



**INTERNATIONAL JOURNAL OF  
PHARMACEUTICAL SCIENCES**  
[ISSN: 0975-4725; CODEN(USA):IJPS00]  
Journal Homepage: <https://www.ijpsjournal.com>



## Research Article

# Formulation And Evaluation Of A Herbal Soap From Tridax Procumbens

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### ARTICLE INFO

Received: 02 Jan 2024  
Accepted: 06 Jan 2024  
Published: 15 Jan 2024

#### Keywords:

Tridax procumbens, herbal soap, cosmetic product, natural skincare, herbal extract

#### DOI:

10.5281/zenodo.10512066

### ABSTRACT

This research paper aims to develop a formulation of herbal soap using Tridax procumbens extract known for its multipurpose activity. The study includes the preparation of the herbal soap by incorporating different concentrations of Tridax procumbens extract and evaluating its physicochemical properties such as pH, foam ability, and stability. Additionally, the antimicrobial and antioxidant properties of the formulated herbal soap were assessed using various microbiological and biochemical assays. The results of this study can provide valuable information for the development of herbal soaps with therapeutic benefits. Moreover, this research contributes substantively to the escalating interest in leveraging natural products within the realm of personal care, underscoring the potential for a symbiotic relationship between science and nature in the formulation of innovative and beneficial consumer goods.

### INTRODUCTION

Herbal soaps are gaining popularity among consumers due to their natural and gentle properties. The use of plant extracts in soap-making has been practiced for centuries, and it is still prevalent today. One such plant that has been used in traditional medicine and has recently gained attention in the cosmetic industry is Tridax procumbens. Tridax, also known as coat buttons or Mexican daisy, is a flowering plant that belongs to the Asteraceae family. It is native to Mexico and Central America but can also be found in other parts of the world. The plant has been used for

various medicinal purposes, including treating skin disorders, fever, and wounds.

In recent years, the plant has been investigated for its potential in the cosmetic industry due to its bioactive compounds. This research paper aims to delve into the depths of Tridax procumbens, exploring the intricate web of bioactive compounds inherent to this botanical wonder. With a particular focus on its potential benefits in soap-making, we will unravel the molecular intricacies that contribute to its skincare properties. Furthermore, the paper will elucidate the soap-making process harnessing Tridax

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



extracts and shed light on the resulting herbal soap's quality.



**Figure 1: Herbal Soap**

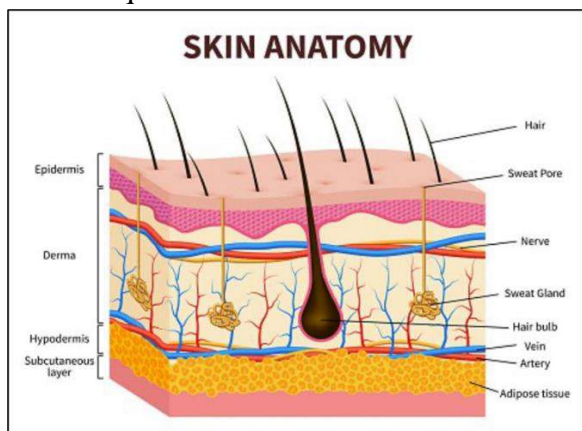


**Figure 2: Tridax procumbens**

The skin is the largest organ of the human body, and it has several important functions such as protection from the environment, thermoregulation, and sensation. The anatomy and physiology of skin are complex and involve multiple layers and cell types, each with a unique function. In this literature review, we will discuss the anatomy and physiology of skin in detail.

### **Anatomy of Skin:**

The skin consists of three primary layers: the epidermis, dermis, and hypodermis. Each layer has its own unique structure and function.



