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Formulation and Evaluation of Papaya Face Pack

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Abstract

Papaya is a tropical fruit known for its sweet taste, vibrant orange colour, and numerous skin and health benefits. Among various botanicals, papaya is rich in vitamins A, C, and E, fiber, and antioxidants. The biological source of papaya is *Carica papaya*. It belongs to the family Caricaceae. Papaya is known by its different names in various parts of the world, like papeeta (Hindi), parangi (Kannada), and papai (Telugu). It is rich in bioactive compounds like papain, chymopapain, carotenoids, vitamins A, C, and E, minerals, and flavonoids that are beneficial for skin health. Papaya's natural skin benefits include exfoliation, skin renewal, hydration, moisturization, hyperpigmentation, skin brightening, acne control, oil regulation, anti-aging, soothing, healing, reduce blemishes, and achieving an even skin tone. Apart from the fruit, the seeds offer several skin benefits due to their rich content of antioxidants, essential fatty acids, enzymes (papain), and antibacterial compounds. Looking at the various skin benefits of papaya prompted us to formulate a cosmeceutical face pack using ripe papaya fruit, papaya seeds, Multani mitti (fuller's earth), neem, rice, and turmeric. Apart from the papaya fruit and the seeds, other ingredients also offer numerous benefits to the skin. Regularly using natural face pack can improve skin texture, reduce blemishes, and enhance glow, as they are chemical-free and provide gentle care for all skin types. The main objective of this work is to formulate a cosmeceutical face pack incorporating papaya with other natural ingredients and evaluate its chemical, physicochemical, and microbiological properties. This face pack will naturally enhance skin health by influencing the natural benefits of papaya and its bioactive compounds.

Keywords: Antioxidant, Anti-aging, Cosmeceutical, Face pack, Multani mitti, Papaya, Skin, Turmeric.

INTRODUCTION

The history of cosmetics dates back to ancient civilizations, where beauty rituals were closely linked to cultural traditions, religious beliefs, and social hierarchy. Around 4000 BCE, the Egyptians used kohl to define the eyes, red ochre to color the lips and cheeks, and aromatic oils to nourish the skin, attributing both protective and aesthetic value to these practices. The Greeks and Romans later adopted their own cosmetic techniques, using lead-based face powders, fragrant perfumes, and various forms of makeup to enhance their appearance.

By the 20th century, cosmetics had evolved into a rapidly expanding global industry, with brands such as Max Factor and Revlon pioneering safer formulations, improved standards, and large-scale production. In the modern era, the beauty sector emphasises sustainability, the use of natural and organic ingredients, and the integration of biotechnology to develop advanced skincare solutions[1].

Cosmetics are products designed for cleansing, beautifying, enhancing attractiveness, or altering one's appearance. The term "cosmetic" originates from the Greek word "*Kosmetikos*," meaning skilled in adornment or decoration. Various herbal ingredients have traditionally been used to cleanse and enhance the appearance of the skin. However, environmental factors significantly affect skin health. During summer, excessive heat can lead to skin dehydration, resulting in wrinkles, freckles, blemishes, pigmentation, and sunburn. In contrast, harsh winter conditions may cause cracks, cuts, wounds, and infections, further compromising the skin's integrity[2].

Human faces and skin are primary sources of personal information; each processed in distinct ways. Every face is unique and serves as the most vital feature for identifying individuals. Faces present a diverse array of visual cues that activate various perceptual and cognitive processes. Examining a face involves evaluating its features, expressions, symmetry, and emotions to extract insights about identity, beauty, health, or psychological states. This analysis helps to interpret identity, attractiveness, health condition, and emotional status. Understanding how the brain processes facial information is essential in fields like psychology, neuroscience, and artificial intelligence, where face recognition is essential. Facial skin condition, including texture, tone, and health, influences perceptions of beauty, ageing, and overall well-being[3].

Skin texture is an essential component of dermatology and cosmetic science, influencing both aesthetic appearance and overall skin health. It encompasses the skin's surface qualities, such as smoothness, roughness, pore visibility, fine lines or wrinkles, and moisture levels. These characteristics serve as important indicators of skin condition and ageing. While smooth, even skin is associated with youthfulness, a coarse or irregular texture may reflect underlying issues such as elastosis, a deterioration of the skin's elastic fibers. Several factors contribute to changes in skin texture, including ageing, sun exposure, and general skin health. With advancing age, collagen and elastin gradually break down, resulting in increased roughness and the formation of wrinkles. Excessive sun exposure accelerates this degradation, leading to photodamage that presents an uneven texture. Evaluating the skin texture plays a vital role in dermatology and cosmetic science, aiding in the diagnosis of skin disorders and in assessing the efficacy of treatments designed to enhance skin appearance[4].

