

Formulation And Evaluation of Herbal Papaya Soap

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Abstract- Herbal soaps are becoming increasingly popular due to their natural origin, therapeutic value, and fewer side effects compared to synthetic soaps. The present study focuses on the formulation and evaluation of herbal papaya soap with antioxidant activity using natural ingredients such as papaya extract, turmeric, honey, sandalwood oil, vitamin E, and rose water. Papaya (*Carica papaya*) is rich in bioactive compounds including vitamins A, C, E, flavonoids, phenolic compounds, and papain enzyme, which provide antioxidant, exfoliating, antimicrobial, and skin-nourishing properties. The herbal soap was prepared using a suitable soap base through the melt-and-pour/cold process method and evaluated for various physicochemical parameters. The formulated soap was assessed for appearance, color, odor, texture, pH, foamability, foam retention, irritation effect, and stability. Antioxidant activity was evaluated using standard methods such as the DPPH free radical scavenging assay. The results showed that the prepared herbal soap possessed good antioxidant activity due to the presence of natural phytoconstituents in papaya and other herbal ingredients. The soap exhibited acceptable pH, good foaming ability, pleasant fragrance, smooth texture, and no skin irritation during testing. The incorporation of natural antioxidants helped protect the skin from oxidative stress and supported skin rejuvenation. The study concludes that herbal papaya soap can be successfully formulated using natural ingredients with effective antioxidant and skin-friendly properties. The developed formulation may serve as a safe, economical, eco-friendly, and beneficial alternative to commercial synthetic soaps. Thus, herbal papaya soap has potential applications in cosmetic and skincare preparations for maintaining healthy and glowing skin.

Keywords – Herbal soap, Papaya, Antioxidant activity, Herbal cosmetics, Physicochemical evaluation, natural ingredients.

I. INTRODUCTION

More than just a delicious fruit, papaya is a source of nutrients with a number of health benefits. According to 2013 paper, the many benefits of papaya can be attributed to the high content of vitamins A, B, C. Its proteolytic enzymes, such as papain and chymopapain also have antibacterial, antifungal, and antiviral properties. Papayas have gained popularity as a natural home treatment, and for their use in skin and hair products. In recent years, people around the world have become more concerned about the harmful effects of synthetic chemicals in personal care products like soap (Khalid & Abdollahi, 2021). Chemicals such as parabens, sulfates, and triclosan, often found in commercial soaps, have been linked to allergies, hormone problems, and harm to the environment (Wirtu, 2024). Because of this, many consumers now prefer natural and herbal alternatives that are seen as safer and more eco-friendly (Bent, 2008; Ramirez et al., 2022). Herbal soaps, made from plant-based ingredients, are becoming more popular because they are gentle on the skin, help with healing, and are better for the environment (Majumdar et Balisi and

Lagua 320 al., 2023; Sharma Verma, 2023). These soaps combine traditional knowledge of medicinal plants with modern cosmetic science to provide antibacterial, antifungal, and anti-inflammatory benefits (Kumar et al., 2023). In the Philippines, many people still use native plants like Lagundi (*Vitex negundo*) and Papaya (*Carica papaya*) for healing purposes (Cordero et al., 2020). Lagundi is a well-known medicinal plant in the Philippines. It is used for its antibacterial, pain-relieving, and anti-inflammatory effects. The Department of Health recommends it for treating colds and minor infections (Maramba-Lizarte, 2024). Research shows that Lagundi extracts can kill different types of bacteria (Amin et al., 2021). On the other hand, Papaya has an enzyme called papain that helps remove dead skin and improve skin texture. It also contains vitamins A, C, and E, which help nourish and brighten the skin (Veersain et al., 2023). Papaya's antimicrobial and antioxidant properties make it useful in skincare. Herbal soaps have gained considerable popularity in recent years due to their minimal side effects, biodegradability, and the presence of bioactive compounds derived from plants. One such promising herbal ingredient is papaya (*Carica papaya*), which is known for its rich phytochemical composition, including vitamins (A, C, E), flavonoids, alkaloids, and papain enzyme, all of which

contribute to its antioxidant, exfoliating, and skin-lightening properties. The cosmetic and pharmaceutical industries have been exploring natural antioxidants as alternatives to synthetic agents, due to the health risks associated with compounds like butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA). Natural antioxidants from plant sources not only provide therapeutic benefits but also contribute to product stability by preventing oxidative degradation of the formulation. Papaya, particularly its pulp and seeds, is rich in phenolic compounds and ascorbic acid, which exhibit significant free radical scavenging activity. The enzyme papain acts as a natural exfoliant, removing dead skin cells and promoting skin regeneration. In soap formulation, papaya extracts can be incorporated into the base to produce a herbal soap that cleanses, nourishes, and protects the skin from oxidative stress. Research Studies on Papaya Soap Formulation and Antioxidant Activity I. Rashmi, G., & Shubha, R. (2018) Formulation and evaluation of herbal soap containing papaya extract. This study formulated a herbal soap using papaya extract and evaluated its physicochemical properties and antioxidant potential.

The soap demonstrated good cleansing ability and exhibited significant antioxidant activity using DPPH assay. Bhawani, S. A., & Rajendran, A. (2015). The researchers created a bath soap with both papaya and aloe vera extracts and evaluated its antioxidant activity and stability. The inclusion of papaya contributed to enhanced skin protection due to its flavonoid content. Akinmoladun, F. O., Akinrinlola, B. L., & Farombi, E. O. (2014) although not a soap formulation specifically, this study analyzed the antioxidant activity of papaya leaf and seed extracts in cosmetic preparations, highlighting their potential in topical antioxidant delivery systems. Sampath Kumar, K. P., et al. (2012) This review paper elaborates on the phytoconstituents of papaya and discusses its various health applications, including antioxidant activity relevant to skincare products. The increased demand for natural and herbal cosmetic products has spurred significant interest in the development of plant-based skincare formulations. Herbal soaps, in particular, have become widely accepted due to their perceived safety, environmental sustainability, and therapeutic benefits (Kumar et al., 2012). Unlike synthetic soaps, herbal soaps are enriched with bioactive plant constituents that not only cleanse but also provide nourishment and protection to the skin. Papaya (*Carica papaya*) is one such medicinal plant that has shown promising applications in dermatology. It is rich in enzymes like papain, and natural antioxidants including vitamins A, C, and E, which contribute to its skin-rejuvenating properties (Bhattacharya et al., 2011). Studies have shown that papaya extract exhibits significant antioxidant, anti-inflammatory, and wound-healing activities (Oloyede et al., 2012), making it a suitable candidate for incorporation into topical formulations such as soaps. Antioxidants are crucial in skincare formulations as they protect the skin from oxidative stress, which contributes to premature aging, inflammation, and

