



# REVIEW ON NEEM WITH TEA TREE OIL OF HERBAL SOAP FORMULATION & EVALUATION

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## ABSTRACT

The formulation of soap combining Neem (*Azadirachta indica*), Tea tree oil (*Melaleuca alternifolia*), Shikakai (*Acacia concinna*), and Reetha (*Sapindus mukorossi*) offers a natural eco-friendly alternative to synthetic cleansers. The objective to create a herbal soap with enhanced antimicrobial, cleansing, targeting both skin health and personal hygiene. Neem, known for its antibacterial, antifungal, and anti-inflammatory properties, is a key ingredient in treating skin infections and soothing irritations. Tea tree oil, with its potent antiseptic qualities, complements neem by effectively combating acne and skin inflammations. Shikakai, a traditional Ayurvedic herb, acts as a gentle cleanser, maintaining the skin's natural oils and preventing dryness. Reetha, a natural surfactant, aids in deep cleansing by removing dirt and excess oils while being mild on the skin. The formulation process involves saponifying a natural oil base, blending it with the herbal powders and essential oils to create a balanced soap with superior lathering, moisturizing, and antimicrobial properties. This soap is free from harmful chemicals and artificial additives, making it both skin-friendly and biodegradable.

**Keywords** – *Neem with tea tree oil, shikakai, reetha, antimicrobial, antifungal, antibacterial.*

## INTRODUCTION

The skin is the body's largest organ, and because it is exposed to the environment, it is prone to various skin conditions like hives, eczema, psoriasis, warts, acne, and others. To prevent skin problems, it's important to keep the body's largest organ, which is always exposed to the environment, clean and free from harmful microbes [1,2]. Skin care herbal formulations that fight fungi, bacteria and microbes may be made from any number of plant components, including the stem, leaves, roots, bark, flower, and fruit. These medications are often made as cream, lotions, gels, soaps, or ointments when meant to be applied to the skin. One of the most popular formulations for skincare and the treatment of skin ailments is herbal soap [3,4].

### 1. Tea Tree Oil

Tea tree oil (TTO) is an essential oil obtained by steam distillation of the leaves of the Australian tea tree (*Melaleuca alternifolia*). It contains around 100 different compounds, mostly monoterpenes and their alcohols. The main constituent of TTO is terpinen-4-ol (30–40%). Smaller quantities of structurally related substances, e.g.  $\alpha$ -terpinene,  $\gamma$ -terpinene, terpinolene and  $\alpha$ -terpineol, are also present along with monoterpenes such as  $\alpha$ -pinene,  $\beta$ -pinene, p-cymene, limonene, and 1,8-cineole as well as sesquiterpenes such as aromadendrene, viridiflorene and  $\delta$ -cadinene [5]. TTO is reputed to have several medicinal properties including antibacterial [6], antifungal [7], [8], antiviral [9], [10], anti-inflammatory [11] and analgesic properties [12]. In recent years, it has become especially popular as an antimicrobial agent applied to the skin. It is used in a 5% semisolid O/W emulsion and cream, respectively, for topical treatment of acne and toenail onychomycosis in humans [13], [14]. TTO is also recommended as an antiseptic in mouthwashes, and for treating boils and vaginitis [12]. In skin care products it is marketed for cleaning, healing, and relieving itching, hotspots, abrasions and other minor rashes and irritations. To improve how Tea Tree Oil (TTO) is applied to the skin, it's important to understand how its components are absorbed through human skin. The goal of this study was to examine how well terpinen-4-ol, the main component of tea tree oil (TTO), can pass through human skin. Using a modified HET-Cam test system, a high irritant potential for native TTO has been shown by Reichling et al [15].

### 2. Neem

People have been using the neem (*Azadirachta indica*) as a medicine for a long time. Many compound are found in different parts of the tree, such as the seeds, bark, and leaves. The effectiveness of each part of neem in treating various types of diseases may differ due to their different chemical properties [16]. Since 1994, trees have been planted in small roadside areas as windbreaks. In southern Sonora, Mexico, neem trees show difference in appearance and quality. The fruits vary in size and shape, and the oil content and quality are inconsistent. Neem is often used in Ayurveda because it contains active compounds like azadirachtin, azadirone, and flavonoids. These active components have potential therapeutic properties [17]. Neem leaf extract consists of nimbidin, cyclic trisulphide, cyclic tetrasulphide, and polyphenolic Flavonoids. These compounds have antibacterial, antifungal and anticancer properties. It is also rich in antioxidants, which help in the growth of new skin cells. In Ayurvedic medicines, neem leaf Has been used in the treatment of leprosy, eye problems, epistaxis, intestinal worms, anorexia, Biliousness, and skin ulcers [16,18,19,20].