In Ayurveda, the herbal facial paste known as *mukha lepa* is widely used as a traditional therapy. This preparation, commonly referred to as a face pack, is applied to the skin to help manage acne, pimples, scars, blemishes, and pigmentation. Herbal face packs are generally applied as liquids or pastes and allowed to dry on the skin, creating a tightening and cleansing effect. They are usually left on the face for ten to twenty-five minutes, allowing the moisture to evaporate. As the paste dries, it forms a thin film that contracts and solidifies, making it easy to remove.

The gentle warmth and tightening sensation produced during application contribute to a feeling of rejuvenation. Colloidal and adsorptive clays often incorporated in these formulations help to draw out dirt, grease, and impurities from the skin. When the dried pack is removed, accumulated debris and dead skin cells are lifted away. A small amount of room-temperature water is recommended to moisten the pack before removal. Afterward, gently rubbing an ice cube over the skin helps tighten the pores and improve skin firmness.

Face packs may include various additives that enhance the therapeutic benefits of the herbal ingredients. Care should be taken to avoid applying them near the delicate eye area, as the skin there is thin and may be damaged during the removal process. Different types of herbal face packs are formulated to suit different skin types and conditions. Regular use can help reduce wrinkles, acne, pimples, and dark circles, while also improving skin smoothness and overall complexion[5].

Face packs are available in various types and forms and are broadly classified into the following categories:

1. Plastic masks: Wax-based, latex-based, or vinyl-based
2. Hydrocolloid masks: Gel masks (ready to use)
3. Argillaceous masks: Clay-based or earth-based (ready to use or dry powder)[6].

Papaya is the ripe fruit of *Carica papaya*, a species belonging to the Caricaceae family. It contains several bioactive compounds, including saponins, tannins, flavonoids, glycosides, alkaloids, and the enzyme papain. Papain functions as a natural exfoliant, aiding in the removal of dead skin cells, improving skin texture, soothing damaged skin, and providing relief from sunburn. The flavonoids present in papaya powder promote collagen synthesis, contributing to a firmer, more supple, and smoother skin tone. Papaya is also rich in vitamins A, C, and E, which help protect, nourish, and rejuvenate the skin. Its antioxidants—particularly vitamins A and C—support collagen formation and help diminish the appearance of fine lines and wrinkles. Additionally, the nutrients in papaya assist in tightening the skin and enhancing its softness. The fruit's anti-inflammatory properties further help reduce redness and swelling associated with acne[7]. Papaya seeds also contain a diverse range of bioactive constituents that contribute to their therapeutic and nutritional value. They are rich in fatty acids, crude protein, and crude fibre, and also contain papaya oil. Several notable phytochemicals are present, including sinigrin, carpaine, benzyl isothiocyanate, benzyl glucosinolate, and benzyl thiourea. Additionally, papaya seeds possess compounds such as hentriacontane, sitosterol, and caricain. The enzyme myrosin, along with various alkaloids, flavonoids, saponins, and tannins, further enhances the medicinal properties of papaya seeds[8].

Fuller's earth, commonly known as multani mitti, derives its name from the historic city in Pakistan where this mineral-rich clay was first recognised for its remarkable skincare benefits. It consists of hydrated aluminum silicate and contains significant amounts of magnesium chloride and calcium bentonite. Highly valued for its excellent oil-absorbing and deep-cleansing properties. Multani mitti provides several benefits for the skin. It helps to unclog pores and reduce their appearance, removes dead skin cells and blackheads, lightens white spots, soothes sunburn, enhances blood circulation, and improves overall skin tone. Magnesium chloride helps to reduce acne and blemishes, leaving the skin clearer, smoother, and naturally radiant. It continues to be a popular component in facial packs and traditional beauty remedies for its ability to cleanse and rejuvenate the skin[7,10].

