
4. Papaya keeps the skin hydrated, soft, and glowing.
5. It helps lighten dark spots and improves skin tone.

Fig.2.2 PAPAYA PULP POWDER

AVOCADO OIL

1. Avocado oil is rich in vitamin E, which protects skin from oxidative damage and slows aging.
2. It contains oleic acid that deeply moisturizes and improves skin elasticity.
3. The oil boosts collagen synthesis, helping reduce fine lines and wrinkles.
4. Its antioxidants (like carotenoids) prevent premature aging caused by UV and pollution.
5. Avocado oil has anti-inflammatory properties that soothe and repair skin.

Fig.2.3 AVOCADO OIL

3. PROTOTYPE FORMULATION (example % w/w - prepare a batch of 100 g)

This is a practical laboratory scale O/W cream formulation. Adjust as needed for texture. Oil phase (Phase A) - 21.5% avocado oil - 10.0%

Caprylic / capric triglycerides - 3.0% (optional moderate emollient) Glyceryl monostearate (and/or emulsifying wax) - 5.0% Stearic acid / cetostearyl alcohol - 1.0% Tocopherol (vitamin E) - 0.5%
Perfume (optional) - 0.2% Aqueous phase (Phase B) - 72.0% distilled water - 62.0%
Glycerin - 6.0%

Aloe vera juice/hydrosol - 2.0%

Banana peel powder (dispersed in glycerin or partly water) - 3.0% Papaya pulp chicken - 2.0%
Active / conservative phase (Phase C) - 6.5% Preservative (phenoxyethanol) - 1.0% Xanthan gum (0.2 to 0.5% as stabilizer) - 0.5%
pH adjuster, chelating agent (EDTA 0.05-0.1%) - 0.1%

% remaining at 100 - adjust with water/perfume Notes:
Banana/papaya powders can stain; pre-test different levels (1-5%) and particle sizes. Use certified food or cosmetic powders and perform microbial tests on raw powders.

If papain stability is critical, consider adding papaya powder freeze-dried at lower temperatures or use enzyme-free papaya extract depending on stability concerns.

4. METHOD OF PREPARATION (laboratory scale, 100 g)

Weigh the components of the oil phase (Phase A) and heat to 70-75 ° C in a water bath until homogeneity.

Weigh the aqueous phase (Phase B) and heat it to the same temperature (70-75°C). Pre-dissolve the piece of banana peel and papaya powder in glycerin or a small amount of hot water to reduce the formation.

Add the emulsifier: Slowly add the oil phase to the water phase under high shear mixing (propeller/stick mixture) while maintaining a temperature of 70-75°C. Mix for 10 to 15 minutes until a uniform emulsion is formed.

Cooled by stirring; at 40-45°C, add heat-sensitive ingredients: tocopherol, preservatives, perfume, EDTA. Add the powders (if not already added).

5. EVALUATION / CHARACTERIZATION (proposed tests and protocols)

5.1 Organoleptic and physical tests

Color, aroma, texture, homogeneity: Visual and tactile control.

pH: Measure using a calibrated pH meter (1% w/w dispersion in distilled water) - acceptable range 5.0 to 6.5.

Viscosity: Brookfield viscosity at 25°C; record shaft and rpm; connection with KP.

Spread: Glass plate method - weight required to separate two glasses from the sample; ratio in cm^2.

Centrifugation test: 3000 rpm for 30 min to filter phase separation.

Accelerated stability: Store samples at 4°C, 25°C, 40°C/75% RH and freeze-thaw cycles for 3 months; evaluate at 0, 1, 2, 3 months for phase separation, colour change, odour, pH and viscosity.

5.2 Microbiological tests

The total number of aerobic microbes, yeasts and molds and analysis of pathogens (S. aureus, P. aeruginosa, E. coli) according to the pharmacopoeia limits for topical products.

5.3 Chemical / bioactive tests

Total phenolic content (TPC): Folin-Ciocalteu test; are expressed in mg of gallic acid equivalents (GAE) per g.