other skin conditions. The role of antioxidants in neutralizing free radicals is well-documented, with DPPH (2, 2-diphenyl-1-picrylhydrazyl) free radical scavenging assays being a widely accepted method for measuring antioxidant capacity (Blois, 1958). This study aims to formulate an herbal soap using papaya extract as a primary active ingredient, combined with natural oils such as coconut oil and olive oil, known for their skin-conditioning properties. The formulated soap is evaluated for its antioxidant activity using DPPH assay and its physicochemical characteristics to determine efficacy and stability. By integrating natural bioactives into soap formulations, this research contributes to the growing field of green cosmetics, offering a safer and more sustainable alternative to synthetic skincare products (Patel & Patel, 2013).

Their benefits vary and are summarized in the table below:

Table No: 1 BENEFITS

SKIN BENEFITS	HAIR BENEFITS
Wrinkle reduction	Conditioner
Acne control	Hair growth
Melisma treatment	Dandruff prevention

Pawpaw grows in a natural way in many humid and subtropical areas. Pawpaw contains thiol and protease active enzymes, which are present in soap to crash determined fibrin in the epidermis and, as a result, desquamate the epidermal cell, that cells has died.

Because of its alchemical component, papaya-related castile soap is available for purchase or sale as pawpaw castile soap. pawpaw castile soap is popular for its skin-whitening properties because it contains ingredients including water, acetate, and pawpaw, which cause the epidermis to lose its colour (pigmentation). The enzyme papain, which is found in the back of the pawpaw or latex, helps to smooth and brighten the epidermis (skin). The use of pawpaw castile (soap) on a regular basis can brighten supple epidermis (skin). Enzyme carries out all chemically brightening the skin but no later it exfoliates off outermost surface of skin achingly can possess sunburnt or tan. Likewise, when papaya is utilized in a castile, it dissolute the deceased dermis on the exterior part of your face , makes it functional as an desquamate whatever disclose your healthy epidermis cells. According to Wall, the fruit contains more fibers, supplements, nutrients C (51.2 mg/100g), carotene, antiophthalmic components such as provitamin A (232.3ug/100g) and cryptoxanthol (594.3 ug/100g), as well as magnestic element (19.2-32.7 mg/100g). It also contains spapaia, which is an important component of pawpaw (dry material) and is widely used in medicine. Over the past year, papaya and endomysium, among others, have displayed a variety of pharmamedical and medical aids, including eliminating fibrin from blood type wounds and taking action to

cure or manage puffiness or lump. Equatorial pawpaw treats burn injuries due to its protease content.

Anomalies such as papaya, endonuclease, leukopenia, and chymopoiesis are allowed to make wound cleansing easier, develop, or help to improving the quality of meaks left on black tissue areas. There are differences in pawpaw fruit due to different types. Although pawpaw is safe to eat and a tasty berry, it has been used to treat a variety of diseases and ailments, ranging from gastrointestinal disorders to respiratory disorders, gonorrhoea, and venereal disease. To avoid cur, the herb is frequently cinerated in tandem with verdant auxiliary. The frond has also been used to mend or cure tape worms and pin worms (internal parasites) in broth or fermentation (infusion). To be extremely effective in the treatment of diarrhea the fruit has a good reputation as a hepatoportal emissary. Unripe immature pawpaw is consumed and used in a concoction on the supposition of cynical and lcerus or chlamydia.

Throughout the period, it has been used as an antihelmintic or deworming, and the entire fruit of the pawpaw has been boiled and used as a drink to cure lesion. In Madagascar, pawpaw leaf tea has been used in the treatment of lesions, abscesses, intestinal difficulties, and ordinary intestinal pain. Extract or a concentrated fluid formed from ripe seeds is called tion or extract in the Congolese region of Africa. According to the review, the pawpaw was high in carbs, starch, and sugars. Quercetol and angelicin are derived from hydroxyl methane latex and then from liquid-latex extracted from immature pawpaw fruit using the Fraz von Soxhlet extractor. They went on to look at the antioxidative capabilities of pawpaw fruits in mice in the lab, and the results showed a significant increase in glutamine ewduction. As a result, it was proposed that immature pawpaws are used to treat illness, but that they frequently induce diabetes, haemoglobin S disease, and cardiac arrest. From the exterior, the skin serves as a protective barrier for the body, but it can cause a variety of issues, such as chronic diseases like cancer, dry skin, and premature ageing. It's possible that air pollution is to blame for the results, which reveal that ultraviolet radiation leads to a lack of cleanliness and an increase in free radicals. Soap is generated from animal fats or vegetable oils that contain potassium or sodium salts of fatty acids and should be used on a regular basis to maintain healthy skin. Natural nutrients combined with soap provide the most nutrition to the skin, whilst chemicals have unwanted effects. Papain, an enzyme found in papaya soap, has a higher activity in breaking down proteins into amino acids and peptides. Papain can be utilised as an active ingredient in skin cleansers because it dissolves dead cells that have stuck to the skin and are difficult to remove physically. Antioxidants are compounds that neutralise free radicals and prevent damage produced by free radicals in the body, including the skin. [10] We can create solid soap that contains antioxidants as a crude

enzyme papain from papaya latex and a crude form of papaya fruit in this study.