Turmeric is the dried rhizome of *Curcuma longa*, a plant belonging to the Zingiberaceae family. It contains a variety of bioactive compounds, including curcuminoids such as curcumin, demethoxycurcumin, and bisdemethoxycurcumin, along with volatile oils like zingiberene, α-turmerone, β-turmerone, and atlantone. Turmeric also provides proteins, resins, sugars, fiber, and a high proportion of starch (40–60%), which acts as both an energy source and a natural thickening agent. Additionally, it is rich in essential minerals such as iron, potassium, calcium, and magnesium. Owing to these constituents, turmeric offers numerous therapeutic and cosmetic benefits. It purifies the blood and improves skin conditions associated with impurities, while its antimicrobial properties support wound healing. It also helps to reduce inflammation, allergies, and excess oil production, making it beneficial for managing acne. Its antioxidant activity slows the appearance of wrinkles and other signs of aging. Traditionally used as a natural bath powder, turmeric brightens the complexion, helps reduce pigmentation and skin damage, and even assists in the gentle removal of unwanted facial hair.

Rice flour and rice water are widely used in traditional skincare practices, with Ayurvedic practitioners in the Indian subcontinent often recommending uncooked rice water for soothing irritated skin. Both ingredients are valued for their ability to brighten, exfoliate, and cleanse the skin. Rice flour, in particular, is a common component of herbal face packs due to its fine texture, which acts as a gentle exfoliant to remove dead skin cells and promote smoothness. Rich in vitamin B and antioxidants, it helps to even out skin tone and brighten dull complexions. Its natural oil-absorbing properties make it especially beneficial for oily and acne-prone skin. Additionally, the antioxidants in rice flour support collagen production, help to reduce the appearance of fine lines and wrinkles. With its calming and cooling effects, rice flour is also well-suited for sensitive or irritated skin[7].

Neem consists of the leaves and other aerial parts of *Azadirachta indica*, a plant belonging to the Meliaceae family. It contains several important bioactive compounds, including nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, and gedunin. These constituents contribute to neem's wide range of skincare benefits. Neem's strong antibacterial properties help combat acne-causing bacteria, while its ability to regulate oil production makes it particularly useful for oily skin by preventing clogged pores. Its anti-inflammatory effects help reduce swelling, redness, and irritation associated with conditions such as acne and eczema. Additionally, neem's antifungal and antibacterial actions protect the skin from infections. Rich in antioxidants, it also supports anti-aging by reducing the appearance of fine lines and dark spots. Regular use of neem powder helps cleanse and detoxify the skin, promoting a brighter and more radiant complexion.

MATERIAL AND METHODS

Plant Material Collection and Authentication

Herbal ingredients mentioned in the formula were procured from the local market and were authenticated by the botanist at Central Ayurveda Research Institute, Bengaluru. The voucher specimen (RRCBI-mus649/439/19476) was preserved for future reference.

Preparation of Papaya face pack

Herbal ingredients mentioned in the formula (Table 1) were cleaned and dried properly. They were separately powdered and sieved through #80. Each powder was weighed independently and mixed. As some of the drugs contained more fibrous matter than others, the formula recommended powdering and weighing each fibrous matter individually before mixing. Ripe papaya, as mentioned in the formula, was separately peeled, dried, powdered and mixed with the other ingredients. The powdered mixture should not adhere together or become moist. The finer the powder, the better its therapeutic value.

Table 1: Formula for preparing a Papaya face pack

Sl. No.	Ingredients	Quantity taken (for 30gms)
1	Papaya powder	8gms
2	Papaya seed powder	3gms
3	Neem leaf powder	3gms
4	Rice water powder	6gms
5	Turmeric powder	4.5gms
6	Multani mitti	5.5gms
	TOTAL	30gms

Figure 1: Papaya face pack

Determination of Organoleptic Evaluation

The color, and odor of powder were evaluated using the sensory organs of our body, and the results are summarized in Table 2.

