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Research Article

Development, Design and Evaluation of Herbal Neem Soap

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ABSTRACT

This project is dedicated to formulating a herbal soap by harnessing the extracts from Azadirachta indica (Neem) and Ocimum tenuiflorum (Tulsi) powders. With an increasing recognition of Ayurvedic cosmetics, renowned for their natural composition and minimal side effects, this formulation seeks to integrate botanical ingredients deeply rooted in traditional medicine practices. Neem, celebrated for its medicinal properties, assumes a crucial role, distinguished for its anti-inflammatory, antihyperglycemic, antimalarial, and antibacterial attributes. The study takes a comprehensive approach, exploring the effects of various Neem leaf extracts. The herbal soap is meticulously crafted, incorporating Neem and Tulsi, demonstrating specific efficacy against dermatophytes, while Tulsi showcases remarkable antiviral properties. This research serves to underscore the vast potential inherent in herbal formulations, shedding light on the manifold benefits of Neem and Tulsi and their transformative applications in skincare products.

INTRODUCTION

SKIN:-

The human skin is not only the largest organ in the body but also plays a crucial role as the body's primary defense mechanism. It serves as a protective barrier, shielding internal organs, muscles, and bones from external elements such as harmful pathogens, temperature changes, and physical injuries. In addition to its protective function, the skin is home to numerous specialized cells and structures that contribute to various important processes, including regulating body temperature, producing vitamin D, and sensing touch, pressure, pain, and pleasure. Its complexity and versatility make the human skin a remarkable organ that deserves our attention and care.[1] Caring for our skin is crucial in maintaining its health and preventing various skin diseases and disorders. Our skin serves a specialized function in our body's overall wellbeing, so it deserves our attention and care. Skin conditions can affect people of all ages, from newborns to the elderly, and they can manifest in different ways. Some common causes of skin issues include infections,

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allergies, excessive sun exposure, injuries, and other environmental factors. These factors can lead to a range of skin problems, such as rashes, dermatitis, acne, eczema, psoriasis, and more.

To keep our skin healthy and free from these issues, there are several measures we can take. Firstly, practicing good hygiene is essential, including regular cleansing and moisturizing. It's important to use gentle and appropriate skincare products that suit our skin type. Additionally, protecting our skin from harmful UV rays by wearing sunscreen and protective clothing when exposed to sunlight is crucial. Sunburns and prolonged sun exposure can damage the skin, leading to long-term effects such as premature aging and an increased risk of skin cancer. Avoiding triggers that may cause allergic reactions or irritations, such as certain chemicals, fabrics, or foods, is also important. Maintaining a healthy lifestyle, including a balanced diet, regular exercise, and adequate sleep, can contribute to overall skin health. In case of any skin concerns or persistent issues, it's advisable to seek medical advice from a dermatologist. They can provide accurate diagnosis, proper treatment, and guidance on how to take care of our skin effectively. Remember, taking care of our skin is not just about appearance; it's about ensuring the health and wellbeing of our largest organ. So let's prioritize skin health and make conscious efforts to keep it radiant, protected, and disease-free.[2]

Types of Skin-

Maintaining well-hydrated skin, which falls within the balanced range between oily and dry, is often considered ideal. However, dry skin is generally more problematic than oily skin. Dry skin, also known as xerosis, is caused by various factors but can be described simply. It appears dull (usually gray-white), has a rough texture, and exhibits an increased number of ridges. Several factors play a significant role in regulating or contributing to dry skin, including levels of stratum corneum lipids, sebum, natural moisturizing factor, and aquaporin. Among these factors, the stratum corneum (SC) bears the most importance in the mechanism of xerosis as it maintains skin hydration. The SC is composed of ceramides, fatty acids, cholesterol, and other constituents. When properly balanced, these constituents protect the skin and ensure its water-tightness. This balance is maintained through the stimulation of keratinocyte lipid synthesis and proliferation by primary cytokines. An imbalance in these constituents leads to a cascade of events, including a reduced capacity to retain water and increased vulnerability to external factors, making the SC more sensitive. These flaws in the skin barrier result in increased transepidermal water loss (TEWL). Inadequate hydration inhibits the enzymes necessary for desmosome metabolism, leading to abnormal shedding of corneocytes. Furthermore, dry skin is associated with a disturbance in the lipid bilayer of the SC, caused by increased fatty acid levels and decreased ceramide levels. This lipid bilayer is also affected by external factors like ultraviolet radiation, detergents, acetone, chlorine, and prolonged exposure to water. Changes in local pH can activate extracellular proteases, influencing the cohesion and shedding of corneocytes from the SC. The natural moisturizing factor (NMF), found exclusively in the SC, plays a crucial role in maintaining water within skin cells. It is released by lamellar bodies and synthesized through the breakdown of the protein filaggrin. NMF consists of lactic acid, urea, citrate, and sugars, which bind strongly to water molecules. The level of NMF present depends on the pace of filaggrin decomposition and the activity of aspartate protease. Low humidity and certain environmental factors can affect NMF production. Overall, achieving and maintaining well-hydrated skin involves a delicate balance of various factors, including the integrity of the skin barrier, adequate lipid composition, proper NMF production, and

efficient water transport through AQP3 channels. [30]