**Figure 3: Skin Anatomy**

### **Epidermis:**

The epidermis is the outermost layer of the skin and is composed of multiple layers of cells. The outermost layer is the stratum corneum, which is composed of dead keratinocytes. The keratinocytes produce a protein called keratin, which helps to protect the skin from external damage. The layer beneath the stratum corneum is the stratum granulosum, which contains granules of keratohyalin, a protein that helps to bind the keratinocytes together. The next layer is the stratum spinosum, which contains several layers of living keratinocytes. The basal layer is the deepest layer of the epidermis and contains the stem cells that produce new keratinocytes.

### **Dermis:**

The dermis is the second layer of the skin and is composed of connective tissue, blood vessels, and nerves. It contains two main regions: the papillary layer and the reticular layer. The papillary layer is composed of loose connective tissue and contains small blood vessels and nerves. The reticular layer is composed of dense irregular connective tissue and contains larger blood vessels and nerves. The dermis also contains structures such as hair follicles, sweat glands, and sebaceous glands.

### **Hypodermis:**

The hypodermis is the deepest layer of the skin and is composed of adipose tissue and connective tissue. It helps to insulate the body and provides a cushion for the underlying tissues.

### **Physiology of Skin:**

The physiology of skin involves several complex processes, including barrier function, thermoregulation, and sensation.

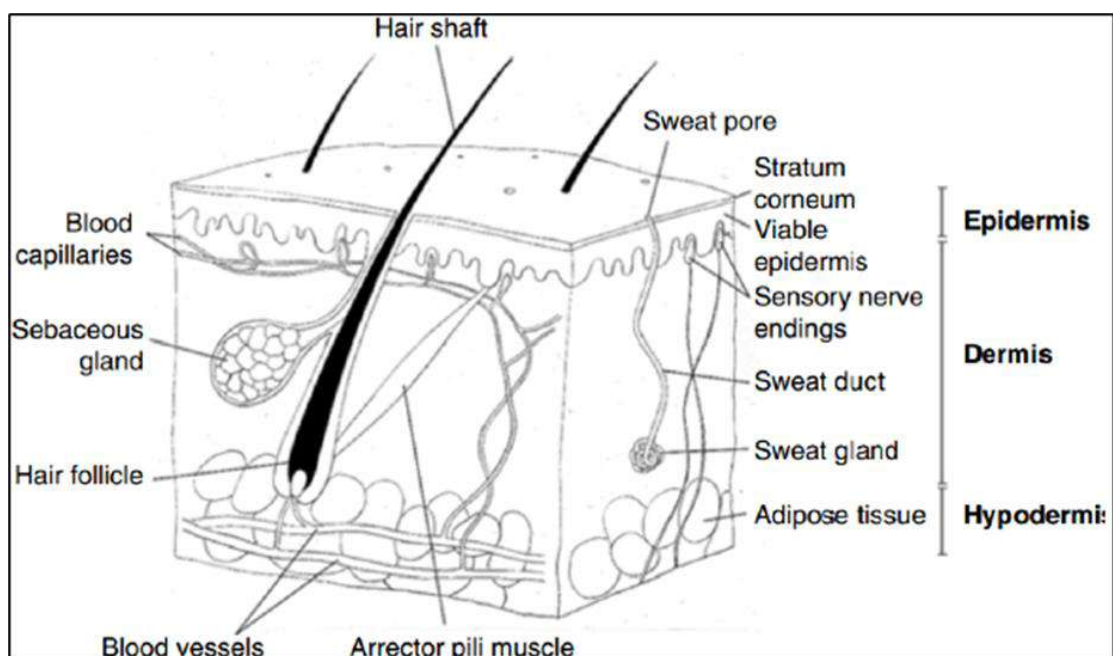


Figure 4: Human Skin

**Barrier Function:**

The skin acts as a barrier between the body and the external environment. The stratum corneum of the epidermis helps to prevent the entry of foreign substances, such as bacteria and viruses, into the body. The skin also helps to prevent the loss of water from the body, which is important for maintaining hydration.

- **Thermoregulation:**

The skin plays an important role in regulating body temperature. When the body becomes too warm, the blood vessels in the skin dilate, allowing heat to be released from the body. When the body becomes too cold, the blood vessels in the skin constrict, reducing blood flow to the skin and conserving heat.