Determination of Physical parameters[9]

1. Bulk Density:

It is the ratio of the given mass of powder and its bulk volume. It is determined by transferring an accurately weighed amount of powder sample to the graduated cylinder with the aid of a funnel. The initial volume was noted. The ratio of the weight of the volume it occupied was calculated.

$$\text{Bulk density} = W_1 / W_2$$

Where, W_1 is the mass of the powder, W_2 is the untapped volume

2. Tapped Density:

It is measured by transferring a known quantity (30 gm) of powder into a graduated cylinder and tapping it for a specific number of times. The initial volume was noted. The graduated cylinder was tapped continuously for 10-

15 minutes. The density can be determined as the ratio of the mass of the powder to the tapped volume.

$$\text{Tapped density} = W_1 / W_2$$

Where, W_1 is the mass of the powder, W_2 is the tapped volume

3. Hausner's Ratio:

It indicates the flow properties of the powder. The ratio of tapped density to the bulk density of the powder is called Hausner's ratio.

$$\text{Hausner's ratio} = \text{Tap density}/\text{bulk density}$$

4. Compressibility Index / Carr Index:

It is the propensity of the powder to be compressed. Based on the apparent bulk density and tapped density the percentage compressibility of the powder can be determined using the following formula.

$$\text{Compressibility Index} = [(\text{tapped density} - \text{bulk density}) / \text{tapped density}] \times 100$$

5. Angle of Repose:

The internal angle between the surface of the pile of powder and the horizontal surface is known as the angle of repose. The powder is passed through a funnel fixed to a burette at a height of 4 cm. A graph paper is placed below the funnel on the table. The height and the radius of the pile were measured. The angle of repose of the powder was calculated using the formula

$$\text{Angle of repose} = \tan^{-1}(h/r)$$

Where, h = height of the pile, r = radius of the pile

Determination of Physicochemical parameter[10]

1. Determination of pH Value:

1 gm of the formulated face pack powder was weighed and added to 100 ml of distilled water in a beaker. It was stirred well and left to stand for 30 minutes. This solution was filtered using a muslin cloth to get a clear extract. Using a pH meter (Eutech pH-Meter Model – OAKTON-4, S/N 2492141) calibrated with standard buffer solutions (pH 4, 7, 9). Then dipped the pH meter into the filtered powder extract. The reading was stabilised, and pH was recorded.

2. Determination of Ash Values: Used to determine the quality and purity of a crude drug.

Total Ash: Approximately 2 gm of formulated face pack powder was accurately weighed into a tarred silica crucible and placed in a muffle furnace at a temperature not exceeding 450°C until it was free from carbon. Then it was cooled and weighed. The percentage of total ash was calculated with reference to the air-dried drug.

$$\%\ \text{Total Ash value} = [\text{Weight of total ash} / \text{air-dried drug}] \times 100$$

Acid-insoluble ash: The total ash obtained was boiled for 5 minutes with 25 ml of dilute hydrochloric acid; the insoluble matter obtained was collected on an ashless filter paper, washed with hot water until the filtrate was neutral, and ignited to constant weight. The percentage of acid-insoluble ash was calculated with reference to the air-dried drug.

$$\%\ \text{Acid insoluble ash value} = [\text{Weight of acid insoluble ash} / \text{air dried drug}] \times 100$$

Water-soluble ash: The ash obtained in the determination of total ash was boiled for 5 minutes with 25 ml of water. The insoluble matter was collected on an ashless filter paper and washed with hot water. The insoluble ash was transferred into a tarred silica crucible and ignited for 15 minutes at a temperature not exceeding 450°C. The weight of the insoluble matter was subtracted from the weight of the total ash. The difference in weight was considered as the water-soluble ash was calculated with reference to the air-dried drug.

$$\%\ \text{Water-soluble ash value} = [\text{Weight of water-soluble ash} / \text{air-dried drug}] \times 100$$

3. Determination of Extractive Value: Used for the estimation of specific constituents, soluble in the particular solvent used for extraction.

Water-soluble Extractive Value: 1 gm of formulated face pack powder was weighed and macerated with 25 ml of distilled water in a closed flask for 24 hours, shaken frequently for 6 hours, and allowed to stand for 18 hours. It was filtered rapidly, taking precautions against the loss of solvent. The filtrate was taken and evaporated to dryness in a tarred flat-bottomed shallow dish at 105°C to constant weight, and the percentage of water-soluble extractive value was calculated with reference to the air-dried sample.

$$\%\ \text{Water-soluble extractive value} = [\text{water-soluble residue} / \text{air-dried drug}] \times 100$$

Alcohol-soluble Extractive value: 1 gm of formulated face pack powder was weighed and macerated with 100 ml of alcohol of specified strength in a closed flask for 24 hours, shaken frequently for 6 hours, and allowed to stand for 18 hours. It was filtered rapidly, taking precautions against the loss of solvent. The filtrate was taken and evaporated to dryness in a tarred flat-bottomed shallow dish at 105°C to constant weight, and the percentage of alcohol-soluble extractive value was calculated with reference to the air-dried sample.