Fig no:1 Skin type

Skin Care for the Oily–Dry Parameter-

Skin that falls in the middle of the oily-dry spectrum can be characterized as having an intact stratum corneum (SC) and barrier, normal levels of natural moisturizing factor (NMF) and hyaluronic acid (HA), normal expression of aquaporin-3 (AQP3), and balanced sebum secretion. When acne is present along with oily skin, it is referred to as OS (oily skin). Acne-infiltrated skin is often more sensitive. Treatment for OS skin focuses on reducing sebum levels using retinoids, antibiotics, benzoyl peroxide, or other antimicrobials to eliminate or decrease skin bacteria, and incorporating anti-inflammatory ingredients. For oily skin without acne, treatment should aim to reduce sebum production, unless other factors like dyspigmentation and wrinkling are also present. Oral medications like ketoconazole and retinoids have shown success in reducing sebum secretion, but similar results have not been observed with topical products. Sebum in OR (oily-resistant) skin can also be camouflaged using sebum-absorbing polymers and talcs. Dry skin that is chronically exposed to the sun is likely to have an impaired skin barrier and reduced NMF. Therapy for this type of skin should focus on repairing the skin barrier and reducing sun exposure through adequate sun protection. Patients with xerosis (dry skin) should avoid using harsh foaming detergents and protracted bathing, particularly in hot or chlorinated water, as these can remove hydrating lipids and NMF from the skin. Using humidifiers in low-humidity environments and applying moisturizers two to three times daily and after bathing is recommended for those with very dry skin. In addition to pharmacologic products, there are several over-the-counter (OTC) moisturizers available that effectively hydrate the skin. These include occlusives, humectants, and emollients. It is important to be aware of the ingredients in these moisturizers, as some may contain potential allergens. Moisturizers labeled "lanolin-free" are becoming more common, but lanolin is still widely used. Occlusives provide temporary benefits by reducing transepidermal water loss (TEWL), but TEWL returns to its previous level once the occlusive agent is removed from the skin. Occlusives are often used in combination with humectants to prevent excessive TEWL and bacterial growth. Propylene glycol (PG) is an odorless liquid with antimicrobial and keratolytic properties commonly used as an occlusive and humectant in moisturizers. PG has been shown to facilitate the penetration of certain drugs into the skin and may contribute to contact dermatitis by allowing allergens to penetrate the epidermis.

In summary, finding the right type of moisturizer and following appropriate skincare practices can help maintain well-hydrated skin and address specific skin concerns, whether oily or dry. [30]

Origin of Soap-

The origin of soap processing enterprises can be traced back to ancient civilizations. While the exact discovery of soap remains a mystery, there are various legends surrounding its beginning. One popular myth suggests that around 1,000 B.C., soap was discovered in Sapon Hill in Rome. It is said that a group of women noticed their clothes becoming clean as they rinsed them at the base of the hill, where soapy clay was oozing down from

a higher elevation where animal sacrifice had taken place (NASSAB, 2010). The women later found out that this cleansing substance was formed when animal fat soaked down through wood ashes and mixed with clay soil (Good Scents Candles, 2006). However, the earliest known evidence of soap making dates back even further, to around 2,800 B.C. Babylonian Clay cylinders from this period have been found containing a soap-like substance (India Soap Industry, 2011). Additionally, a Babylonian tablet dating approximately to 2,200 B.C. provides further evidence of soap use.From these ancient beginnings, the art and knowledge of soap making spread across different regions and cultures. Soap-making enterprises emerged in various parts of the world, each contributing unique techniques, ingredients, and formulations to the craft. Today, soap processing enterprises continue to thrive worldwide, ranging from small-scale artisanal soap makers to large industrial manufacturers. These enterprises utilize advanced technology, modern ingredients, and innovative techniques to produce a wide variety of soaps catering to diverse consumer needs and preferences.[3]



Fig no:2 Soap

Herbal Soap

Soaps are used to clean our bodies and get rid of dirt and bad smells. Herbal soaps, made from plants like seeds, roots, and rhizomes, have natural properties that can kill bacteria, slow down aging, protect against damage, and keep things clean. These soaps don't have artificial colors, flavors, or other extra stuff like regular soaps do. Herbs are often used in medicine and skincare because they're effective, affordable, easy to find, and safe to use. Aloe vera is a plant that has been used for a long time to keep us healthy and make us look good. It's especially popular in the beauty industry because it has so many great benefits for our skin and body.[4]



Fig no:-3 herbal Soap

Neem (Azadirachta indica)-

Neem, scientifically known as Azadirachta indica, is a versatile tree that belongs to the Meliaceae Family. Its bark, leaves, and seeds are commonly used for medicinal purposes. In some instances, the root, flower, and fruit also have therapeutic properties. The neem leaf is particularly renowned for its wide range of applications. It is utilized in treating conditions such as leprosy, eye disorders, bloody nose, intestinal worms, stomach upset, loss of appetite, skin ulcers, cardiovascular diseases, fever, diabetes, gingivitis, and liver problems. Remarkably, the neem leaf is even used as a form of birth control and to induce abortions. When applied topically, neem can effectively combat head lice, skin diseases, wounds, and skin ulcers. Additionally, it serves as a natural mosquito repellent and helps to soften the skin. A notable characteristic of neem is its insecticidal properties, making it a popular choice as a natural pesticide. Overall, neem is a remarkable plant with a broad spectrum of applications in traditional medicine and beyond.[5]

Table 1: Important uses of various parts of neem tree

Part	Medical uses
Leaf	Leprosy, eye problem, skin ulcer, worms.
Bark	Analgesic, alternative and curative of fever.
Flower	Bile suppression and intestinal worms.
Twing	Relieves cough, asthma, piles, phantom tumour and diabetes.
Gum	Effective against skin disease like ringworm, scabies, wound and ulcers.
Seed pulp	Leprosy and intestinal worm.



Fig no:4 Neem Plant

The neem tree is a fast-growing tree that can always stay green. It is found in India, Africa, and America. People have been using it in medicine for thousands of years because it has special healing properties. In the Sanskrit language, neem is called 'arista,' which means it is perfect and never gets destroyed. Another name for neem is 'Arishtha,' which means it helps relieve sickness. Because of its amazing qualities, the neem tree is considered very important, even by the US National Academy of Sciences. They wrote a report in 1992 that said neem is a tree that can help solve problems all over the world.[6]

Historical significance of Neem

The history of the neem tree spans from ancient times to the present, highlighting its crucial role in sustaining mankind. In the ancient Siddha medicinal system, neem was the first medicinal plant described, also known as margosa. It was used as a disinfectant against highly contagious diseases like smallpox and was believed to protect against evil spirits. Medications and applications were recorded on palm leaves in the old medicinal system, preserving the knowledge for generations. The use of the neem tree dates back 4500 years to the Indus civilization, specifically during the Harappa culture. Documentation from that time mentions the various beneficial medical properties of neem, including its fruits, seeds, oils, leaves, roots, and bark. Writing on palm leaf manuscripts has been an ancient practice in India, serving as a means to conserve knowledge and store the history of herbal heritage. The Centre for Traditional Medicine and Research in Chennai, India, has revealed the medicinal uses of different parts of the neem tree. For example, neem flowers are used to treat bile disorders, neem leaves can prevent and treat ulcers, and neem bark is beneficial for fighting paralysis and central nervous system disorders. The significance of neem as a therapeutic herb extends beyond India. Evidence from the ancient civilizations of Harappa and Mohenjo-Daro demonstrates that neem was highly valued for its medicinal properties. In the epic Mahabharata, it is mentioned that Neem oil was utilized by Nakul and Sahadeva to treat wounds in horses and elephants. From its ancient origins, the neem tree has played a major role in traditional medicine and continues to be recognized for its healing properties in the present day.[7]