- **Sensation:**

The skin contains several types of sensory receptors, including mechanoreceptors, thermoreceptors, and nociceptors. Mechanoreceptors detect pressure, touch, and vibration. Thermoreceptors detect temperature changes and nociceptors detect painful stimuli.

**2. MATERIALS AND METHODS**

**2.1 Materials**

**2.1.1 Herbal Extract (*Tridax procumbens*)**

**Synonyms:**

*Tridax procumbens* also known as coat buttons, *Tridax daisy*, Mexican daisy, and smallpox weed, Avanti.

**Kingdom:** Plantae.

**Genus:** *Tridax*

**Species:** *T. procumbens*

**Botanical Name:** *Tridax procumbens*

**Family:** *Tridax procumbens* belongs to the Asteraceae family, also known as the daisy or sunflower family.



Figure 5: Flower of *Tridax procumbens*

**Microscopy:**

Microscopic analysis of *Tridax procumbens* shows the presence of a thick cuticle, paracytic stomata, and glandular trichomes. The leaf has a dorsoventral mesophyll, with a single-layered

palisade and spongy parenchyma. The stem shows the presence of collenchymatous cells and vascular bundles arranged in a ring-like pattern.

### **Macroscopy:**

*Tridax procumbens* is a small herbaceous plant that grows up to 60 cm in height. It has a taproot system and a hairy stem that is erect or prostrate. The leaves are simple, alternate, and toothed with a triangular shape. The flowers are yellow, with ray florets arranged in a head-like inflorescence. The fruits are small, oblong achenes with pappus. Geographical location: *Tridax procumbens* is native to South America but is widely distributed throughout tropical and subtropical regions of the world. It is found in India, Africa, and parts of North America. In India, it is commonly found in the southern states of Karnataka, Tamil Nadu, and Kerala.

### **Cultivation and collection:**

*Tridax procumbens* is a hardy plant that can grow in a wide range of soil types and climatic conditions. It is propagated by seeds and can be grown as a weed in many areas. However, for commercial cultivation, the seeds can be sown in well-drained soil during the rainy season. The plant can be harvested after 3-4 months of growth when it is in full bloom. The aerial parts of the plant are collected, dried, and stored in a dry place away from direct sunlight for further use.

### **Medicinal Uses of *Tridax procumbens*:**

*Tridax procumbens* is renowned for its diverse medicinal applications, each contributing to its significance in traditional and contemporary healthcare practices. Its medicinal applications are delineated as follows:

- **Wound Healing:**

*Tridax procumbens* has been traditionally used for its wound-healing properties. The leaves of the plant can be crushed and applied topically to wounds, cuts, and bruises. They possess antimicrobial and anti-inflammatory properties,

which aid in faster healing and prevention of infections.

- **Anti-inflammatory Effects:**

The plant exhibits significant anti-inflammatory properties. The leaves or extracts of *Tridax procumbens* can be used to alleviate symptoms of inflammation, such as swelling, redness, and pain. It can be applied topically or consumed as a decoction.

- **Digestive Disorders:**

*Tridax procumbens* is known to possess digestive properties and has been used to treat various gastrointestinal disorders. The plant can be prepared as a tea or decoction and consumed to relieve symptoms such as indigestion, bloating, and stomach aches.

- **Antipyretic Activity:**

The leaves and stems of *Tridax procumbens* possess antipyretic properties, which can help reduce fever. The plant can be prepared as an infusion and consumed to bring down body temperature during fever episodes.

- **Respiratory Disorders:**

*Tridax procumbens* has been used in traditional medicine for the treatment of respiratory conditions such as cough, bronchitis, and asthma. The leaves or extracts can be consumed or used in a steam inhalation to relieve respiratory symptoms.