DPPH radical scavenging test: prepare cream extracts (methanolic or ethanol extracts), perform DPPH and calculate % inhibition and IC50; compared to a standard antioxidant (eg, ascorbic acid).

Inhibition of collagenase and elastase (in vitro assay): Use commercial kits or standard spectrophotometric tests to assess the ability of extracts to inhibit enzymes associated with wrinkle formation.

Papain activity (if papaya powder should provide active papain): casein digestion test or specific papain activity test to confirm proteolytic activity and to verify stability after formulation.

5.4 Safety / Skin Compatibility

Patch test (Human Repeat Insult Patch Test or 48 hour closed patch) in 20 healthy volunteers - assess erythema/edema at 24, 48, 72 hours.
In vitro skin irritation (if available): tests on reconstituted human epidermis (RhE).

5.5 Anti-wrinkle clinical/instrumental evaluation (if a small clinical trial is conducted)

Study design: Randomized, double-blind, placebo-controlled pilot study, N = 20-40 (split-face or parallel groups), duration 8-12 weeks.

End points: instrumental imaging of skin roughness/wrinkles (Visioscan or PRIMOS), skin elasticity (Cutometer), hydration (Corneometer), standardized clinical photographs and dermatologic scoring.

Statistical analysis: paired t test or ANOVA as appropriate, $p < 0.05$ considered significant.

6. DATA PROCESSING AND EXPECTED RESULTS

Antioxidant Dose: Expect measurable DPPH and moderate TPC removal from contributions from banana peel and papaya; Avocado oil provides lipophilic antioxidant vitamins (E). Compare the formulation extract with the virgin cream and the standards.
Asian Journal of Pharmacy
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Enzyme inhibition: Papain can exert a slight proteolytic/exfoliating activity; caution if irritation occurs. The antiaging potential of papain has been discussed in the literature. Pharmacognosy reviews.

Clinical criteria: improve skin hydration and elasticity measurable with Cutometer; a reduction in the depth of wrinkles and skin roughness over a period of 8 to 12 weeks is the expected result of the course if the active ingredients are bioavailable in the formulation. Previous studies that have combined avocado oil with antioxidant extracts have shown positive results.

7. STABILITY AND FORMULATION CONSIDERATIONS

Papain / proteolytic enzymes can be unstable at high temperatures and in the presence of some preservatives: check the enzyme activity after formulation and during the conservation test. Consider encapsulation (eg, liposomes or microencapsulation) if enzyme stability is required.

Banana and papaya powders can darken (polyphenoloxidase activity) - they contain antioxidants (vitamin E) and chelators (EDTA) and control pH. Asian Journal of Pharmaceutics.

Microbial risk: ensure that raw plant powders are low microbial load or gamma/heat treated; test the effectiveness of the preservative (challenge test).

8. DISCUSSION (how to interpret the results and the context of the literature)

Banana peel and papaya provide complementary actions: moisturizing antioxidants/polysaccharides (banana peel) and gentle proteolytic exfoliation (papain) from papaya; Avocado oil restores lipids and provides fat-soluble vitamins. These combined mechanisms attack the main pathways of aging: oxidative damage, loss of lipids, decreased collagen integrity, and accumulation of dead corneocytes. Recent formulations using banana peel and papaya in antioxidant creams have shown promising physicochemical and antioxidant results; Avocado oil has been used successfully in anti-wrinkle creams.

9. CONCLUSION

A herbal O/W cream containing banana peel powder (≈1–3%), papaya pulp pulp (≈1–2%) and avocado oil (≈8–12%) is a potential cosmetic formulation for anti-wrinkle/anti-aging applications. Appropriate formulation controls (enzyme stability, microbial safety, color/oxidation control) and comprehensive evaluation (physicochemical, antioxidant, enzyme activity, safety and instrumental clinical testing) are needed to establish efficacy and safety.

10. REFERENCES (selected)

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