Phytochemical Studies and Biologically Active Chemical Constituents of Neem

Since it was discovered in 1942, researchers have found more than 140 different compounds in the neem tree. These compounds can be divided into two groups: isoprenoids and non-isoprenoids. Isoprenoids include things like diterpenoids and triterpenoids, while non-isoprenoids include proteins, amino acids, carbohydrates, and other substances. While many compounds have been found in neem, only a few have been studied for

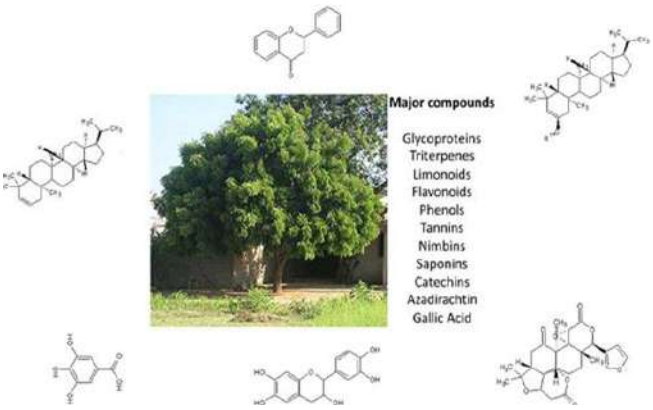
their effects on living things. For example, nimbin and azadirachtin, both found in neem, can kill insects, making neem oil a good natural pesticide. Gedunin and its derivatives have shown promise in treating malaria, and some of the compounds in neem have anti-inflammatory and anti-cancer properties as well. The proteins, amino acids, carbohydrates, and other substances in neem have medicinal benefits too, like fighting against oxidation and inflammation. Although there have been previous reviews on neem's compounds and their effects, this review will focus on a few important ones and their biological activities. Scheme 1 shows the compounds.[8]

Biological Activity Of Neem Chemical Constituents

- **Antioxidant effect**

Free radicals or reactive oxygen species (ROS) can cause inflammation and damage to our body's cells. This can lead to oxidative stress, which can contribute to various diseases. To prevent this, it is important to provide our bodies with antioxidants, which help neutralize these harmful radicals.

Fig no:5 Chemical Compound of Neem



One potential source of antioxidants is Neem, a natural plant extract. Neem extracts, such as teas and oils, can be added to our diet to introduce these antioxidants. While the safety and effectiveness of Neem extracts are still being studied, some traditional preparations are generally considered safe to use. Studies have shown that Neem extracts can have antioxidant effects. For example, when tested on rats with intestinal injury, Neem extract reduced markers of inflammation and increased the levels of a protective enzyme called glutathione. This suggests that Neem extract can enhance our body's natural defense mechanisms.

In another study, rats with colitis (inflammation of the colon) were treated with Neem extract. The extract reduced tissue damage and inflammation in the colon and restored the levels of antioxidant enzymes. This indicates that Neem extract can help improve our body's ability to combat oxidative stress. Additionally, Neem-enriched yogurts have been found to have higher levels of antioxidants compared to regular yogurt. These enriched yogurts showed enhanced antioxidant capacity and the ability to inhibit molecules involved in diseases like diabetes and hypertension. In conclusion, Neem extracts have the potential to be beneficial antioxidants that can support our body's natural defenses against oxidative stress. However, more research is needed to fully understand their effectiveness and ensure their safety.[9]

- **Antiulcer Effects**

Neem leaf extract has been shown to have significant antiulcer and antisecretory effects in rats. It reduces ulcer index, acidity levels, and gastric secretion volume at doses of 80 and 160 mg/kg. A clinical study with nimbidin, a bitter compound from neem, demonstrated its effectiveness in healing duodenal ulcers and relieving pain in the epigastric region. The nimbidin fraction of neem oil contains stearic acid and palmitic acid, which are believed to contribute to its ulcer-healing properties. An aqueous extract from neem bark has potent antiacid secretory and antiulcer activity, with a glycoside being the attributed bioactive compound. Neem is used as a constituent in the drug "Bhunimbadi Ghanasar," which effectively relieves symptoms of acid dyspeptic disease without any known side effects. "Nimbatiktam," a crude extract from neem seeds,

contains nimbidin as its active principle. It demonstrates significant ulcer-healing capability without notable side effects. Salanin, a limnoid bitter principle found in neem seed oil, has also shown ulcer-healing activity. It protects against aspirin-induced gastric lesions in experimental animals. Neem bark extract has been studied for its potential as a therapeutic agent for controlling gastric hyperacidity and ulcers. It inhibits acid secretion and ulcer formation induced by various factors and exhibits antioxidative properties. The pharmacological effects of neem bark extract are attributed to its phenolic glycoside content. In animal studies, neem extract was well-tolerated at doses below the observed LD50, both when taken in a single dose or administered orally over 15 days. It also showed no significant adverse effects in rats. Overall, neem and its various extracts show promising potential in the treatment of ulcers and related gastrointestinal conditions.[8]