- **Antimicrobial Properties:**

*Tridax procumbens* exhibits antimicrobial activity against various pathogens, including bacteria and fungi. It can be used topically to prevent or treat skin infections caused by these microorganisms.

- **Anti-diabetic Effects:**

Studies have suggested that *Tridax procumbens* may possess antidiabetic properties. The plant extracts have shown potential in reducing blood glucose levels and improving insulin sensitivity. However, further research is required to establish its efficacy in diabetic management.



### 2.1.2 ALOE VERA

**Kingdom:** Plantae.

**Genus:** Aloe

**Species:** A. vera

**Botanical Name:** Aloe vera

**Family:** Liliaceae



**Figure 6: Aloe Vera**

#### Medicinal Uses of Aloe vera:

- **Skin Healing:**

Aloe vera is widely recognized for its healing properties on the skin. It can be used to treat various skin conditions such as burns, cuts, wounds, and insect bites. The gel inside the leaves of Aloe vera contains compounds that help soothe inflammation, reduce pain, and promote tissue regeneration.

- **Sunburn Relief:**

Aloe vera gel is commonly used as a natural remedy for sunburn. Its cooling and moisturizing properties can help alleviate the discomfort associated with sunburn, reduce redness, and promote the healing process of damaged skin.

- **Moisturizer:**

Aloe vera gel is an excellent natural moisturizer for the skin. It can be used to hydrate and nourish the skin, leaving it soft and supple. Aloe vera is often included in various cosmetic products such as lotions, creams, and soaps due to its moisturizing benefits.

- **Digestive Aid:**

Aloe vera has been used for centuries to support digestive health. The latex found in the outer layer of the Aloe vera leaf has laxative properties and

can be used as a natural remedy for constipation. However, it is important to use Aloe vera latex with caution and under the guidance of a healthcare professional.

- **Wound Healing:**

Aloe vera gel can accelerate the healing process of wounds. It has been found to promote collagen production, enhance tissue regeneration, and reduce the risk of infection. Aloe vera gel can be applied topically to minor wounds, cuts, or abrasions to facilitate healing.

- **Anti-inflammatory Effects:**

Aloe vera possesses anti-inflammatory properties that can help reduce inflammation in various conditions. It can be applied topically to alleviate inflammation caused by skin irritations, acne, or inflammatory skin conditions like psoriasis or eczema.

- **Oral Health:**

Aloe vera juice or gel can be used as a natural mouthwash to promote oral health. It has antimicrobial properties that can help reduce plaque formation, gingivitis, and bad breath. However, it should be used in moderation and not swallowed as the latex component can have a laxative effect.

### 2.1.3 MENTHA PIPERITA

**Kingdom:** Plantae

**Genus:** Mentha

**Species:** M. piperita

**Botanical Name:** Mentha piperita

**Family:** Lamiaceae



**Figure 7: Mentha piperita**

#### Medicinal Uses of Peppermint Oil:

- **Digestive Aid:**

Peppermint oil is commonly used to support digestive health. It has been found to help alleviate symptoms such as indigestion, bloating, and gas. Peppermint oil can help relax the muscles of the gastrointestinal tract, promoting smoother digestion and reducing discomfort.

- **Headache and Migraine Relief:**

Peppermint oil has analgesic and vasoconstrictive properties that can help relieve headaches and migraines. Applying diluted peppermint oil to the temples or inhaling its aroma may provide relief by easing tension and improving blood flow.

- **Respiratory Support:**

Inhalation of peppermint oil vapour can help clear the respiratory passages and provide relief from congestion due to colds, sinusitis, or allergies. It has expectorant properties that can help loosen mucus and reduce coughing.

- **Muscle Pain and Joint Relief:**

Peppermint oil has a cooling effect and can help soothe sore muscles and joints. It is commonly used topically to alleviate pain caused by conditions such as muscle strains, arthritis, or fibromyalgia.

- **Mental Clarity and Focus:**

The aroma of peppermint oil has been found to enhance mental alertness, improve focus, and increase cognitive performance. Inhaling peppermint oil or using it in a diffuser can help promote mental clarity and concentration.