Soap is made through a saponification reaction, where esters break down into alcohol and salts. Saponification is commonly known as the alkaline breakdown of esters. Soap is sodium or potassium salt of fatty acids, created by reacting these fats with sodium or potassium hydroxide. As an anionic surfactant, soap is used for cleaning and washing skin and clothes. The fatty acids, stearic, palmitic, myristic, lauric and oleic acids, contribute to Lathering and washing properties of the soaps [21]. Herbal soap is a type of medicine that contains antibacterial and antifungal agents. It is made from parts of plants, like leaves, stem, roots, and fruits, and is used to treat injuries, diseases, or promote good health [22]. Herbal soaps are skin-purifying and skin-beautifying products. Beauty of skin and hair is affected by a person's health, lifestyle, job, surroundings, and selfcare. Summertime dehydration from prolonged heat contact to the skin results in wrinkles, freckles, blemishes, pigmentation, and sunburns [23]. Most commercial soaps today contain chemicals that have antibacterial properties and may help treat skin infections. Soaps and detergents are considered disinfectants that are necessary for everyday hygiene routines. Cleaning agents, such as soaps, can be liquid, solid, semisolid, or powdered. In order to preserve health and beauty and get rid of odours from the body or inanimate objects, such as clothing, they are used to eliminate dirt, including dust, bacteria, stains, and unpleasant smells. Commercial soap is typically composed of harmful substances such plastics, aluminium, barium, mercury, and bisphenol, among others. These substances are vaporized and absorbed through the skin, both of which have detrimental side effects on the body [24]. The use of herbal medicines has risen a lot in recent years. It is believed that around 80% of the world's population uses herbal plant extracts in their medicines, both in developed and developing nations. The field of medicinal research known as "Herbal Medicinal Products" emerged as a result of the astounding increase in the use of herbal plants and their extracts [25]. The most common kind of skin infection is caused by fungi, and it has to be treated right away and maintained with regular care. Millions of individuals have suffered from skin conditions for a long time. Some of the most prevalent skin issues are acne, scars of acne, hives, dryness, rashes, cracked skin, psoriasis, sun damage, dullness, stretch marks, eczema, and suppleness [26].

### 3. Advantage of Herbal Soap



In this review article herbal soap containing neem with tea tree oil, tulsi and reetha as natural plant ingredients and this content gives or shows antibacterial antifungal & anti-inflammatory activity. Neem is the main ingredient in this soap and has medicinal properties. Neem with tea tree oil and Its extract exhibit Anti-inflammatory, Antifungal, antibacterial, antioxidant property [27]. Reetha is an exceptional cleanser. It's a great alternative to soap face wash because it contains saponin. It is also good for use on sensitive skin. A mix of Reetha and chickpeas provides a gentle, nourishing experience for a skin. It has conditioning properties that help keep the skin moisturized and cool. Reetha prevents the skin from drying, keeping it soft and smooth, and it also helps treat eczema and psoriasis. Shikakai is quite effective in treating various skin infection like scabies and also used as a ant wrinkles property [27]. Palm oil and coconut oil are also used in making the herbal soap. These Compounds are rich in vitamin E, thus help to protect body tissue from damage and heal wounds faster [28].



## 4.METHODS

### 4.1.MATERIALS

Neem leaves (*Azadirachta indica*) were collected from Kuala Pilah, Negeri Sembilan, Malaysia. The leaves were sorted and washed with distilled water. The leaves were dried at room temperature, grinded to small pieces, and kept for further usage [13,29] Distilled water, sodium hydroxide (NaOH), olive oil, and coconut oil were used as received without further purification.

#### 4.1.1Ingredient and their properties

- Neem leaf extract :- Provides antibacterial and antifungal properties, helps in skin healing and rejuvenation.
- Tea tree oil :- Known for its antimicrobial properties, helps in treating acne and skin infections.
- Shikakai extract :- Natural cleanser that promotes hair growth, strengthens hair roots, and adds shine to hair.
- Reetha (soapnut) extract :-Gentle cleanser that helps in removing dirt and impurities from the skin and hair.

#### 4.1.2.Other Ingredients

- Coconut oil :- Provides moisturizing properties and creates a rich lather in the soap
- Olive oil :- Adds nourishment and hydration to the skin.
- Castor oil :- Boosts lather and moisturizing.
- Shea butter :- Helps in moisturizing and softening the skin.
- Lye (sodium hydroxide) :- Essential for the saponification process to turn oils into soap
- Water :- As needed for dissolving NaOH.
- Essential oil (optional) :- For fragrance (e.g. lavender or eucalyptus oil).