- **Antimalarial Activity**

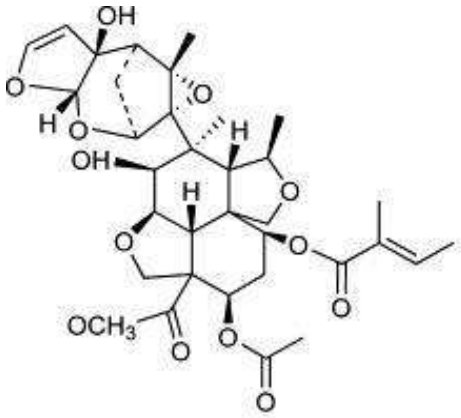
Neem has been found to possess antimalarial activity. Extracts of neem seeds have been studied for their effects on the growth and development of the human malarial parasite Plasmodium falciparum, both in vitro and in vivo. These extracts showed highly significant results. What's interesting is that the antimalarial effect of neem components was observed even on parasites that were previously resistant to other antimalarial drugs like chloroquine and pyrimethamine. This suggests that neem may have a different mode of action against malaria. Neem seed fractions not only act against the parasite stages that cause the clinical manifestation of malaria, but they also target the stages responsible for the continued transmission of the disease. Specific limonoid compounds such as meldenin, isomeldnin, nimocinol, and nimbadiol, isolated from the ethanolic extract of fresh neem leaves, have demonstrated antimalarial activity against chloroquine-resistant strains of Plasmodium falciparum. These findings highlight the potential of neem as a natural and effective alternative for the treatment of malaria, especially in cases where the parasite has developed resistance to conventional antimalarial drugs.[8]

- **Anti-cancer Effect**

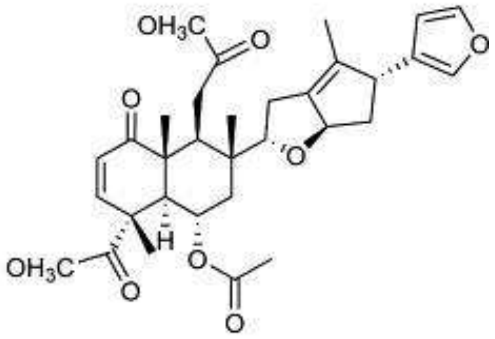
Various chemical compounds present in neem bark, leaves, seeds, and seed oil have shown efficient reduction of tumors and cancers without causing side effects. These compounds, including polysaccharides, limonoids, terpenoids, and steroids, have been extensively used for the treatment of various cancer conditions. The antitumor properties of neem extracts involve immunomodulatory and apoptotic activities, which help prevent, protect, and suppress different types of tumors and cancers by influencing their molecular mechanisms and mode of action. Studies have demonstrated that active neem principles detoxify carcinogens in hepatic tissues and have been effective against fore-stomach and skin papillomagenesis in mice. Neem extracts have also shown potent anticancer properties against oral squamous cell carcinoma and have induced apoptosis in breast cancer cells. Nimbolide, a limonoid found in neem leaves and flowers, has been found to induce apoptosis in human breast cancer cells. In fish models, neem extracts have exhibited significant antimutagenic effects, suggesting further exploration of this aspect for the well-being of humans. In experimental studies on mice, aqueous preparations from neem leaves have generated immune responses that react with specific tumor markers, making them potential candidates for immunotherapy. The effect of neem extracts on hepatocarcinogenesis caused by specific carcinogens has also been studied, showing chemopreventive capabilities and regression of liver carcinogenesis. Additionally, certain neem compounds have demonstrated cytotoxic and DNA binding activities, along with the ability to

sensitize cancer cells to radiation therapy. These findings highlight the potential of neem as a natural and effective approach for the prevention and treatment of various forms of cancer, offering a promising alternative or complementary therapy to conventional treatments.[7]

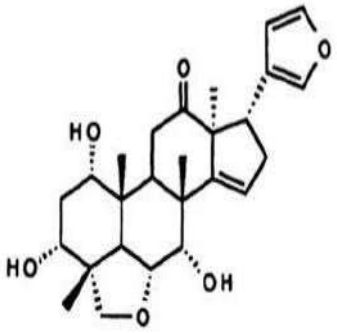
Chemical Constituents Structure



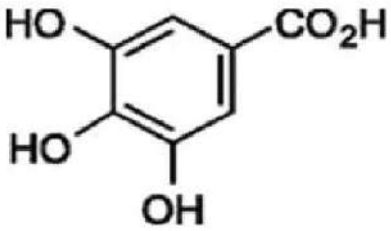
Azadirachtin



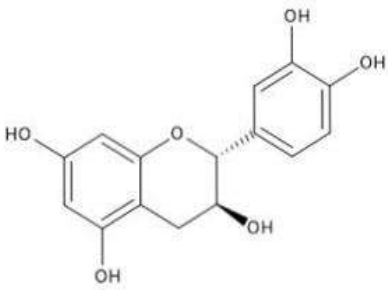
Nimbin



nimbidin



gallic acid (GA)



Catechin

Table 2: Chemical constituents present in neem

Chemical constituents	Properties and uses
Azadirachtin	Natural insecticide and repellent
Nimbin	Exhibits anti-inflammatory and analgesic properties
Quercetin	Antioxidant and anti-inflammatory effects.
Beta-sitosterol	Supports heart health and may have anti-cancer properties.
Margosic acid	Antibacterial and antifungal activity.
Nimbidin	Anti-inflammatory and analgesic properties
Salannin	Natural insecticidal properties
Gedunin	Exhibits antimalarial effects

Neem is a plant that has been widely utilized in Ayurveda, Unani, and Homeopathic medicine, and has also gained significant attention in modern medicine. In traditional medicine, all parts of the neem tree, including leaves, flowers, seeds, roots, and bark, have been used as remedies for various human ailments. Among these, neem leaves have been particularly valued and extensively used in ancient medicinal preparations due to their year-round availability and ease of compound extraction. Neem leaves exhibit a broad range of pharmacological activities and have numerous medicinal applications. This discussion will focus

specifically on the pharmacological activities associated with neem leaves.[10]

Neem role on skin health

Acne is often associated with poor hygiene, so it is important for acne vulgaris patients to follow a proper cleansing regimen. Using mild and gentle cleansers with herbal ingredients can effectively remove dirt, bacteria, sebum, and dead skin cells without drying out the skin. One herbal soap that aims to address common facial skin problems is made from neem and turmeric. This soap utilizes the beneficial properties of these herbs to help prevent and reduce acne. Studies have been conducted to evaluate the safety and efficacy of this herbal soap in preventing and reducing inflammatory and non-inflammatory acne lesions. The aim is to build confidence among consumers regarding the effectiveness of this promising product. Using soap-based formulations with an alkaline pH can strip the skin of its natural lipids and cause irritation, especially for individuals with dry skin or a predisposition to acne vulgaris or seborrhea. Therefore, it is recommended to use low pH cleansing systems, such as herbal soaps, for such individuals. Herbal soaps with a combination of different natural ingredients can effectively remove dirt and grime while remaining gentle and mild on the skin. Neem, one of the active ingredients in the mentioned herbal soap, has been known for its anti-inflammatory and antimicrobial properties that can help reduce acne and improve overall skin condition.[11]