- **Stress and Anxiety Reduction:**

Peppermint oil has calming and relaxing properties that can help reduce stress and anxiety. Inhalation of its aroma or using it in aromatherapy can induce a sense of calmness and provide relief from emotional tension.

- **Dental Care:**

Peppermint oil is commonly used in oral care products as it can help freshen your breath, kill bacteria that cause bad breath, and promote oral hygiene.

## 2.1.4 Vitamin E

Vitamin E refers to a group of fat-soluble compounds known as tocopherols and tocotrienols. The most common and biologically active form of vitamin E is alpha-tocopherol.



Figure 8: Vitamin E Capsules

### Medicinal Uses of Vitamin E:

- **Antioxidant Properties:**

Vitamin E is a potent antioxidant that helps protect cells from damage caused by free radicals. It helps neutralize the harmful effects of oxidative stress, which is associated with various chronic diseases such as heart disease, cancer, and age-related macular degeneration.

- **Skin Health:**

Vitamin E is known for its beneficial effects on the skin. It helps moisturize and nourish the skin, promoting its health and elasticity. Vitamin E is often used in skincare products to improve the appearance of scars, wrinkles, and dry skin conditions.

- **Wound Healing:**

Vitamin E plays a role in promoting wound healing. It helps in the formation of new blood vessels and collagen synthesis, which are essential for tissue repair. Applying vitamin E topically or taking it as a supplement may aid in the healing process of wounds, burns, and surgical incisions.

- **Immune System Support:**

Vitamin E plays a vital role in supporting a healthy immune system. It enhances the function of immune cells and helps protect them from damage. Adequate vitamin E intake is important for

maintaining optimal immune function and reducing the risk of infections.

- **Heart Health:**

Vitamin E has been associated with cardiovascular benefits. It helps prevent the oxidation of LDL cholesterol, which reduces the risk of plaque formation in arteries. This antioxidant effect may contribute to a lower risk of heart disease and stroke.

- **Eye Health:**

Vitamin E is believed to have a protective effect on eye health. It helps combat oxidative stress in the eyes and may reduce the risk of age-related macular degeneration and cataracts. Adequate intake of vitamin E, along with other essential nutrients, is important for maintaining good vision.

- **Neurological Health:**

Vitamin E has been studied for its potential role in maintaining brain health and reducing the risk of cognitive decline. It has antioxidant and anti-inflammatory properties that may help protect against neurodegenerative diseases such as Alzheimer's disease.

### 2.1.5 Glycerine Soap Base

The glycerine soap base is typically made up of glycerine, a type of humectant, along with other ingredients such as oils, fats, and lye (sodium hydroxide). Glycerine, also known as glycerol, is a colourless and odourless liquid that is derived from plant or animal fats.



Figure 9: Glycerine Soap Base

### Medicinal Uses of Glycerine Soap Base:

- **Moisturizing:**

The glycerine soap base is highly moisturizing due to its glycerine content. Glycerine attracts moisture from the air to the skin, helping to keep it hydrated and preventing dryness. It is particularly beneficial for individuals with dry or sensitive skin as it helps to maintain the skin's natural moisture barrier.

- **Gentle Cleansing:**

The glycerine soap base is known for its gentle cleansing properties. It effectively removes dirt, excess oil, and impurities from the skin without stripping away its natural oils. This makes it suitable for individuals with sensitive skin or conditions like eczema or psoriasis.

- **Soothing:**

The glycerine soap base can have a soothing effect on the skin. It is often used to alleviate itching, irritation, and inflammation associated with various skin conditions. The moisturizing properties of glycerine help to soothe and hydrate the skin, promoting its healing and reducing discomfort.

- **Non-Irritating:**

The glycerine soap base is generally non-irritating and well-tolerated by most skin types. It is free from harsh chemicals and synthetic fragrances that can cause irritation or allergic reactions. People with sensitive skin or allergies can often use glycerine soap base without experiencing adverse effects.