Oxidation

An atom increases the number of links it has to oxygen, decreases the number of bonds it has to hydrogen, or loses electrons during oxidation. Phenols (such as morphine), catecholamine's (such as adrenaline (epinephrine) and noradrenaline (norepinephrine), and polyunsaturated compounds (such as oils, fats, and fat-soluble vitamins (e.g. vitamins A and E) are all affected. The opposite process is reduction, which occurs when an atom, molecule, or ion gains electrons or has its oxidation status reduced (Unkar NJ Tisui TY). Researchers have been interested in Oxidative stress. Oxidative damage to proteins, fats, nucleic acids, and carbohydrates results from a clash between free radicals and antioxidants. Antioxidants have shielded the body from the detrimental effects of free radicals. Extrinsic agents are the result of exposure to external elements, particularly UV radiation without protection, which affects the rate of normal skin ageing by forming free radicals that attack the skin structures, destroying collagen and elastic fibres and impairing hydration, resulting in dyschromias, changes in skin relief, and wrinkles. At its most basic level, oxidation is the loss of electrons that occurs when one or more electrons are lost by an atom or molecule. Some elements are more prone to losing electrons than others. These aspects are mentioned. When an atom, molecule, or ion loses one or more electrons in a chemical reaction, it is called oxidation. Oxidation and reduction are complimentary processes that entail electron release and uptake, respectively. In redox processes involving covalent bonds, such as in alcohols, these electron transfer mechanisms only occur to a limited extent. Although covalently bound carbon is surrounded by the same number of electrons before and after oxidation, the oxidation state might change because electrons are assigned to the most electronegative atom in the bond. Oxidation is the loss of electrons at its most fundamental level. It occurs when one or more electrons are lost from an atom or molecule. Some elements are more prone to losing electrons than others. Alcohols, alkyl benzenes, aldehydes, alkenes, and amines undergo two-electron transfer reactions, while oxidation occurs by on-electron transfer, resulting in oxidised degradation products in the presence of oxygen in the atmosphere (Hayek T ,Atlas J, Below JL Kelidas).

The Process Of Oxidation :

The properties of an atom or compound alter as it is oxidized. When an iron thing, for example, gets oxidized, it is altered because electrons are lost. Oxidized iron is a brittle, reddish powder, whereas oxidized iron is a strong, structurally sound metal. The following diagram depicts what happens to an atom of iron as it oxidizes. Because iron is rapidly oxidised, it's critical to keep it out of contact with oxygen and moisture. As long as oxygen is there, iron will continue to lose electrons to

it. When iron is oxidised, it takes on a charge. It now has a positive charge of three after losing three electrons. The number three and an are used to indicate this positive three charge.

Risk factor ;

Free radicals are produced naturally in everyone's body as a result of processes like exercise or inflammation. This is natural and is part of the body's complex mechanism for maintaining health.

Citrus fruits

Dark leafy greens

Broccoli

Carrots

Olives

1. A regular, moderate exercise routine:

This has been linked to higher amounts of natural antioxidants and less oxidative stress damage. Exercise has been associated to a longer lifespan, less ageing symptoms, and a lower chance of cancer and disease.

Don't smok. Avoid exposure to secondhand smoke as well.

2. Use caution with chemicals:

Cleaning chemicals, avoiding needless radiation exposure, and being mindful of other chemical sources, such as pesticides used on food or in gardening, are all examples of this.

3. Antioxidant trials oxidation hypothesis:

At first glance, it might seem that these negative results close the book and that additional clinical trials of any antioxidants would be pointless. Closer examination, we believe, will show that such a conclusion would be premature and inappropriate. The oxidative modification hypothesis is not that vitamin E will improve the human condition but that oxidative modification of LDL and/or other oxidative processes play a substantial role in human atherogenesis as it does in animal models of atherogenesis.

4. Oxidation kinetics working hypothesis:

A closed-form kinetic hypothesis for zirconium oxidation was developed by assuming a constant strain-energy gradient as a diffusional driving force in addition to an oxygen chemical potential gradient, and quantitatively verified using thermogravimetry in the air atmosphere over a temperature range of 400–800 °C. The protective scale is a mixed ionic electronic conductor with an ionic transference number of 0.5, according to the open-circuit potential measurement.

As a result, the intrinsic diffusivity is thought to represent a Nernst-type combination Of partial conductivities of oxide ions and electrons.

5. Hypothesis of oxidation:

According to the oxidation theory, low density lipoprotein must be oxidative changed to cause atherosclerosis pathology.

In this article, we review recent research on the pathways that increase LDL oxidation in vivo and the effects of antioxidants on atherogenesis in animals, with a focus on the clinical implications of these findings for the oxidation hypothesis.

IMPORTANT POINTS IN INTRODUCTION

1. Background on Herbal Soaps:

Definition and growing popularity of herbal/cosmetic soaps.

Advantages over synthetic soaps: fewer side effects, environmentally friendly, natural ingredients.

Rising consumer demand for natural skincare products with therapeutic benefits.

2. Importance of Antioxidants in Skincare:

Role of antioxidants in neutralizing free radicals that cause skin damage and aging. Benefits of antioxidants in cosmetic formulations: anti-aging, anti-inflammatory, and protective effects.

Common natural antioxidants used in cosmetics.

3. Why Papaya (Carica papaya)?

Papaya as a rich source of natural antioxidants: vitamins A, C, E, and phytochemicals (e.g., flavonoids, carotenoids).

Enzymes like papain contribute to exfoliation and skin renewal.

Traditional and modern use of papaya in skincare for brightening, anti-acne, and moisturizing effects.

4. Scientific Rationale:

Importance of formulating a herbal soap that retains antioxidant properties of papaya. Challenge of maintaining stability and efficacy of natural antioxidants in soap formulations.

5. Need for Evaluation:

Importance of scientifically evaluating antioxidant activity to ensure effectiveness. Common evaluation methods: DPPH assay, ABTS assay, etc. Need for assessing both physicochemical properties and biological efficacy of the soap.

II. MATERIALS AND METHODOLOGY

PAPAYA :



- FIGURE NO : 1 PAPAYA
- Botanical Name – Carica Papaya
- Biological Source – Papaya (Carica Papaya), also called Papaw or Pawpaw, Succulent of large plant fruit.
- Family – Caricaceae
- Geographical Source – Mexico and Central America
- Chemical Constituent – Carbohydrates, Proteins, Alkaloids (Carpaine and Pseudocarpaine) Protolytic Enzyme
- Description: Colour – Green Yellowish and Orange
- Odour- Strong Odour
- Taste – Sweet and Juicy taste
- Use – Papaya products help to reduce acne by removing dead skin cells.
- Papaya is also used skin whitening (C.K Kokate A.P. Purohit S.B Gokhale 2014).

