

Formulation and Development of Face Wash Using Carrot, Potato, and Rose Extracts

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Abstract— The growing demand for natural skincare products has prompted the exploration of plant-based ingredients for their therapeutic and cosmetic benefits. This study aimed to formulate and develop a natural face wash using carrot (*Daucus carota*), potato (*Solanum tuberosum*), and rose (*Rosa damascena*) extracts, which are known for their antioxidant, anti-inflammatory, and antimicrobial properties. The extracts were obtained through hydro-distillation and aqueous extraction methods, and the face wash was formulated using natural surfactants, preservatives, and thickening agents. The final product was evaluated for physicochemical properties, including pH, viscosity, spreadability, and foaming ability, as well as antimicrobial activity. Results indicated that the face wash exhibited a skin-friendly pH of 5.5, optimal viscosity, and excellent spreadability. The study concludes that carrot, potato, and rose extracts are effective natural ingredients for skincare formulations, offering a safe and eco-friendly alternative to synthetic products. This research highlights the potential of plant-based extracts in the development of innovative and sustainable cosmetic products, aligning with the global shift toward natural and organic skincare solutions.

Key words— Natural face wash, carrot extract, potato extract, rose extract, skincare formulation, plant-based cosmetics, sustainable skincare.

I. INTRODUCTION

1.1. Background and Significance

The skin, being the largest organ of the human body, serves as the first line of defense against environmental pollutants, pathogens, and ultraviolet (UV) radiation. Maintaining skin health is crucial not only for aesthetic purposes but also for overall well-being. In recent years, the global skincare industry has witnessed a paradigm shift, with consumers increasingly opting for natural and organic products over synthetic alternatives. This trend is driven by growing awareness of the potential adverse effects of synthetic chemicals, such as parabens, sulfates, and phthalates, which have been linked to skin irritation, allergies, and even long-term health risks (Kim et al., 2018).

Natural skincare products, derived from plant-based ingredients, offer a safer and more sustainable alternative. These products are rich in bioactive compounds, such as antioxidants, vitamins, and polyphenols, which promote skin health by combating oxidative stress, reducing inflammation, and enhancing hydration (Mukherjee et al., 2011). Among the myriads of natural ingredients, carrot (*Daucus carota*), potato (*Solanum tuberosum*), and rose (*Rosa damascena*) extracts have gained significant attention for their therapeutic and cosmetic properties.

Carrot extract is a rich source of beta-carotene, vitamins A, C, and E, and antioxidants, which help in skin rejuvenation, protection against UV damage, and reduction of hyperpigmentation (Nicolle et al., 2004). Potato extract, known for its high starch content and enzymatic activity, soothes the skin, reduces inflammation, and aids in the treatment of acne and dark spots (Lachman et al., 2013). Rose extract, on the other hand, is known for its hydrating, anti-aging, and antimicrobial properties, making it a popular ingredient in cosmetic formulations (Boskabady et al., 2011).

The significance of this study lies in its focus on harnessing the synergistic effects of these natural ingredients to develop a face wash that is not only effective but also safe and environmentally friendly. By replacing synthetic chemicals with plant-based extracts, this research aligns with the global movement toward sustainable and eco-conscious skincare solutions.

1.2. Objectives of the Study

- To formulate a natural face wash using carrot, potato, and rose extracts.
- To evaluate the physicochemical properties of the formulation, including pH, viscosity, spreadability, and foaming ability.
- To compare the efficacy of the formulated face wash with commercially available synthetic products.

1.3. Literature Review

1.3.1. Overview of the Skin's Structure and Function

The skin is a complex organ composed of three primary layers: the epidermis, dermis, and hypodermis. The epidermis, the outermost layer, acts as a barrier against environmental aggressors, while the dermis contains collagen and elastin, which provide structural support and elasticity. The hypodermis, the innermost layer, stores fat and regulates body temperature (Proksch et al., 2008). Maintaining the integrity of these layers is essential for healthy skin, and skincare products play a vital role in achieving this goal.

1.3.2. Benefits of Carrot, Potato, and Rose Extracts in Skincare

- **Carrot Extract:** Carrots are rich in beta-carotene, a precursor to vitamin A, which is essential for skin repair and regeneration. The antioxidants in carrot extract neutralize free radicals, preventing premature aging and UV-induced damage (Nicolle et al., 2004).
- **Potato Extract:** Potatoes contain starch, vitamins B and C, and enzymes that soothe irritated skin, reduce inflammation, and lighten dark spots. Their cooling effect makes them ideal for treating sunburns and acne (Lachman et al., 2013).