- **Acne Treatment:**

The glycerine soap base can be beneficial for individuals with acne-prone skin. It gently cleanses the skin without clogging pores, helping to prevent the formation of acne. Additionally, its moisturizing properties can help balance oil production and reduce excessive sebum on the skin's surface.

- **Wound Healing:**

The glycerine soap base can aid in the healing of minor wounds or abrasions. It helps to keep the affected area clean and moisturized, promoting the natural healing process. The gentle nature of the glycerine soap base makes it suitable for cleansing wounds without causing further irritation.

## 2.2. METHODOLOGY

### 2.2.1 Collection of Materials

The *T. procumbens* plants were collected from the Garden of Mahavir Institute of Pharmacy, Varvandi, Mhasrul, Nashik, Maharashtra, India. The collected plant was authenticated as *T. procumbens* by Botanist Prof. Manisha M Raut and Plant expert Tushar Pingale (Vrukshavalli Foundation, Raha Foundation). The leaves were separated from the plant material. The collected leaves were washed with water and shade dried for 3 days and ground into a fine powder using a mixer grinder. The glycerine soap base is brought from the E-commerce site Amazon India. Vitamin E oil is purchased from a local pharmacy Kansara Medical. Peppermint oil was purchased from the local market.

### 2.2.2 Preparation of Plant Extract

The dried leaf powder was used for the extraction of phytoconstituents. The powdered plant leaves were stored in an airtight container and the powder was extracted using methanol as solvent by the Soxhlet extraction method. *T. procumbens* dried leaf powder is weighed accurately and packed in filter paper. The solid matrix is kept in the Soxhlet evaporator and the solvent is heated in the process of reflux. To 50 g of dried leaf powder 500 ml of methanol is used in the extraction process. Continuous extraction was done and solvent was transferred into the reservoir from the chamber. This process is continued for 12 hours and the extract is collected and concentrated using a hot water bath. The final concentrated extract is used in the formulation.



Figure 10: Soxhlet Extraction of *Tridax procumbens*

### 2.2.3 Formulation of Herbal Soap

1. The glassware is sterilized by dry heat sterilization technique.
2. 20g of glycerine soap base was weighed and melted.
3. The glycerine soap base can be prepared using coconut oil and sodium hydroxide, it is alcohol-free.
4. In another beaker plant extract, vitamin E oil and aloe vera gel, were mixed until all the ingredients dissolved completely.
5. 0.5 ml of Peppermint oil is added for the fragrance and its cooling property to the mixture.
6. Finally, the plant extract mixture is incorporated into the melted soap base.
7. This mixture is poured into moulds and allowed to solidify at room temperature.



Figure 11: Herbal soap prepared from *Tridax procumbens*



Four formulations were prepared and tested for their activity in each preparation some changes were made to the formula as given in Table No.1, Table No.2, Table No.3 and Table No.4, respectively.

The ingredients of the formulation are:

- Plant extract (Tridax procumbens)
- Vitamin E
- Peppermint Oil
- Aloe vera Gel
- Glycerine Soap Base

## 2.3 FORMULATIONS

Table No.3		
Sr. No.	Extract	Quantity
1.	Plant extract	1g
2.	(Tridax procumbens)	0.5g
3.	Vitamin E	0.5ml
4.	Peppermint Oil	1g
5.	Aloe vera Gel	Q.S. (up to 20 g)

Table no.2.		
Sr. No.	Extract	Quantity
1.	Plant extract (Tridax procumbens)	0.50g
2.	Vitamin E	0.5g
3.	Peppermint Oil	0.6ml
4.	Aloe vera Gel	2 g
5.	Glycerine Soap Base	0.50g

Table No. 3		
Sr.No.	Extract	Quantity
1.	Plant extract (Tridax procumbens)	0.65g
2.	Vitamin E	0.5g
3.	Peppermint Oil	0.8 ml
4.	Aloe vera Gel	1 g
5.	Glycerine Soap Base	Q.S. (up to 20 g)

Table No.4		
Sr. No	Quantity	Extract
1.	Plant extract (Tridax procumbens)	1g
2.	Vitamin E	0.5g
3.	Peppermint Oil	1ml
4.	Aloe vera Gel	1 g
5.	Glycerine Soap Base	Q.S. (up to 20 g)
6.	Colouring Agent	Q.S.