Phytochemical Constituents:

Papaya contains a variety of bioactive compounds, including:

- Enzymes: Papain, chymopapain
- Vitamins: Vitamin A, C, E (important antioxidants)
- Alkaloids: Carpaine
- Flavonoids: Quercetin
- Phenolic compounds: Gallic acid, ferulic acid
- Other antioxidants: Lycopene, β-carotene

Relevance in Herbal Soap Formulation:

Papaya's potent antioxidant and exfoliating properties make it highly suitable for skincare formulations. When used in herbal soap, it helps:

- Improve skin tone and texture
- Reduce signs of aging
- Cleanse and exfoliate the skin naturally Protect against oxidative damage

Medicinal Properties

TABLE NO: 3 MEDICINAL PROPERTIES PAPAYA

PROPERTY	DETAILS
Antioxidant	High content of vit.C , flavonoids and carotenoids neutralizes free radicals.
Anti-inflammatory	Reduces skin inflammation and redness
Wound healing	Promotes skin repair and collagen formation
Antibacterial	Effective against various skin pathogens.
Exfoliating	Papain enzymes helps to remove dead skin cells

Morphology :

1. Habit:

Papaya is a fast-growing, herbaceous plant that resembles a tree (tree-like herb). It usually grows 2–10 meters tall with a soft, hollow, unbranched stem.

2. Root:

It has a taproot system with numerous lateral roots. The roots are deep and help in anchoring the tall plant.

3. Stem:

The stem is soft, green when young, and becomes grayish with age. It is hollow, cylindrical, and bears leaf scars.

4. Leaves:

Leaves are large, palmately lobed, and borne on long petioles. They are arranged spirally at the top of the stem, forming a crown. The leaf blade can have 5–9 lobes.

5. Flowers:

Papaya is dioecious or sometimes hermaphroditic. Flowers are borne in leaf axils. They are unisexual or bisexual, depending on the plant. Male flowers are in clusters, while female and hermaphrodite flowers are solitary.

6. Fruit:

The fruit is a large, fleshy berry, green when immature and yellow-orange when ripe. It contains numerous black seeds embedded in mucilage.

7. Seeds:

Seeds are small, round, and black with a gelatinous coating.

TABLE NO: 4 TAXONOMICAL CLASSIFICATION OF PAPAYA

Kingdom	: Plantae	Varnacular : names	
Subkingdom :	Tracheobionta	Hindi	: Papita
Division	:Magnoliophyta	English	: Papaya

Class	: magnoliopsida	Eclectics	: Papaw
Family	:Caricaceae	Brazil	: Mamao
Genus	: Carica L	Caribbean	: Ababai
Species	: Carica papaya L	Cuba	: Fruta de bomba

- Biological Source-termeric consist of dried , as well as fresh rhizomes of plant known as Curcuma Longa Linn
- Family-Zingiberaceae Kingdom - Plantae
- Geographical Source-West Pakistan , India , Malaysia, and China In India Maharashtra ,Tamil Nada , West Bengal , up and Punjab.
- Chemical constituent-Volatile oil , Resinous matter , Starch
- ,Curcuminoids Clade- Monocots ; Angiosperms Order-
- Zingiberaceae Geneus -Curcuma
- Use- Improve skin health and cures acne (Dr. Rajesh A Sahu , Mrs Rashmi 2019)

HONEY:



Figure No : 2 Honey

- Botnical Name : Apis millifera, Apis dorsata
- Biological source : Sugary Secretion deposited in honey comb by the bees. Family : Apidae.
- Geographical Source : Africa , Australia , New Zealand ,California and Gums Colour : Pale Yellowish to Yellowish Brown.
- Odour : Characteristic, Pleasant. Taste : Sweet and Faintly acid.
- Solubility : Soluble in water Insoluble in alcohol
- Use : Demulcent, Sweetening agent Antiseptic Vehicle for Ayurvedic Formulation (C.K Kokate. A.P Purohit S.B 2014).

Turmeric:



Figure No : 3 Turmeric

- Botnical Name-Indian Saffron , Haldi

Sandle Wood:



Figure No: 4 Sandle Wood

- Botnical Name : Yellowish Sandle Wood , Lignum Santali
- Biological Source : dried heart wood of Santalum album
- Family : Santalaceae
- Chemical constituent : Sandle wood oil , contains 95% two isomeric Colour : yellowish or Pale raddish
- Odour : Strong and Fragrant Taste
- Used : Antiseptic, Expectorant, Colouring agent, Flavoring agent (C.K Kokate A.P purohit(2014)).

Vitamin E:



Figure No: 4 Vit. E Capsule

Vitamin e is the term that referes to various forms of Alpha-tocopherol. The exact biochemical function of vitamin e is unknown , but the antioxidant properties of the vitamin have been implicated (Brady James 9th edition).

- Vitamin E uses:

 1. Moisturizing skin.

2. Wound healing.
3. Skin cancer prevention.
4. Reducing skin itching.
5. Eczema.
6. Psoriasis.
7. Preventing or minimizing the appearance of scars.
8. Preventing or treating fine lines and wrinkles. [24]

Rose Water:



FIGURE NO: 5 ROSE WATER

Rose water is created by distilling rose petals with steam. Rose water is fragrant, and it's sometimes used as a mild natural fragrance as an alternative to chemical-filled perfumes. Rose water has been used for thousands of years, including in the Middle Ages.

It's thought to have originated in what is now Iran. It's been used traditionally in both beauty products and food and drink products. It also comes with plenty of potential health benefits;

- **Including the following:**
 1. Helps soothe skin irritation
 2. Soothes sore throats
 3. Reduces skin redness
 4. Helps prevent and treats infections
 5. Contains antioxidants Heals cuts, scars, and burns

Method of Preparation

Melt and Pour Method

Step 1: Preparation of Soap Base

The glycerin soap base was cut into small pieces and melted on a water bath at 45°C.