Tulsi (Ocimum tenuiflorum)

Tulsi, scientifically known as Ocimum sanctum or Ocimum tenuiflorum, is an important herb belonging to the Lamiaceae family. It is widely cultivated around the world for its numerous uses in medicine, perfumery, religion, ceremonies, food, and essential oil production. Tulsi has two main cultivars: Rama Tulsi, which has green leaves, and Krishna Tulsi, with purple leaves. Extensive research has been conducted on Tulsi due to its remarkable medicinal properties. It has been found to possess a wide range of beneficial effects, including antidiabetic, wound healing, antioxidant, radiation protective, immunomodulatory, antifertility, anti-inflammatory, antimicrobial, antistress, and anticancer activities. Importantly, studies have shown that Tulsi is non-toxic and safe for human use. The essential oil derived from Tulsi, known for its rich content of eugenol, holds significant commercial value. It is utilized in various industries such as pharmaceuticals, cosmetics, and food as an effective antiallergic and antimicrobial agent. Despite Tulsi's commercial and medicinal importance, there is still a need for a comprehensive study focusing on its traditional uses, chemical constituents, nutritional values, and the pharmacological activities of its secondary metabolites. By addressing this research gap, we can establish a valuable chemical database that will guide future investigations and shed light on potential areas for further exploration.[12]

Fig no:6 Tulsi Plant



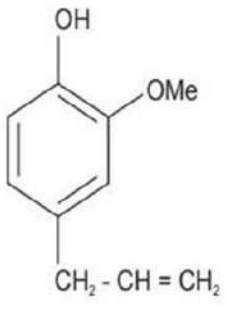
Historical significance of Tulsi

Basil oils have been classified into three major groups based on their chemical composition and geographical origin: European type, exotic or reunion type, and Tulsi, also known as Holy Basil, holds great historical significance in the Indian subcontinent. It is a revered aromatic herb that has been used in Ayurvedic medicine for over 3000 years. In Ayurveda, tulsi is often referred to as the "Elixir of Life" due to its remarkable healing

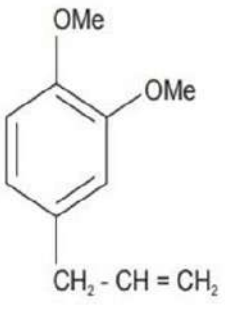
powers. It has been traditionally used to treat various common health conditions. In the Indian Materia Medica, tulsi leaf extracts are described for their effectiveness in treating bronchitis, rheumatism, and pyrexia (fever). Additionally, tulsi has been used to treat epilepsy, asthma, hiccups, cough, skin and hematological diseases, parasitic infections, neuralgia, headache, wounds, inflammation, and oral conditions. The juice of the leaves has even been applied as a drop for earaches, while the tea infusion has been used to address gastric and hepatic disorders. There are three commonly described types of tulsi. Ocimum tenuiflorum, also known as Ocimum sanctum, includes two distinct cultivars: Rama or Sri tulsi with green leaves, and Krishna or Shyama tulsi with purplish leaves. Another type, Ocimum gratissimum, is referred to as Vana or wild/forest tulsi, characterized by dark green leaves. These different types of tulsi exhibit variations in morphology and phytochemical composition, including secondary metabolites. However, they are traditionally used in similar ways to treat similar ailments. Tulsi has been the subject of numerous scientific studies, with over a hundred publications in the past decade alone. Research has revealed its pharmacological properties and wide range of therapeutic applications. In vitro and animal studies have demonstrated the potent actions of tulsi leaves, including adaptogenic, metabolic, immunomodulatory, anticancer, anti-inflammatory, antioxidant, hepatoprotective, radioprotective, antimicrobial, and antidiabetic effects. These findings have been extensively reviewed in the scientific community, highlighting the significant potential of tulsi for medicinal purposes.[13]

Chemical constituents of Tulsi

Tulsi, or Holy Basil, essential oils are complex mixtures containing approximately 20-60 components at varying concentrations. These oils are predominantly composed of terpenic hydrocarbons such as myrcene, pinene, terpinene, limonene, p-cymene, α- and β-phellandrene, as well as terpenoids, which are oxygen-containing hydrocarbons. Terpenoid components include acyclic monoterpene alcohols like geraniol and linalool, monocyclic alcohols such as menthol and 4-carvomenthol, aliphatic aldehydes like citral and citronellal, aromatic phenols including carvacrol, thymol, safrol, and eugenol, and other compounds like verbenol, menthone, pulegone, carvone, thujone, verbenone, fenchone, citronellic acid, cinnamic acid, and linalyl acetate. African type. Within O. Basilicum, four essential oil chemotypes have been identified: methyl chavicol, linalool, methyl eugenol, and methyl cinnamate. Other chemotypes, such as eugenol-rich and thymol-rich in O. Gratissimum, sesquiterpene-rich in O. Canum and O. Sanctum, and terpinene-4-ol-rich, have also been reported in different regions. The chemical constituents and their respective percentages in Tulsi essential oils can vary depending on the origin and cultivar of the plant. Various studies have collected Tulsi species from different countries and regions worldwide, including Bangladesh, Brazil, Cameroon, Egypt, Europe, Guinea, India, Iran, Italy, Mali, Nigeria, Pakistan, Rwanda, Thailand, Togo, Turkey, Um Ruaba, and Yaounde. The diversity in chemical composition reflects the variations in these essential oils found in different parts of the world.[14]