## 2.4 Phytochemical Analysis of Plant Extract

### 1. Test for Flavonoids

Alkaline reagent test: A few drops of 10 % NaOH solution were added to 2 - 3 mL of extract in a test



tube. The formation of an intense yellow colour that becomes colourless in addition to dilute HCl indicates the presence of flavonoids.

## 2. Test for Phenols

0.5 mL of alcoholic Ferric chloride (FeCl<sub>3</sub>) solution was added to 2 mL of extract. The formation of an intense bluish-black colour in addition to the FeCl<sub>3</sub> solution indicates the presence of Phenols.

## 3. Test for Tannins

Gelatine test: Gelatine solution was prepared by dissolving gelatine powder in water by heating using a water bath. To this gelatine solution, 2 mL

extract was added. The presence of tannins is indicated by the formation of a white precipitate.

## 4. Test for Alkaloids

Iodine test: A few drops of dilute Iodine solution are added into 3 ml of test solution. The formation of a blue colour which disappears on boiling and reappears on cooling indicates the presence of alkaloids.

## 5. Test for Saponins

### Foam test:

The extract was diluted with 20 ml of distilled water and shaken for 15 min in a graduated cylinder. The formation of a foam layer indicates the presence of saponins.

### Phytochemical Analysis Observation Results:

Table No. 5		
TEST	OBSERVATION	RESULT
Test for Flavonoids (Alkaline reagent test)	Dark yellow colour was formed	Present
Test for Phenol	Bluish-black colour was observed	Present
Test for Tannins (Gelatine Test)	White precipitate was formed	Present
Test for Alkaloids (Iodine test)	Blue colour was observed and disappears on heating	Present
Test for Saponins (Foam test)	Foam was generated on shaking	Present

## 2.5 Evaluation Tests

The following are some common evaluation tests for herbal soap:

### 1. Fragrance:

The fragrance of the soap can be evaluated by performing a sensory evaluation test.

Appearance: The appearance of the soap can be evaluated by examining its colour, texture, and shape.

### 2 pH:

The pH of the soap is an important parameter as it determines the compatibility of the soap with the skin. The pH of the soap should be in the range of 8 to 10.

### 3 Cleansing Power:

The cleansing power of the soap can be evaluated by measuring the amount of dirt, oil and other impurities removed from the skin after using the soap.

### 4 Moisturizing Ability:

The moisturizing ability of the soap can be evaluated by measuring the hydration level of the skin after using the soap.

### 5 Skin Irritation:

The skin irritation potential of the soap can be evaluated by performing a patch test on the skin.

Foaming Index: Foaming index is the measure of the foam ability and foam stability of the soap. It is determined by measuring the height of the foam generated by the soap solution after a certain amount of time.



### 3. RESULT

Parameters	Results
Fragrance	Pleasant fragrance of peppermint
Appearance	Harmonious blend of colour, texture and shape
pH	Between 8.0 to 8.5
Cleansing Power	Notable removal of dirt, oil, and other impurities from the skin upon use
Moisturizing Ability	Post-application, shows an elevated level of skin hydration
Skin Irritation	No irritation was observed after patch test on skin
Foaming Index	Between 4 to 5cm