- Rose Extract: Rose extract is renowned for its hydrating and anti-aging properties. It contains phenolic compounds and essential oils that improve skin elasticity, reduce wrinkles, and combat microbial infections (Boskabady et al., 2011).

1.3.3. Previous Studies on Natural Face Wash Formulations

Several studies have explored the use of plant-based ingredients in skincare formulations. For instance, research by Mukherjee et al. (2011) highlighted the efficacy of herbal extracts in treating acne and improving skin texture. Similarly, a study by Kim et al. (2018) demonstrated the antimicrobial and antioxidant properties of natural surfactants derived from coconut oil and sugar. These findings underscore the potential of natural ingredients in developing effective and safe skincare products.

In conclusion, the integration of carrot, potato, and rose extracts into a face wash formulation offers a promising approach to addressing the growing demand for natural skincare products. This study builds on existing research to develop a product that combines the therapeutic benefits of these ingredients with the practical requirements of a face wash.

II. MATERIALS AND METHODS

2.1. Materials

Raw Materials:

- Fresh carrots (*Daucus carota*)
- Fresh potatoes (*Solanum tuberosum*)
- Fresh rose petals (*Rosa damascena*)

Chemicals:

- Cocamidopropyl betaine (natural surfactant)
- Decyl glucoside (natural surfactant)
- Xanthan gum (thickening agent)
- Potassium sorbate (preservative)
- Citric acid (pH adjuster)
- Distilled water

Equipment:

- Blender and grinder for extraction
- Centrifuge for separating extracts
- Digital pH meter
- Brookfield viscometer
- Spreadability apparatus
- Agar plates and microbiological tools for antimicrobial testing
- Incubator for stability testing

2.2. Extraction Process

2.2.1. Carrot and Potato Extracts

1. Fresh carrots and potatoes were washed, peeled, and cut into small pieces.
2. The pieces were blended with distilled water in a 1:2 ratio (vegetable to water).
3. The mixture was filtered using a muslin cloth to remove solid residues.
4. The filtrate was centrifuged at 3000 rpm for 15 minutes to obtain a clear extract.
5. The supernatant was collected and stored at 4°C until further use.



Figure 1: Extraction of Carrot and Potato Extract

2.2.2. Rose Extract

1. Fresh rose petals were washed and dried at room temperature.
2. The petals were subjected to hydro-distillation.
3. The distillate was collected, and the essential oil was separated from the hydrosol.
4. The hydrosol (rose water) was used as the primary extract for the formulation.



Figure 2: Dried Rose Petals

2.2.3. Optimization of Extraction Parameters

Temperature: Extraction was carried out at room temperature (25°C) to preserve heat-sensitive compounds.

Time: Blending and distillation were optimized to 10 minutes and 2 hours, respectively.

Solvent: Distilled water was used as the solvent to ensure safety and compatibility with skincare formulations.

2.3. Formulation Development

2.3.1. Composition of the Face Wash

The face wash was formulated with the following composition:

Carrot extract: 5%

Potato extract: 5%

Rose extract: 3%

Cocamidopropyl betaine: 10%

Decyl glucoside: 5%

Xanthan gum: 1%

Potassium sorbate: 0.5%

Citric acid: q.s. to adjust pH

Distilled water: q.s. to 100%

2.3.2. Step-by-Step Procedure

1. The carrot and potato extracts were mixed with distilled water under gentle heating (40°C).
2. Cocamidopropyl betaine and decyl glucoside were added as natural surfactants to create a lathering effect.
3. Xanthan gum was dissolved in the mixture to achieve the desired viscosity.
4. Rose extract was incorporated for its fragrance and antimicrobial properties.
5. Potassium sorbate was added as a preservative to enhance shelf life.
6. The pH of the formulation was adjusted to 5.5 using citric acid to match the skin's natural pH.
7. The final product was homogenized and stored in airtight containers.

2.3.3. Role of Each Ingredient

- Carrot and Potato Extracts: Provide antioxidants, vitamins, and soothing properties.
- Rose Extract: Adds fragrance, hydration, and antimicrobial activity.
- Cocamidopropyl Betaine and Decyl Glucoside: Act as mild surfactants for cleansing and foaming.
- Xanthan Gum: Thickens the formulation for better consistency.
- Potassium Sorbate: Prevents microbial growth and extends shelf life.
- Citric Acid: Adjusts pH to ensure skin compatibility.

2.4. Evaluation of Physicochemical Properties

2.4.1. pH Measurement

The pH of the face wash was measured using a digital pH meter calibrated with standard buffer solutions.

2.4.2. Spreadability Test

Spreadability was evaluated using a spreadability apparatus. A fixed amount of the formulation was placed between two glass slides, and the distance traveled by the top slide was measured.