Eugenol



Methyleugenol

Biological activity of Tulsi

- **Antibacterial activity**

Tulsi, or Holy Basil, is known for its antibacterial activity. The fixed oil of O. Sanctum, which is rich in linolenic acid, has been found to contribute to this activity. Studies have shown that fresh leaves extract and oil of O. Sanctum are more effective against bacterial strains compared to dried leaves extract. Research by Mahmood et al. Demonstrated that O. Sanctum contains active constituents that exhibit antibacterial effects against strains of S. Aureus. It has also been found to have antimicrobial effects against P. Aeruginosa, S. Aureus, and Bacillus pumilus, which are responsible for food spoilage, food poisoning, and other diseases in humans. The extract and oil of Ocimum sanctum have shown inhibitory effects on the growth of Micrococcus pyogenes var. Aureus and Mycobacterium tuberculosis. Tulsi essential oil has been found to have 1/10th the anti-tubercular potency of streptomycin and 1/4th that of isoniazid. Studies have also demonstrated that Tulsi leaves extract inhibits the growth of bacteria such as E. Coli, S. Aureus, Klebsiella, and Vibrio cholera. It has been found to be highly effective against gram-positive and gram-negative bacteria including Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas putida, Bacillus subtilis, and Escherichia coli. Furthermore, Tulsi leaves extract has shown significant antibacterial potential against Streptococcus mutans, which is involved in dental caries. It has also exhibited antibacterial properties against Staphylococcus aureus, Streptococcus mutans, and Enterococcus faecalis.

Overall, the biological activity of Tulsi includes strong antibacterial effects against a wide range of bacterial strains, making it a valuable natural remedy for various infections and diseases caused by bacteria.[15]

- **Antimicrobial activity**

Tulsi, also known as Holy Basil or Ocimum sanctum, possesses a range of pharmacological properties including anti-toxic, antioxidant, anti-cancer, antimicrobial, antihypertensive, anti-inflammatory, anticoagulant, analgesic, and anti-thyroid effects. The leaf extract of O. Sanctum contains phenolic constituents such as isothymusin, apigenin, rosmarinic acid, cirsineol, and eugenol. These compounds contribute to its various biological activities. Studies have shown that the aqueous extracts of O. Sanctum leaves are more effective against pathogens compared to methanolic extracts. The leaf extract of O. Sanctum exhibits potent antioxidant activity and inhibits the growth of bacteria such as E. Coli, Klebsiella, Staphylococcus aureus, and Proteus.

Overall, Tulsi demonstrates extensive biological activity, making it a valuable natural remedy with therapeutic potential in areas such as detoxification, oxidative stress management, cancer treatment, microbial infections, hypertension, inflammation, blood clot prevention, pain relief, and thyroid disorders.[15]

Tulsi role on skin health

The major constituents of O. Sanctum, such as eugenol, ursolic acid, linalool, and rosmarinic acid, have been reported to possess anti-inflammatory and antioxidant properties. This makes O. Sanctum an attractive plant for the development of cosmetic products. However, its specific biological activities related to skin aging, such as anti-collagenase, anti-elastase, and anti-hyaluronidase activities, have not been previously reported. This study aims to investigate the anti-aging activity of O. Sanctum extracts, particularly in relation to skin aging. Additionally, the content of rosmarinic acid in O. Sanctum extracts will be determined, and the inhibitory activities of both rosmarinic acid and O. Sanctum extracts against oxidation, inflammation, collagenase, elastase, and hyaluronidase will be examined. Overall, this study will contribute valuable insights into the role

of Tulsi in skincare and its potential as an effective ingredient in anti-aging cosmetic products. It will shed light on the anti-collagenase, anti-elastase, and anti-hyaluronidase activities of O. Sanctum extracts and their constituents, providing a foundation for further research and development in the field of cosmetic science.[16]

Orange peel or Orange oil

Orange peels or orange by-products are a significant component of the citrus industry, particularly for sweet oranges grown in tropical and subtropical regions worldwide. In 2013/14, global orange production was projected to reach 51.8 million metric tons, with 2.0 million metric tons of orange juice produced. These citrus by-products, which make up about 50% of their weight, consist primarily of skins (flavedo and albedo), pulp, and seeds. They are rich in various compounds such as fats (oleic, linoleic, linolenic, palmitic, stearic acids, glycerin, and phytosterols), sugars (glucose, fructose, sucrose), acids (especially citric and malic acid, as well as tartaric, benzoic, oxalic, and succinic acids), insoluble carbohydrates (cellulose, pectin), enzymes (pectinesterase, phosphatase, peroxidase), flavonoids (hesperidin, narirutin), essential oils (D-limonene), pectins, and pigments (carotenoids, xanthophylls). The essential oil extracted from orange by-products finds applications in the food industry as flavoring agents for beverages, ice creams, and other food products. It is also utilized in the pharmaceutical industry due to its anti-inflammatory and antibacterial effects. Additionally, large quantities of this oil are employed in the production of toiletries such as soaps, perfumes, cosmetics, and other home care products, or as an environmentally friendly solvent. The abundance of orange peels and the valuable components they contain make them a valuable resource for various industries. The extraction of orange oil from these by-products not only provides flavor and fragrance but also offers potential health benefits and eco-friendly alternatives in different applications.[17]



Fig no:7 Orange Peel

Literature review

- **(Sharique Ahmad,et.Al 2019)**

Neem stands as an incredibly versatile medicinal plant, offering a wealth of limonoids known for their powerful medicinal traits, particularly in antioxidative, anti-inflammatory, and anticancer activities. The extensive utility of Neem has led to the creation of various medically and industrially beneficial formulations, demonstrating potent medicinal applications for the development of novel drugs to address a range of acute and chronic diseases. Nevertheless, further research on its biological components is necessary to enhance both commercial and therapeutic utilization.[18] This study aimed to develop antimicrobial herbal soaps using neem and tulsi extracts, specifically targeting the treatment of pimples, acne, and scars. The soaps were prepared with careful consideration given to their size, shape, thickness, weight, and ability to produce a good foam. Various evaluation parameters such as clarity, color, odor, size, shape, weight, and pH were assessed, and both formulations demonstrated satisfactory results.