Step 2: Addition of Herbal Ingredients

Papaya extract, turmeric powder, honey, vitamin E, and rose water were added slowly into the melted soap base with continuous stirring.

Step 3: Addition of Fragrance

Sandalwood oil was added to improve fragrance and provide antiseptic action.

Step 4: Moulding

The prepared mixture was poured carefully into soap moulds.

Step 5: Cooling and Solidification

The moulds were allowed to stand for 2–3 hours until complete solidification occurred.

Step 6: Removal and Storage

Prepared soap bars were removed from moulds and packed in airtight containers for further evaluation.

Materials :

These are selected for their antioxidant, cleansing, and skin-nourishing properties.

- **Ingredient And Functions**
- **Papaya (Carica papaya) extract:** Rich in papain enzyme, vitamins A, C, E – natural exfoliant and antioxidant
- **Aloe vera gel:** Soothing agent, moisturizing
- **Turmeric extract:** Potent antioxidant and anti-inflammatory
- **Green tea extract:** High in polyphenols, antioxidant
- **Essential oils (e.g., tea tree, lavender):** Fragrance, antimicrobial
- **Coconut oil / Olive oilBase oils:** for soap formation, emollient
- **Shea butter / Cocoa butter:** Conditioning agents
- **Distilled water Solvent:** for lye

1. Soap preparation method

Cold Process Method :

- Prepare herbal extracts (if not using commercial ones) via maceration or decoction.
- Dissolve NaOH in water (caution: exothermic reaction).
- Melt oils and butters separately.
- Mix lye water with oils at 35–40°C.
- Add herbal extracts and essential oils.
- Blend until "trace" (slightly thickened).
- Pour into molds, cure for 4–6 weeks at room temperature.

2. Evaluation Parameters

- pH : Digital pH meter
- Foam Height/Volume : Shake test
- Moisture Content : Oven drying
- Hardness : Penetrometer or durometer
- Lathering Ability : Volume after shaking
- Stability Test : Subject to different temperatures/humidity
- Microbial Load : Total aerobic microbial count (TAMC), Total yeast/mold count (TYMC)

3. Active Ingredient (Drug)

Carica papaya (Papaya) Extract or Papaya Pulp

Contains vitamins A, C, and E, flavonoids, and papain enzyme
 Provides antioxidant, skin-brightening, and exfoliating effects

A. Excipients

Base/Soap Forming Agents Sodium hydroxide (NaOH)
 Saponifying agent used- Almond oil
 Serve as emollients and participate in saponification

B. Solvents / Dispersants

Distilled Water- Acts as a solvent

Can help extract active compounds if using raw plant material

a. Antioxidant Enhancers / Co-actives (optional) Vitamin E (Tocopherol)
 Boosts antioxidant capacity and stabilizes oils

Green tea extract or Aloe vera gel, Complementary antioxidants.

C. Chelating Agents

EDTA (Ethylenediaminetetraacetic acid)

Helps bind metal ions to improve stability and prevent oxidation

D. Fragrance / Essential Oils

Lavender, Lemon, or Tea tree oil

Natural options with added antimicrobial or soothing effects

E. Colorants (Optional & Natural) Turmeric (for yellow tint + antioxidant properties) Beetroot powder (for pink hue)

F. Evaluation Parameters for Antioxidant Activity
 You'll evaluate the antioxidant property using in vitro methods such as: DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay
 ABTS assay

Ferric reducing antioxidant power (FRAP) assay Also, assess:

Ph

- Skin irritation test (optional)
- Physical appearance
- Moisture content
- Foam ability

SAMPLE FORMULA OUTLINE:

TABLE NO : 5 SAMPLE FORMULA OUTLINE

INGREDIENT	QUANTITY (g or %)
Papaya extract/pulp	5–10%
Coconut oil	20%

Olive oil	15%
Almond oil	5%
NaOH	As per SAP value
Distilled water	As per amount
Vitamin E	0.5%
Fragrance oil 0.5–1%	Fragrance oil 0.5–1%

Calculate % scavenging activity

$$\text{Scavenging Activity (\%)} = \frac{(\text{A control} - \text{A sample})}{\text{A control}} \times 100$$

Where :

1. A sample = Absorbance of the sample (DPPH + Soap extract)
2. A control = Absorbance of the control (DPPH + solvent, no soap extract)

Methodology Preparation of solid soap:

To Prepare Soap we take the required quantity of base in 500 ml of beaker and maintain the temperature at 45c to heat the soap base on the water bath without stirring.

Then the soap base will be converts into liquid form and then add the all ingredients to the above mixture.

Boil the mixture 45c on the water bath to obtain proper mixture without stirring. the mixtures poured into the soap moulds and freeze the soap containing moulds and freeze the soap containing mould up to 2-3 hours after 2-3 houses remove the soap moulds from the freeze.

Allow to 5 minutes then soap will be formed.

Formulation Table :

Table No : 6 Formulation Table

INGREDIENTS	QUANTITY
Papaya Powder	15 gm.
Sandle Wood Oil	3-4 Drops
Turmeric	0.6 gm.
Honey	1.3 gm.
Vit E Capsule	5 Drops
Rose Water	q.s
Soap Base	83 gm.

1. Collection and Authentication of Plant Material:

Fresh Carica papaya (papaya) leaves/fruit were collected from a local source.

The plant material was authenticated by a qualified botanist/herbarium department and assigned a voucher specimen number.

2. Preparation of Herbal Extract:

The plant material was cleaned, shade-dried, and powdered.

Aqueous or ethanolic extracts were prepared using cold maceration or Soxhlet extraction.

Filtration was carried out using Whatman filter paper and extract was concentrated using a rotary evaporator.

3. Phytochemical Screening:

Preliminary qualitative phytochemical analysis was conducted to detect compounds such as:

- Alkaloids
- Flavonoids
- Tannins
- Phenols
- Saponins
- Terpenoids

4. Soap Formulation Process :

Soap was prepared using the cold process method:

Base oils (e.g., coconut oil, palm oil, castor oil) Lye solution (NaOH) Papaya extract added during trace stage

Optional: Essential oils (e.g., tea tree oil), natural colorants, and exfoliants The mixture was poured into molds and allowed to cure for 3–4 weeks.