$$\%\ \text{Alcohol soluble extractive value} = [\text{alcohol soluble residue} / \text{air-dried drug}] \times 100$$

4. Moisture Content (Loss on Drying): Formulated face pack powder was weighed and placed in a tarred flat-bottomed shallow dish. It was warmed for half an hour in a hot air oven which was adjusted to 105-110°C. The amount of moisture present in the crude drug was calculated using the standard formula.

$$\%\ \text{Loss on drying} = [\text{Initial weight} - \text{final weight} / \text{initial weight}] \times 100$$

5. Swelling Factor:

1 gm of accurately weighed formulated face pack powder was transferred into a 25 ml measuring cylinder. To this, 25 ml of distilled water was added. The mixture was then shaken thoroughly every 10 minutes for a period of 1 hour to ensure complete wetting and uniform swelling of

the material. After this shaking phase, the cylinder was allowed to stand undisturbed for 3 hours at room temperature to permit full swelling. At the end of the standing time, the final volume occupied by the swollen material, including any mucilage formed, was recorded in milliliters.

Swelling Index (SI) = Final volume of swollen material (ml) / initial volume of swollen material × 100

Determination of Phytochemical Evaluation[11]

To prepare the sample solution of face pack powder, it was extracted with chloroform-water. After extraction, it was filtered, and the filtrates were used for the following tests.

1. Detection of Alkaloids

Mayer's Test: a little quantity of filtrate was dissolved with a few droplets of Mayer's reagent (HgI_4K_2). A yellow to off-white color precipitate developed, indicating the presence of alkaloids.

Wagner's Test: A small quantity of filtrate was dissolved with a few drops of Wagner's reagent (Iodo-potassium iodide) and observed. A reddish-brown or brown precipitate developed, indicating the presence of alkaloids.

Dragendroff's Test: Little quantity of filtrate was dissolved with Dragendroff's reagent (K[BiI_4] solution). A red-colored precipitate developed, indicating the presence of alkaloids.

Hager's Test: a little quantity of filtrate was dissolved with Hager's reagent (saturated picric acid solution). A yellow precipitate developed, indicating the presence of alkaloids.

2. Detection of Glycosides

Modified Borntrager's test (Anthraquinone Glycoside): a little quantity of filtrate was prepared with $FeCl_3$ solution. Then it was warmed on a water bath for a few minutes, cooled, and shaken with the same amount of benzene. The layer of benzene was discarded and treated with an NH_3 solution. The development of a cherry red or pink color in the ammonical layer indicated the presence of anthraquinone glycosides.

Legal's Test (Cardiac Glycoside): Treated the test extract with pyridine and methanolic alkali and added sodium nitroprusside. A pink-to-red color is produced, which indicated cardiac glycosides.

Baljet Test (Cardiac Glycoside): Treated the test filtrate with sodium picrate. A deep orange-yellow color confirmed cardiac glycosides.

Liebermann-Burchard's Test (Cardiac Glycoside): To the extract, chloroform was added and filtered. Drops of acetic anhydride and concentrated H_2SO_4 were added to the filtrates through the walls of the test tube. A deep brown or pink-colored ring developed at the junction of two layers, which confirmed cardiac glycosides.

Froth Test (Saponins Glycoside): To the extracts (alcoholic and aqueous), distilled water was added and shaken for a few minutes in a measuring cylinder. 1 cm of foam developed, which indicated saponins.

Liebermann-Burchard's Test (Steroidal and triterpenoid glycosides): To the extract, chloroform was added and filtered. Drops of acetic anhydride and concentrated H_2SO_4 were added to the filtrates through the walls of the test tube. A deep brown-colored ring developed at the junction of two layers. The top layer turned green, which confirmed steroidal or triterpenoid glycosides.

3. Detection of Phenolic compounds and Tannins

Ferric Chloride Test: Added ferric chloride solution (5%) to the filtrate. A blue-black color is produced, which confirmed the presence of a phenolic nucleus.

Gelatin Test (Tannin Test): Filtrate was treated with gelatin solution (1%) containing NaCl. A white precipitate developed, which confirmed the presence of tannins.