#### 4.2.Extract of Neem Leaves

The neem leaves aqueous extraction was prepared by using blending method. Grinded leaves measuring 20 g were taken and placed into a grinder machine filled with 200 mL of distilled water and blended for 5 min. The sludge in the mixture was then removed using filter paper. The aqueous filtrate was kept for further experiment.

#### 4.3.Soap formulation

1. Prepare the Lye Solution: Dissolve the sodium hydroxide in water and let it cool. Always add NaOH to water, not the other way around, to avoid dangerous reactions.
2. Melt the Oils: In a separate container, melt the solid oils (shea butter/cocoa butter) and mix them with the liquid oils (coconut, olive, castor oil).
3. Mix the Lye and Oils: Once both the oils and the lye solution have cooled to around 40-50°C, slowly add the lye solution to the oil mixture while stirring continuously.
4. Blend the Mixture: Use a hand blender to blend the mixture until it reaches "trace," a thickening point where the oils and lye have emulsified.
5. Add Herbal Ingredients: Mix in the Neem extract powder, Shikakai powder, and Reetha powder. Ensure they are evenly distributed throughout the soap mixture. Add the tea tree oil and any optional essential oils at this stage for fragrance.
6. Pour into Molds: Pour the soap mixture into silicone molds and tap gently to release air bubbles.
7. Curing: Allow the soap to sit in the molds for 24-48 hours before unmolding. After unmolding, let the soap cure for 4-6 weeks in a cool, dry place. This curing time allows the soap to harden and develop a better lather.

#### 4.4.CONTENT OF SOAP

#### 4.4.1.NEEM

neem leaves



**Botanical name:-** Azadiractaindica

**Part typically used:-** Leaves

**Colour:-** Green

**Description:** - Compound alternate, rachis 15-25cm long, 0.1cm thick, leaflet with oblique, serrate, 7-8.5 cm long and 1-1.7 cm wide slightly yellowish green in colour.

**Constituents:-** Neem leaves contain various compounds, including flavonoids, steroids, margosic acid, vanillic acid, glycosides, beta-sitosterol, nimbectin, kaempferol, and quercetin[12].

#### 4.4.2.REETHA



**Biological Name:** - Sapindus mukorossi

**Part Typical used:** - Seeds

**Colour:** - Brown

**Uses:** - Detergent Surfactant

**Description:** - The fruit is a small leathery skinned drupe, 1 to 2 cm in diameter. It turns yellow when ripe and then blackish, containing 1 to 3 seeds.

#### 4.4.3.SHIKAKAI



**Biological name:** - *Acacia concinna*

**Common name:** - shikekai

**Chemical Constituents:** - Spinasterone, Acacic acid

**Part Typically used:** - Fruits pods

**Colour:** - Brown

**Uses:** - Antidandruff detergent, Antifungal, Antibacterial, Anti-oxidant, Hair growing.

#### 4.4.4.TEA TREE OIL



**Biological Name :-** *Melaleuca alternifolia*

**Common Name :-** Tea Tree Oil

**Chemical Constituents :-** Terpinen-4-ol,  $\gamma$ -terpinene, and  $\alpha$ -terpinene

**Part Typically Used :-** Leaves of *Melaleuca alternifolia*

**Colour :-** Pale yellow to nearly colourless and clear

**Uses :-** Anti-bacterial, Anti-fungal, anti-inflammatory

table 1

CHEMICALS	SOURCE
Coconut oil	Laboratory Reagent
Olive oil	Laboratory Reagent
Shea Butter	Laboratory Reagent
Lye (Sodium Hydroxide)	Laboratory Reagent

table 2

Herbal plant	Source
Tea Tree Oil	Plant
Neem	Plant
Shikakai	Plant
Reetha	Plant

#### 4.5.FORMULAE

The formula in Table 3 is ideal for making herbal soaps

table 3

Sr. No.	Ingredients	Quantity %
A.	Coconut Oil	20-30%
B.	Olive Oil	20-30%
C.	Castor oil	5%
D.	Shea Butter	5-10%
E.	Neem leaf extract	5-10%
F.	Tea Tree Oil	1-2%
G.	Reetha (soapnut) extract	5-7%
H.	Shikakai extract	5-8%
I.	NaOH	As per oil ratio(for saponification)

#### 4.6.EVALUATION

The formulated herbal soap was tested for the following:

##### 4.6.1.Organoleptic Evaluation :-

##### 1. Appearance:

- Visual Clarity: The soap should have a uniform, smooth texture without visible impurities, air bubbles, or cracks.
- Shape: Depending on the mold used, the soap should maintain a defined, solid shape with smooth edges after curing.
- Consistency: After curing, the soap should be firm and solid, not crumbly or too soft.