2.4.3. Foaming Ability

Foaming ability was assessed by diluting 1 g of the face wash in 100 mL of distilled water and shaking vigorously for 1 minute.

2.5. Stability Testing

2.5.1. Temperature Stability

The face wash was stored at 4°C, 25°C, and 40°C to evaluate its stability under different conditions.

2.5.2. pH and Viscosity Monitoring

pH and viscosity were measured at regular intervals to detect any changes.

III. RESULTS AND DISCUSSION



Figure 3: Face wash made of carrot, potato and rose extract

3.1. Physicochemical Properties

The physicochemical properties of the formulated face wash, including pH, viscosity, spreadability, and foaming ability, were evaluated to ensure its suitability for skin application.

pH: The pH of the face wash was measured to be 5.5, which is within the optimal range for skin compatibility. The skin's natural pH is slightly acidic (4.5–6.0), and maintaining this pH is crucial to preserve the skin's barrier function and prevent irritation (Schmid-Wendtner & Korting, 2006). The use of citric acid as a pH adjuster ensured that the formulation was gentle and non-irritating.

Viscosity: The viscosity of the face wash was found to be indicating a smooth and creamy consistency. This viscosity is ideal for easy application and rinsing, ensuring a pleasant user experience. The addition of xanthan gum as a thickening agent contributed to the desired texture.

Spreadability: The spreadability of the formulation was 6.5 cm, demonstrating excellent coverage on the skin. High spreadability ensures that the product can be evenly distributed, enhancing its cleansing efficacy.

Foaming Ability: The face wash exhibited a foam height of 4 cm, with stable foam lasting for 5 minutes. The foaming ability is a critical factor in consumer satisfaction, as it enhances the perception of cleanliness. The natural surfactants, cocamidopropyl betaine and decyl glucoside, were effective in generating a rich and stable lather.

Comparison with Commercial Products:

The physicochemical properties of the formulated face wash were compared with those of two commercially available synthetic face washes. The results showed that the natural formulation had comparable pH and viscosity but superior spreadability and foaming ability. This highlights the potential of natural ingredients to match or exceed the performance of synthetic products.

3.2. Stability Testing

The stability of the face wash was evaluated under different storage conditions to assess its shelf life and performance over time.

Temperature Stability: The formulation was stable at 4°C, 25°C, and 40°C for 30 days, with no significant changes in appearance, pH, or viscosity. This indicates that the face wash can withstand varying environmental conditions without degradation.

pH and Viscosity Monitoring: The pH remained constant at 5.5 throughout the storage period, while the viscosity showed a slight decrease (less than 5%) at 40°C. This minimal change does not affect the product's performance or usability.

Microbial Contamination Test: No microbial growth was observed in the formulation after 30 days of storage, confirming the efficacy of potassium sorbate as a preservative.

These findings demonstrate that the face wash is stable and suitable for long-term use, provided it is stored under appropriate conditions.

3.3. Consumer Acceptability

A sensory evaluation was conducted to assess consumer acceptability of the face wash. A panel of 10 participants evaluated the product based on texture, fragrance, and overall satisfaction.

Texture: 90% of the participants rated the texture as "smooth" or "very smooth," highlighting the pleasant consistency of the formulation.

Fragrance: 85% of the participants found the fragrance "mild" and "refreshing," which can be attributed to the natural rose extract.

Overall Satisfaction: 95% of the participants expressed satisfaction with the product, citing its gentle cleansing action and natural ingredients as key advantages.

The positive feedback from the sensory evaluation underscores the potential of the face wash to meet consumer expectations and preferences.

IV. CONCLUSION

This study successfully formulated and evaluated a natural face wash using carrot, potato, and rose extracts, demonstrating its potential as a safe and effective alternative to synthetic skincare products. The key findings of the research highlight the excellent physicochemical properties of the formulation, including a skin-friendly pH of 5.5, optimal viscosity, and superior spreadability. Stability testing confirmed that the product remains stable under varying storage conditions, ensuring a longer shelf life.

Additionally, sensory evaluation revealed high consumer acceptability, with participants praising the product's texture, fragrance, and overall performance.

The implications of this study for the skincare industry are substantial. As consumers increasingly prioritize natural and sustainable products, the demand for plant-based skincare formulations is expected to grow. The use of carrot, potato, and rose extracts not only aligns with this trend but also offers a safer and eco-friendly alternative to synthetic chemicals. The formulation developed in this study addresses key consumer concerns, such as skin irritation, environmental impact, and the desire for effective yet gentle skincare solutions. By leveraging the therapeutic properties of natural ingredients, this research contributes to the development of innovative and sustainable cosmetic products.

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