Lead Acetate Test (Flavonoid Test): The filtrates were treated with a 10% lead acetate solution. A yellow precipitate developed, which confirmed the presence of flavonoids.

Alkaline Reagent Test (Flavonoid Test): The filtrates were treated with NaOH. A yellow color developed that turned colourless on adding drops of dilute acid, indicating the presence of flavonoids.

Shinoda Test (Flavonoid Test): To the filtrates, a few fragments of Mg metal were added, followed by the addition of concentrated HCl. Magenta color developed, which indicated the presence of flavonoid.

Vanillin Hydrochloric Test (Tannin Test): The filtrates were treated with drops of vanillin hydrochloride reagent. A pink-red color developed, which confirmed the presence of tannins.

4. Detection of proteins and amino acids

Millon's Test: The filtrates were treated with Millon's reagent. A white precipitate developed, which turned red on heating; this indicated the presence of proteins and amino acids.

Biuret Test: The filtrates were treated with a 10% NaOH solution and warmed. To it, it added a 0.7% $CuSO_4$ solution. Violet color developed, which indicated the presence of proteins.

Ninhydrin Test: The filtrates were treated with ninhydrin reagent and boiled. Blue color developed, which indicated the presence of amino acids.

5. Detection of Fixed Oils and Fats

Stain Test: The filtrate was sandwiched between two filter papers. An oily stain on filter paper indicated the presence of fixed oil.

Soap Test: The filtrates were heated with a 0.5 N alcoholic KOH solution. Soapy formation occurred, which indicated the presence of fixed oils and fats.

6. Detection of Carbohydrates

Molisch's Test: To the filtrates, added alcoholic α-naphthol solution and concentrated H_2SO_4. A violet ring appeared at the junction, which confirmed the presence of carbohydrates.

Benedict's test (Reducing sugar test): To the filtrates, added Benedict's reagent. The mixture was heated on a water bath. A precipitate developed, which was orange-red, indicating the presence of reducing sugars.

Fehling's Test (Reducing Sugar Test): To the filtrates, dilute HCl was added for hydrolysis and heated. Equal volumes of Fehling's A and B solutions were added. A precipitate developed, which was a deep red colour, indicating the presence of carbohydrates.

Barfoed's Test (Monosaccharide): The filtrates were treated with Barfoed's reagent. The mixture was heated on a water bath. A precipitate developed, which was orange-red, indicating the presence of reducing sugars.

7. Detection of Gums and Mucilage

Alcohol Precipitate Test: The filtrates were treated with absolute alcohol and stirred. The precipitate developed, which was filtered and air-dried. It was then observed for swelling properties.

Molisch's Test: To the above precipitate, alcoholic α-naphthol solution and concentrated H_2SO_4 were added. The appearance of a violet ring at the junction indicates the presence of carbohydrates.

Ruthenium Red Test: The above precipitate was mounted on a slide, and ruthenium red solution was added and observed under a microscope. A red-pink color developed, which indicates the presence of gums and mucilage.

Analysis of Essential Mineral Nutrients[12]

The formulated face pack powder was dried in the oven at 60°C to constant weight, following the procedure as described by Piper (1966), ground in a porcelain mortar and pestle, and stored in airtight containers. The concentration of phosphorus in powder samples was determined by the molybdovanadate method, and potassium was determined by flame photometer. The concentration of micronutrients was determined using an Atomic Absorption Spectrophotometer (AAS 280 FS Agilent Technologies, Santa Clara, USA) by the wet digest method with HNO_3 and $HClO_4$ in a 10:4 ratio.

Determination of Microbial Content[13,14]

1 gm of formulated face pack powder was dissolved in lactose broth, and the volume was adjusted to 100 ml with the same medium. About 10 ml of the sample was transferred into 100 ml of MacConkey broth and incubated for 18-24 hours at 43-45°C. A subculture was prepared on a plate with MacConkey agar and incubated at 43-45°C for 18-24 hours. The growth of red, generally non-mucoid colonies of gram-negative rods appearing as reddish zones indicates the presence of *Escherichia coli* if not, then it indicates the absence of *Escherichia coli*.

Irritancy Test[6]

The skin irritancy test is a toxicological and dermatological evaluation used to determine whether a formulation (such as cosmetics, topical drugs) causes irritation or inflammation on the skin. It helps to ensure product safety before use on humans.