- **(Dr.A.Seetha Devi,etal 2021)**

The herbal soaps exhibited a pleasing appearance with a pink color and emitted a pleasant aromatic smell. Moreover, they displayed effective antibacterial properties. This study concludes that herbal products can be successfully formulated

into medicated herbal soaps using the cold process technique to achieve excellent antibacterial effects. [19]

- **(Olubunmi Atolani,et.Al 2019)**

In accordance with green chemistry principles, eco-friendly herbal antiseptic soaps have been created using underutilized oil seeds. By utilizing these techniques and natural resources, the production of these herbal soaps helps protect. The environment from the daily introduction of hazardous chemical products found in commercial synthetic soaps. The soaps made through this process do not include auxiliary materials like sodium silicate, sodium sulfate, artificial perfumes, colorants, preservatives, or synthetic antimicrobial agents. Among the soaps tested, the one made from Daniellia oliveri seed oil, an often-overlooked resource, exhibited the best properties in terms of hardness, formation ability, texture, color, antimicrobial activity, and commercial rating. This approach contributes to converting agricultural waste into useful commercial products, thereby improving the economic status of the community. [20]

- **(Marcel Friedman, et.Al 1996)**

The soap industry has a long history, dating back to ancient times, including the Phoenicians. In the mid-20th century, significant progress was made with the introduction of soapless soaps, and since then, the industry has continued to advance and improve. Creating a good soap is a complex task, requiring knowledge of chemistry, engineering, as well as imagination and inspiration. Soap formulation involves various ingredients with diverse functions and effects. The development of soap formulas today is the result of extensive research, development, and trial and error by large research teams over many years. Due to the limitations of this article and its intended audience of physicians who may not be familiar with the intricate chemistry and equipment used in the soap industry, only a small fraction of this vast industry can be revealed. The formulation of a soap is closely linked to its marketing strategy, considering consumer needs, target market segments, intended purposes, and distribution channels. Marketing strategy and technical requirements work hand in hand, influencing each other in a circular manner. The chosen marketing strategy sets the soap's target market, price, and desired characteristics, which are then executed through a formulation that impacts the final product's price and features. There exists a reciprocal relationship between formulation and manufacturing, as well as marketing and commercial aspects. Soap formulation and production are primarily commercial processes that underpin a global industry worth billions of dollars. Therefore, it is necessary to address this aspect alongside the theoretical aspects to provide a comprehensive and satisfactory discussion. [21] (Aishwarya S. Patil,et.Al 2017) The global consumer trend towards eco-friendly choices is particularly evident in the cosmetics industry. In recent years, the beauty market has experienced significant growth driven by products that utilize natural or herbal components. Consequently, the market share of natural-based products has been steadily increasing. In India, there is a strong cultural inclination towards natural beauty products, with a rich history and knowledge of utilizing such products. To cater to this demand, companies must modernize ancient Ayurvedic recipes by creating user-friendly formats without compromising on quality. The growing concern over harmful chemicals in beauty products has further fueled consumer interest in natural cosmetics. As a result, more and more products are now incorporating herbal and botanical ingredients. Despite competition from synthetic brands, Ayurvedic cosmetics should strive to maintain a comparable level of quality to meet consumer expectations. [22]

- **(K. Sudheer Kumar et.Al 2022)**

To summarize, the formulation and evaluation of the Herbal soap involved carefully selecting ingredients, including two for fragrance and three for skin care purposes. The soap was formulated using naturally obtained herbs, and the extraction of oils was done without the use of any chemicals. Our tests, which included evaluation parameters and phytochemical analysis, revealed positive results indicating that the soap is suitable for use. Our next step is to formulate a medicated version of the herbal soap and obtain the necessary certification for its release in the market. [23]

- **(Mrs. T.Radha, et.Al 2019)**

Our study focused on the phytochemical analysis of neem flowers, which revealed the presence of various bioactive compounds such as alkaloids, flavonoids, coumarin, and leucoanthocyanin in both aqueous and acetone extracts. These compounds contribute to the antibacterial activity of neem.To create a true soap that effectively cleanses the body without disrupting the skin's pH level, we prepared a homemade neem flower soap. Neem flowers are known to be rich in cholesterol, which results in a higher fat content in the soap compared to soaps made from other neem components like leaves, unripened and ripened fruits, and seeds. Our research and analysis demonstrate that neem flower soap possesses antibacterial properties. By utilizing various neem components, this soap effectively eliminates microorganisms, ensuring the safety and health of our skin. As a result, homemade neem soap can serve as a beneficial alternative to synthetic soaps, delivering superior results. In conclusion, our study highlights the significance of neem flowers in soap production due to their antibacterial activity and higher fat content. This homemade neem soap offers a natural and effective solution for cleansing the body while maintaining skin health and can be considered as a preferable substitute for synthetic soaps. [24]

- **(Crépin T. S. Aniwanou et.Al 2021)**

The objective of this study was to assess the effectiveness of various biorational insecticides against Spodoptera frugiperda larvae in laboratory and field settings. The insecticides tested included Plant Neem, Palmida soap, and Dezone (diatomaceous earth). In field trials conducted in maize fields, all biorational insecticides demonstrated superior performance compared to the untreated control group. In fact, some of them even showed better control than the chemical insecticide Emacot 19 EC. Moreover, a cost-benefit analysis revealed that utilizing the biorational insecticides resulted in significantly increased profits. These findings indicate that spraying plants with these insecticides can be a feasible and profitable approach to managing FAW (fall armyworm) in maize fields. However, further studies are necessary to fully comprehend the potential of these technologies in effectively managing FAW. [25]

- **(Aswathy Das D et.Al 2023)**

In conclusion, this study suggests that herbal drugs can be more effectively utilized by transforming them into a convenient dosage form. In this particular case, a soap formulation was developed with minimal additives to ensure effectiveness, cost-effectiveness, and minimal to no side effects. The results of the study demonstrated that an antibacterial soap labeled as code R 4 was more effective than a plain soap in controlling acne and dry skin. This indicates that the use of this specific soap formulation can potentially provide significant benefits for individuals dealing with these skin conditions. [26]

- **(Saudagar R. B. et.Al 2018)**

Herbal cosmetics play a vital role in today's modern life, primarily used for beautification purposes, which has led to a substantial increase in demand. These cosmetics offer several advantages over synthetic cosmetics, including their affordability, easy availability in the market, and minimal toxicity with little to no adverse effects. Considering all the studies conducted on herbal

cosmetics, it can be concluded that they serve as a significant alternative to synthetic cosmetics. [27]

Plant Profile

Contents of the Soap

- **Neem**



Fig no:8 Neem leaves

Botanical Name: Azadiracta indica

Part Typically Used: Leaves

Color: Green

Description: The leaves of Azadiracta indica are compound and alternate in arrangement. The rachis measures around 15-25cm in length and is approximately 0.1cm thick. Each leaflet is oblique, serrate, and measures about 7-8.5cm in length and 1-1.7cm in width. The color of the leaflets is slightly yellowish green.