5. Physicochemical Evaluation of Soap:

1) Appearance:

- Color
- Texture
- Odour

2) PH measurement:

Using pH meter

- Foam height/foaming ability
- Hardness test
- Total fatty matter (TFM)
- Moisture content
- Lathering and cleansing ability
- Weight variation
- Irritation/safety test (in vitro or patch tests)

6. Antioxidant Activity Evaluation:

DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay:

- Soap extract tested for free radical scavenging ability
- % Inhibition calculated at different concentrations
- IC₅₀ value determined
- ABTS radical scavenging assay (if applicable)
- Total Phenolic Content (TPC) using Folin–Ciocalteu reagent
- Total Flavonoid Content (TFC) using aluminum chloride method

7. Stability Studies:

- Soap samples were stored under varying conditions (temperature, humidity) to assess:

- Color and odor stability
- Texture changes
- pH variation over time

8. Microbial Limit Test:

Evaluation of microbial contamination (bacterial and fungal) using standard plate count method.

• FORMULATION AND EVALUATION OF HERBAL PAPAYA SOAP :

1. Objective

To formulate a herbal soap incorporating Carica papaya extract along with other natural ingredients, and to evaluate its antioxidant activity, physicochemical properties, and skin compatibility.

2. Ingredients and Their Roles:

Take accurate amount of ingredients to observe their roles

3. Preparation Method (Cold Process Method):

Step 1: Preparation of Papaya Extract

Fresh, ripe papaya fruit is washed, peeled, and seeds removed. The pulp is blended into a smooth puree.

The extract is filtered through muslin cloth or centrifuged to remove coarse particles.

Step 2: Oil Phase Preparation

Coconut, olive, castor, and palm oils are measured and mixed in a clean container. The oils are gently heated to 40–45°C to ensure uniform blending.

Step 3: Lye Solution Preparation

Sodium hydroxide is carefully dissolved in distilled water with constant stirring.

The solution is allowed to cool to room temperature (safety precautions must be observed).

Step 4: Saponification

The lye solution is added slowly to the oil mixture while continuously stirring.

The mixture is blended using a stick blender until it reaches “trace” (a pudding-like consistency).

Step 5: Addition of Herbal Extracts

Once trace is achieved, papaya extract, aloe vera gel, and essential oils are added. Optional antioxidants like turmeric or neem can be incorporated at this stage.

The mixture is stirred thoroughly to ensure even distribution.

Step 6: Molding and Curin

The soap mixture is poured into molds and left to set for 24–48 hours.

After unmolding, the soap is cured in a dry, cool place for 4–6 weeks to complete saponification and harden.

4. Considerations for Stability

Antioxidant-rich ingredients like papaya extract are added after saponification (post-trace) to preserve their bioactivity.

Essential oils are added at lower temperatures to prevent evaporation.

pH of the final soap is monitored to ensure it's skin-friendly (ideally between 5.5 and 7.0).

5. Storage and Packaging

After curing, the soap is packaged in moisture-proof paper or cardboard boxes. The product is stored away from sunlight and moisture to maintain stability.

III. HERBAL CONSTITUENT:

Fruits:

Minerals: calcium, phosphorous, iron, vitamin C, thiamine, riboflavin, niacin, and carotene, amino acids, citric and malic acids (green fruits), volatile compounds: linalool, benzyl isothiocyanate, cis and trans 2, 6-dimethyl-3,6 epoxy-7 octen-2-ol, Alkaloid; carpaine, benzyl—D glucoside. Juice:

N-butyric, n-hexanoic and n-octanoic acids, lipids; myristic, palmitic, stearic, linoleic, linolenic and cis-vaccenic and oleic acids.

Seed:

Fatty acids, crude protein, crude fibre, papaya oil, sinigrin, Carpaine, benzylisothiocyanate, benzyl glucosinolate, glucotropacolin, hentriacontane, - sitosterol, caricin, and an enzyme called myrosin, as well as leaves associated alkaloids, flavonoids, saponins, tannins, cardiac glycoside, anthraquinonin.

Materials Required

Herbal Ingredients: Papaya (*Carica papaya*) pulp or extract
Aloe vera gel (optional, for soothing effect)
Turmeric powder or extract (optional, for antioxidant and antibacterial properties)
Essential oils (e.g., tea tree, lavender) – for fragrance and added benefits.

Soap Base:

- Glycerin melt-and-pour soap base (or sodium hydroxide + oils for cold process soap)
- Coconut oil / Olive oil / Castor oil
- Distilled water
- Ethanol (for extraction, if needed)
- Analytical Reagents (for antioxidant evaluation):
- DPPH (2, 2-diphenyl-1-picrylhydrazyl)
- Methanol
- Ascorbic acid (standard antioxidant)

Formulation of Herbal Papaya Soap

A. Papaya Extract Preparation:

1. Fresh Papaya Pulp Extraction:

- Peel and deseed ripe papaya.
- Blend pulp into a smooth puree.
- Filter using muslin cloth to obtain juice/extract.
- Optional: Dry extract using freeze-drying or evaporation to get a powder.

2. Ethanolic Extract (for antioxidant evaluation):

Dry the papaya pulp or leaves.
Powder and macerate with 70% ethanol for 48–72 hours. Filter and concentrate using a rotary evaporator or water bath.

B. Soap Base Preparation (Melt and Pour Method):

- Cut the glycerin soap base into small pieces.
 - Melt it in a double boiler at ~60–70°C.
 - Add the following quantities are variable depending on batch size:
 - Papaya extract (dry papaya powder)
 - Essential oils (5–10 drops/100g soap)
- Aloe vera gel (1–2 tbsp), Other herbal additives (e.g., turmeric – a pinch)



FIGURE NO: 6 SOAP BASE

- Mix thoroughly to ensure uniform distribution.
- Pour into soap molds and allow to cool and solidify (2–4 hours).
- Remove from molds and store in airtight containers.
- Evaluation of Antioxidant Activity

C. DPPH Radical Scavenging Assay:

1. Preparation of Extracts:

Dissolve a known amount of papaya soap (e.g., 1 g) in methanol. Filter and use for antioxidant assay.