The formulated face pack was applied to the previously marked area of a 1 square cm on the left-hand dorsal surface, and time was recorded. Skin was then observed for irritancy, peeling, burning, or itching sensations, erythema (redness), and edema, for regular intervals up to 24 hrs. Conducted under OECD Guideline 439.

RESULT AND DISCUSSION

Organoleptic Evaluation

The organoleptic evaluation of the formulated face pack powder confirmed acceptable sensory characteristics, including color, taste, texture, odor, and appearance, ensuring consumer palatability and compliance, as shown in Table 2.

Table 2: Parameters in Organoleptic Evaluation

Sl. No.	Organoleptic studies	Description
1.	Color	Brown
2.	Odor	Aromatic
3.	Texture	Grainy

Physical Parameters

The physical parameters, such as bulk density, tapped density, Hausner's ratio, compressibility index, angle of repose, and flowability, as shown in Table 3, indicating that the formulation possessed good characteristics suitable for packaging and dispensing in powdered form.

Table 3: Physical parameters

Sl. No.	Physical Parameters	Results
1	Bulk density	0.144 gm/ml
2	Tapped density	0.147 gm/ml
3	Hausner's ratio	1.020
4	Compressibility Index	2%
5	Angle of repose	27.47

Physicochemical parameters

Physicochemical evaluation showed desirable values for moisture content, ash value, and pH, indicating the face pack powder's stability, purity, and shelf-life compatibility.

Table 4: Physicochemical parameters

Sl. No.	Physicochemical studies	Parameters
1	pH	7.0
2	Ash value in %	
	Total Ash value	33%
	Acid-insoluble ash value	40.05%
	Water-soluble ash value	39%
3	Extractive value in %	
	Water-soluble extractive value	0.172%
	Alcohol-soluble extractive value	0.028%
4	% Loss on drying	12.2%
5	Swelling factor	8.6%

Phytochemical Evaluation

The phytochemical screening revealed the presence of important bioactive constituents, including alkaloids, glycosides, flavonoids, phenols, tannins, proteins, amino acids, saponins, and carbohydrates, associated with antimicrobial, anti-inflammatory, and antioxidant activities.

Table 5: Phytochemical parameters

Sl. No.	Phytochemical tests	Description
1	Alkaloids	+
2	Glycosides	+
3	Phenolic compounds and Tannins	+
4	Proteins and Amino Acids	+
5	Fixed oils and Fats	+
6	Carbohydrates	+
7	Gums and Mucilage	-

Analysis of Essential Mineral Nutrients

The analysis of essential mineral nutrients confirmed that the papaya face pack contains essential macro- and micronutrients like calcium, manganese, copper, magnesium, iron, and zinc which are important for skin health. Macronutrients (Ca, Mg) maintain skin hydration, structure, and repair. Micronutrients (Cu, Zn, Fe, Mn) support antioxidant defence, healing, and collagen synthesis.

Table 6: Analytical results of essential mineral nutrients in formulated face pack (FP).

Sl. No.	Sample code	Ca (%)	Mg (%)	Cu (ppm)	Zn (ppm)	Fe (ppm)	Mn (ppm)
1.	FP- R1	2.27	0.34	22.20	35.92	6478.13	97.10
2.	FP- R2	1.85	0.36	16.80	36.32	6276.56	93.10

Microbial Content

The formulated face pack powder was finally subjected to microbiological evaluation, for *Escherichia coli* and was found to be absent; hence, the formulated face pack powder complied with the WHO requirements.

Irritancy Test

Finally, the formulated face pack was subjected to an irritancy test to ensure product safety before use on larger humans. The irritancy test was conducted under OECD Guideline 439. It showed no irritation or inflammation on the skin.

Table 7: Detection of microbes in formulated face pack

Sl. No.	Microorganism	Present/Absent
1	*Escherichia coli*	Absent

Figure 2: Irritancy test using water

Figure 3: Irritancy test using rose water

Figure 4: Irritancy test using glycerine

Figure 5: Papaya face pack

CONCLUSIONS

The papaya-based cosmeceutical face pack showed promising characteristics in terms of organoleptic appeal, physicochemical and phytochemical profile, essential mineral nutrients, and irritancy test, supporting its formulation as a papaya face pack for skin health. However, to validate these findings, clinical evaluations are in process to confirm their efficacy, safety, and dermatological benefits on larger human populations.

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