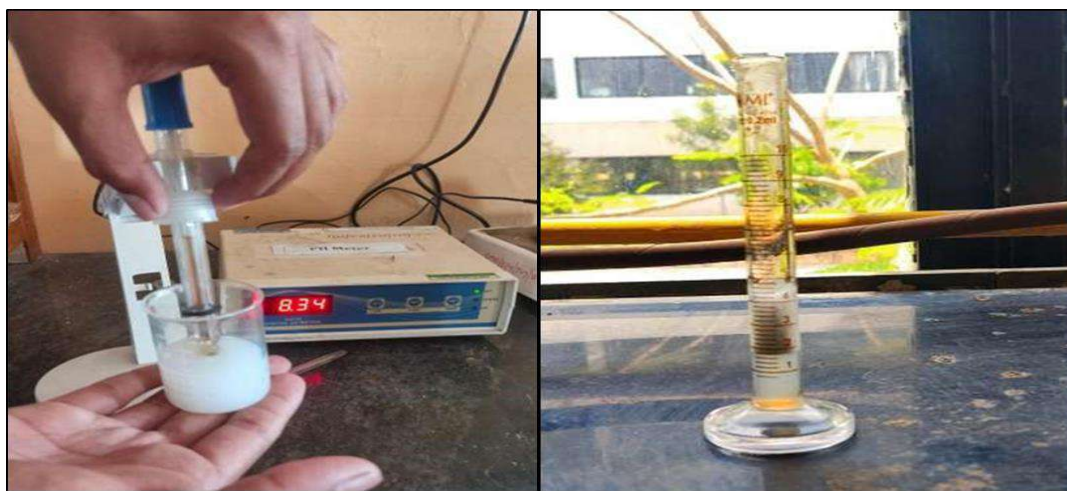


Figure 12: a) testing pH of the soap b) Foaming index of the soap.

### CONCLUSION

In conclusion, the formulated herbal soap, enriched with Tridax procumbens, aloe vera, vitamin E, and peppermint oil as key ingredients, exhibits promising physical characteristics and specific activities beneficial for skin health. The soap demonstrates favourable attributes such as appropriate colour, pleasant odour, and homogeneity. The pH level falls within the suitable range for skin use, and the foaming index meets acceptable standards. The significant antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*, particularly in the soap containing 5% Tridax procumbens extract, underscores its potential as a cleansing and protective skincare product. The integration of Tridax procumbens contributes to skin healing, while aloe vera, vitamin E, and the soap base provide moisturizing and nourishing effects.

Moreover, the anti-inflammatory properties of Tridax procumbens and aloe vera, coupled with the soothing characteristics of peppermint oil, make the herbal soap a potential solution for addressing skin conditions such as rashes, eczema, and sunburns. The inclusion of vitamin E imparts antioxidant protection, guarding the skin against free radicals and oxidative stress. The soap's refreshing and invigorating qualities, attributed to the presence of peppermint oil, offer a sensory experience that goes beyond mere cleansing. However, it's crucial to acknowledge that the efficacy of the herbal soap may vary based on ingredient concentrations and quality. Individual results are subject to variation, and it is advisable to conduct a patch test and seek advice from healthcare professionals for specific skin concerns or allergies. Overall, the findings suggest that the formulated herbal soap holds promise as a holistic

skincare solution, combining cleansing, healing, and nourishing properties for healthier and radiant-looking skin.

### ACKNOWLEDGEMENT

We extend our heartfelt gratitude to the Mahavir Institute of Pharmacy for generously granting us access to their invaluable resources, state-of-the-art equipment, and well-equipped laboratory facilities, which significantly contributed to the successful completion of our research project. Furthermore, our appreciation goes to our mentor, Assistant Professor Ms. Manish Raut, whose guidance, expertise, and unwavering support played a pivotal role in shaping the course of our research endeavours.

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**HOW TO CITE:** Y. D. Pardeshi, V. R. Patel, O. B. Kasar, G. S. Amrutkar, Formulation and Evaluation of a Herbal Soap from *Tridax Procumbens*, *Int. J. of Pharm. Sci.*, 2024, Vol 2, Issue 1, 214-227. <https://doi.org/10.5281/zenodo.10512066>