2. DPPH Solution:

Prepare 0.1 mM DPPH solution in methanol.

PROCEDURE:

Mix 1 mL of soap extract with 2 mL of DPPH solution. Incubate in the dark at room temperature for 30 minutes.

Measure absorbance at 517 nm using a UV-Vis spectrophotometer.

1. Control & Standard:

Control: DPPH + methanol (no extract)

Standard: Use ascorbic acid at various concentrations.

2. Calculation:

$$\text{Scavenging Activity (\%)} = \frac{(A \text{ control} - A \text{ sample})}{A \text{ control}} \times 100$$

Where:

A_{sample} = Absorbance of the sample (DPPH + Soap extract)

A_{control} = Absorbance of the control (DPPH + solvent, no soap extract)

3. Other Evaluations :

- pH of soap (ideal: 7–9)
- Foaming index
- Moisture content
- Hardness test
- Microbial load (to ensure safety)
- Stability testing (under various temperature/humidity)

Data Analysis and Interpretation:

Compare antioxidant activity of herbal soap with standard antioxidant (ascorbic acid). Graphical analysis of % inhibition vs. concentration.

Statistical tools (like ANOVA or t-test) can be used for significance testing if required.

Documentation and Conclusion:

Record all observations: physical appearance, fragrance, pH, etc. Summarize antioxidant efficiency.



Figure No : 8 Setting Of Soap



Figure No: 9 Papaya Soap



Figure No : 7 Chemical Ingredients

IV. PREFORMULATION STUDIES

Organoleptic properties of Papaya Extract

Table no. 7

Parameter	Observation
Colour	Orange yellow
Odour	Characteristic fruity odour
Taste	Slightly sweet
Texture	Smooth pulp/ powder
Solubility	Soluble In water and ethanol

2. Identification and authentication of drug

Table no.8

Parameter	Details
Biological Source	Fruit of carica papaya
Family	Caricaceae
Common name	Papaya
Part used	Fruit pulp
Active constituent	Papain, flavonoids, vit. A,C,E

3. Phytochemical Screening of Papaya

Table no.9

Phytochemical Test	Observation	Result
Alkaloids	Orange precipitate	Present
Flavonoids	Yellow colour	Present
Tannins	Blue- black colour	Present
Phenolic compounds	Green coloration	Present
Saponins	Persistent foam	Present
Glycosides	Brown ring formation	Present

4. Compatibility Studies

The papaya extract was mixed with soap and excipients. No colour change, precipitation, phase separation, or incompatibility was observed during storage for 7 days at room temperature.

5. Physical Characteristics of Papaya Extract

Table no.10

Parameter	Result
Ph	5.8
Moisture content	6.5
Appearance	Fine orange powder/pulp
Stability	Stable at room temperature

Formulation Of Herbal Papaya Soap Soap Batch Formulation

Table no.11

Ingredient	F1(g)	F2(g)	F3(g)
Papaya extract	5	10	15
Soap base	88	85	83
Honey	1.0	1.2	1.3
Turmeric	0.3	0.5	0.6
Sandale wood oil	2 drops	3 drops	4 drops
Vitamin E	3 drops	4 drops	5 drops
Rose water	q.s	q.s	q.s

Batch details

Table no. 12

Batch code	Description
F1	Low concentration papaya soap
F2	Medium concentration papaya soap
F3	High concentration papaya soap

Evaluation Of Herbal Papaya Soap

Table no. 13 Physical Evaluation

Parameter	F1	F2	F3
Colour	Orange	Orange	Orange
Odour	Pleasant	Pleasant	Pleasant
Texture	Smooth	Smooth	Smooth
State	Solid	Solid	Solid

V. RESULT AND DISCUSSION

RESULT

The soap made was evaluated for physicochemical characters such as PH, foam ability, foam retention, foam height, irritation test, user satisfaction test and the improvement of skin color level and for other parameters, good characteristics were observed.

Physical Parameters :

In this test colour, odour, texture, and state of soap are observed here;

TABLE NO : 14 PHYSICAL PARAMETERS

SR NO.	PARAMETERS	F1S	F2S	F3S
1	Colour	Orange	Orange	Orange
2	Odour	Pleasant	Pleasant	Pleasant
3	Texture	Smooth	Smooth	Smooth
4	State	Solid	Solid	Solid

PH Determination:

The pH was measured with a pH meter, and a 10% soap solution was made with distilled water. After calibrating the pH meter with buffer solution, the electrode was put into the solution. The pH level was measured and recorded.

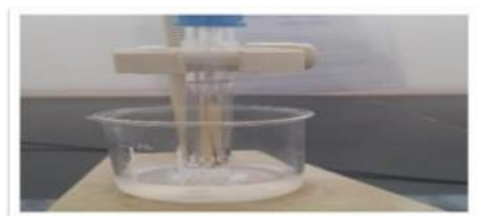


Figure No : 10 Ph Meter

TABLE NO: 15

SR NO.	FORMULATION	PH
1	F1	9.10

2	F2	9.9
3	F3	9.11

Foam Ability test:

In a 20 mL measuring cylinder containing 10 mL of distilled water, 1 gramme of sample soap was introduced. To form foams, the mixture was violently shaken with a vortex.



FIGURE NO : 11 FOAM ABILITY TEST

The measuring cylinder was left to stand for 5 minutes after shaking for around 30 seconds (t5). Following that, the height of the foam in the solution was measured and recorded.

Irritation test:

Testing for potential adverse skin effects (irritation and allergy) is required before new skin care products and ingredients are offered to the market. This dermatological test for human irritation was carried out to ensure consumer safety. Under the test conditions, all of the test materials (soap base, orange peel soap, extracted orange oil, and orange Peel Powder) did not cause skin irritation. Furthermore, during the test time, none of the volunteers experienced irritation. It is reasonable to conclude that the two soaps were not likely to cause skin irritation under normal conditions of use.