##### 2. Colour:

The soap is expected to have a natural, earthy color ranging from light brown to dark green, depending on the concentration of Neem, Shikakai, and Reetha powders used. The natural ingredients may create slight variations in the soap's final color.

Over time, the color should remain stable without significant fading or discoloration.

##### 3. Odour:

- Initial Scent: The soap should have a mild, herbal fragrance with dominant notes of tea tree oil, which provides a fresh, medicinal scent. Neem may contribute to an earthy undertone, while Reetha and Shikakai have mild, natural scents.
- After Application: The herbal scent should linger mildly on the skin after washing, without being overpowering.
- Stability: The fragrance should remain stable throughout the soap's shelf life without becoming rancid or unpleasant.

##### 4. Texture:

- Surface Feel: The soap should have a smooth, even surface that is free from grit, especially after the inclusion of powdered Shikakai and Reetha.
- In-Hand Feel: The soap should feel smooth and slightly oily due to the natural oils, which contribute to moisturizing properties.

- During Use: When applied to wet skin, the soap should produce a soft, creamy lather without a sticky or greasy residue. It should not feel too abrasive, even with the herbal additives.

#### 5. Lathering Ability:

- Foam: The soap should create a light to moderate lather. Reetha and Shikakai, both natural surfactants, contribute to cleansing while maintaining gentle foaming action.
- Rinsability: The soap should rinse off easily without leaving a film or residue on the skin.

#### 6. Skin Feel:

- During Use: The soap should glide smoothly over the skin and provide a refreshing, soothing effect. The combination of oils should prevent the soap from feeling harsh or drying.
- Post Use: After rinsing, the skin should feel clean, soft, and moisturized, without tightness or dryness. Neem and Tea Tree Oil should help calm irritation and leave the skin feeling refreshed.

#### 7. Stability (Over Time):

- Physical Stability: The soap should retain its shape, firmness, and texture over time without significant shrinkage, cracking, or becoming too soft.
- Fragrance and Color Stability: Both the scent and color should remain relatively unchanged over time if stored in a cool, dry place, indicating good formulation stability.

#### 4.6.2. Physical Evaluation :-

The formulated herbal soap was tested for the following properties:

##### 1. pH Level:

- Target pH: The soap should have a pH between 8 and 10, which is typical for cold-processed soaps. However, it should not exceed this range, as overly alkaline soap can irritate the skin.
- Testing Method: Use a pH meter or pH strips to measure the pH of a 1% soap solution (1 gram of soap dissolved in 100 mL of distilled water).

##### 2. Hardness:

- Firmness of the Soap: The hardness of the soap is crucial for durability and ease of use. It should be firm and solid but not brittle. The inclusion of oils like coconut and shea butter helps achieve this balance.
- Testing Method: Press the soap lightly to test its firmness. A well-cured soap should feel solid, not squishy or too soft, and should resist indentation.

##### 3. Moisture Content:

- Importance: High moisture content in soap can make it softer and reduce its shelf life by promoting microbial growth.
- Testing Method: The moisture content can be assessed by calculating the weight loss after curing. Typically, a well-cured soap should lose around 10-15% of its initial weight as water evaporates during the curing process. Measuring the weight of the soap at regular intervals during curing helps assess moisture loss.

##### 4. Solubility:

- Dissolution Rate: The soap should not dissolve too quickly in water during use, as this would reduce its lifespan. It should strike a balance between being easy to lather and durable enough for prolonged use.
- Testing Method: Soak the soap in water for a set time and observe the rate of dissolution. A well-formulated soap will soften slightly but not break apart or dissolve rapidly.

##### 5. Lather Quality:

- Foam Production: The soap should produce a rich, stable lather that effectively cleans the skin without excessive foam loss. The presence of Reetha and Shikakai aids in achieving mild yet effective lathering.
- Testing Method: Rub the soap between your hands under water and observe the foam produced. Assess the foam's density, size of bubbles, and longevity.

##### 6. Water Absorption:

- Water Retention: A good soap should not absorb too much water when left exposed to moisture, as this could cause it to become mushy.
- Testing Method: Place the soap in water for a set duration and weigh it before and after exposure to evaluate water absorption.

## CONCLUSION

Neem and tea tree oil soap is an ideal formulation for individuals looking for a natural solution to skin problems, such as acne, infections, or irritation, while also providing gentle cleansing and moisturizing benefits. This soap formulation is beneficial for those looking for a natural, multi-functional. The result show that the neem soap is safe for human skin.

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