Irritation Test:

TABLE NO : 16 IRRITATION EFFECT

SR NO.	FORMULATION	IRRITATION EFFECT
1	F1	Nil
2	F2	Nil
3	F3	Nil

User satisfaction test:

Twenty participants were asked to complete a survey after using both soaps to measure their happiness. A 5-point Likert scale was used to gauge volunteer satisfaction. The texture of orange peel soap satisfied the volunteers to a high degree,

whereas the odour of orange peel soap satisfied them to a medium degree. In any event, their overall preference for orange peel soap was strong. The participants were really satisfied with the spread ability of orange peel soap during use. Furthermore, they achieved a high level of absorbable, scrubbing, and moisturised peel soap feeling. In conclusion, the volunteers were really satisfied with the orange peel soap. Similarly, the look of orange peel soap did not change.

The improvement of skin colour level:

Before and after one month of soap application, skin colour improvement was measured using a skin colorbar (customised from Von Luschan's Chromatic scale). The skin colour level improvement was used to determine the scores. According to the findings, orange peel soap had a greater impact on skin colour improvement (different level = 1.150.93) than soap base (different level = 0.700.64).

Foam Height:

A sample of 0.5 grams of soap was distributed in 25 mL of distilled water. The volume was then made up to 50 ml with water in a 100 ml measuring cylinder. 25 strokes were administered and let to stand until the aqueous volume reached 50 ml, at which point the foam height was measured above the aqueous liquid.

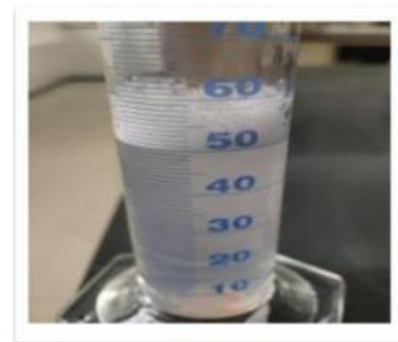


FIGURE NO : 12 FOAM HEIGHT

1. FOAM HEIGHT:

TABLE NO : 17 FOAM HEIGHT

SR NO.	FORMULATION	FOAM HEIGHT (cm)
1	F1	2.5
2	F2	2.6
3	F3	2.9

Foam Retention:

A 100 ml graduated measuring cylinder was filled with 25 ml of the 1% soap solution. Hands were placed over the cylinder and shaken ten times. For 4 minutes, the volume of foam was measured at 1 minute intervals (Setiadi Patin and Familia An India).



Figure No : 12 Foam Retention

1. FOAM RETENTION:

TABLE NO : 18 FOAM RETENTION

Sr No.	Formulation	Foam Retention Per Min
1	F1	2.4
2	F2	1.5
3	F3	0.8

Discussion:

The soap also exhibited good cleaning efficiency in removing microbes on hands. Papaya soap is rich in vitamin C, an antioxidant that can reduce irregular pigmentation and stimulate collagen production. The soap also contains vitamin A, another important nutrient for the skin. It promotes the production of new skin cells, and may help reduce dark spots, blemishes, and scars. Soap removes dirt and sweat from your body, leaving your skin feeling clean and refreshed.

VI. CONCLUSION

Based on the findings, it can be concluded that adding crude enzyme papain to solid soap increased dirt removal compared to soap without enzyme, but had no effect on fatty acids, alkali free, pH, specific density, or foam stability. Formula IV was the best formula based on antioxidant activity, skin safety, and full compliance with SNI 1996 requirements. After standing for 5 minutes, Formula IV (which included 30% papaya fruit as an antioxidant and 1.5 percent crude papain enzyme) had a pH of 9.11, a fatty acid value of 79 percent, an alkali free 0.108 percent, a specific density of 1.0595 gr/mL, and a 78 percent foam ability. Formulating herbal soap using papaya and other antioxidant-rich herbs is a promising approach for developing effective and skin-friendly cosmetic products. Papaya's enzymatic and antioxidant properties, combined with suitable formulation and evaluation techniques, can yield soaps that offer both cleansing and therapeutic benefits. However, further research and standardization are necessary for commercial-scale development and long-term stability. The formulation and evaluation of antioxidant-rich herbal papaya soap offer a fertile

ground for scientific innovation, sustainable skincare development, and market growth. Continued research can lead to clinically validated, commercially viable, and consumer-friendly products that meet the rising global demand for natural personal care solution.

Future Scope

1. Advanced Phytochemical Research

Isolate and identify specific bioactive compounds in papaya (e.g., papain, flavonoids, vitamins A, C, and E) and other herbal ingredients. Study synergistic effects of combined herbs on antioxidant activity.

Use novel extraction techniques like supercritical CO₂ or ultrasound-assisted extraction to maximize efficacy.

2. Enhanced Evaluation Techniques

Apply in vitro and in vivo models for deeper understanding of antioxidant behavior on skin. Incorporate cell culture studies (e.g., keratinocyte or fibroblast models) to observe cellular responses. Use skin mimic systems or 3D skin models for advanced evaluation.

3. Product Optimization

Focus on sustainable, biodegradable formulations that are eco-friendly. Develop pH-balanced, dermatologically tested formulations suitable for sensitive skin. Incorporate Nano-encapsulation or liposomal delivery of active ingredients for better skin penetration.

4. Expanding Herbal Ingredients

Combine papaya with other antioxidant-rich herbs like turmeric, neem, green tea, aloe vera, or licorice. Tailor combinations based on target skin concerns: aging, acne, dullness, or inflammation.

5. Market & Commercial Scope

Increasing demand for organic and herbal cosmetics presents a strong commercialization opportunity. Potential for product line expansion: body washes, scrubs, facial bars using the same antioxidant-rich base. Appeal to vegan, cruelty-free, and sustainability-conscious markets. and Consumer Studies

Conduct clinical trials and user studies to validate efficacy and safety.

Gather data on long-term benefits of regular use (e.g., anti-aging, hydration, glow). Evaluate sensory attributes and consumer acceptance through real-world testing.

Regulatory and Safety Studies

Assess regulatory compliance with FDA, AYUSH, or other regional bodies.

Conduct toxicological assessments and ensure the absence of allergens or harmful residues.

Sustainable Production & Packaging

Use eco-friendly, recyclable packaging to appeal to green consumers.

Consider locally sourced herbs to reduce environmental impact and support local economical.

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