Constituents:

Neem leaves contain various constituents such as flavonoids, alkaloids, azadirone, nimbin, nimbidin, terpenoids, steroids, margosic acid, vanillic acid, glycosides, B-sitosterol, nimbectin, kaempferol, and quercetin.[28]

- **Tulsi**



Fig no:9 Tulsi Leaves

Description:-

The leaves of the Tulsi plant, also known as Holy Basil, are simple and opposite in arrangement. The rachis measures around 5-10cm in length and is approximately 0.1cm thick. Each leaf is oval-shaped, serrated, and measures about 2-5cm in length and 1-3cm in width. The color of the leaves is vibrant green.

Constituents:-

Azadirachtin and the others are nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, gedunin, salannin, and quercetin.[28]

Material and methodology

- **Material**

Collection of plant material:-

The leaves of Neem (Azadirachta indica) and Tulsi (Ocimum sanctum) were collected from the local area in Shrirampur. The leaves were meticulously sun dried, carefully pulverized, and then stored in sealed bottles for the studies. Sun drying allows for the preservation of the leaves natural qualities, ensuring they remain intact for future use and research purposes.

Material Use:-

Neem and Tulsi plant materials are commonly used for their medicinal properties, natural pest control, skincare and haircare products, and in Indian cuisine. Tulsi is also considered sacred and used for religious and spiritual purposes.[5]

- **Methodology**

Prepration of extract:-

The Azadiricta indica, Ocimum tenuiflorum, leaves grinded into Powder. In the Soxhlet apparatus extraction process for orange peel, the dried and powdered peel is placed in a thimble within the extraction chamber. A suitable solvent, such as acetone, is poured into the flask below. As the solvent vaporizes, it travels up to the condenser where it condenses and drips back down onto the orange peel powder. This continuous cycle allows for efficient extraction of desired compounds from the peel. After a specific period, the solvent is

collected in the flask, leaving behind the extracted essence of orange peel in the thimble.[28]

FORMULATION AND EVALUATION OF HERBAL SOAP

Table 1

Chemical	Source
Beeswax	Laboratory reagent
Sodium lauryl sulphate	Laboratory reagent

Table 2

Herbal Plant	Source
Neem	Plant
Tulsi	Plant
Orange oil	Plant

Table 3:- Morphological characters of ingredients

Sr. No.	Ingredients	Color	Oduor	Taste
1	Beeswax	Yellowish	Honey-Like	Waxy
2	Neem Leaves	Green	Bitter	Bitter
3	Tulsi Leaves	Green	Bitter	Bitter
4	Sodium lauryl sulphate	White	Odorless	-
5	Orange oil	Orange	-	-

FORMULA [1]:

The formula shown in Table 3 is best suited for the preparation of herbal soaps.

Table 3:- Formula for preparation of soap

Sr.	Ingredients	Quantity	Use
No.	Beeswax	(%)	Hardening
1	Neem powder	20gm	Antibacterial
2	Tulsi	20gm	Antiviral
3	Sodium	10gm	Cleansing and foaming
4	lauryl sulphate	15gm	Perfume

Prepration of herbal neem soap:-

To formulate a herbal neem soap, the following ingredients will be used:

- Neem powder: 20gm
- Tulsi powder: 10gm
- Beeswax: 20gm
- Sodium lauryl sulfate: 15gm
- Orange oil

The formulation process involves these steps:

1. Weigh out 20gm of neem powder and 10gm of tulsi powder.
2. In a double boiler, melt 20gm of beeswax over low heat until it becomes liquid.
3. Gradually add the neem powder and tulsi powder to the melted beeswax, stirring continuously to ensure they are fully incorporated.
4. Once the powders are well mixed, add 15gm of sodium lauryl sulfate to the mixture. The addition of sodium lauryl sulfate helps create lather in the soap.
5. Stir the mixture well to combine all the ingredients thoroughly.
6. Remove the mixture from heat and allow it to cool slightly.
7. As the mixture cools, add a few drops of orange oil for fragrance. Adjust the amount according to your preference, but be careful not to make the scent overpowering.
8. Pour the semi-solid soap mixture into soap molds or any desired container.
9. Allow the soap to cool and solidify completely before removing it from the molds.
10. Once the soap has hardened, gently press on the back of the molds or slightly twist them to release the soap bars from the molds.
11. Place the finished neem soap bars on a drying rack or any well-ventilated area to cure and harden further. This helps to improve the longevity and quality of the soap.
12. Allow the soap bars to cure for at least 4-6 weeks before using. During this curing period, the soap will gradually lose excess moisture and become harder, resulting in a longer-lasting bar.[28]

Phytochemical Test:-

1. **Phytochemical Test for Saponins [Soapnut]:**

- Take 5 ml of the solvent extract in a test tube.
- Add a few drops of sodium bicarbonate to the test tube.

- Shake the test tube vigorously and let it stand for 3 minutes.
- The development of a cloudy white precipitate indicates the presence of saponins.

2. Phytochemical Test for Triterpenoids [Lavender Oil]:

- Add 2 ml of the solvent extract and 1 ml of CHCl3 (chloroform) to a test tube.
- Shake the test tube gently.
- Add 1 ml of acetic anhydride to the test tube.
- Add 1 ml of concentrated H2SO4 (sulfuric acid) along the sides of the test tube.
- The appearance of two junctions indicates the presence of triterpenoids.

3. Phytochemical Test for Tannins [Coconut Oil]:

- Take 1 ml of the solvent and dilute it with distilled water.
- Add 2 drops of ferric chloride to the solution.
- A cream gelatinous precipitate or a transient greenish to black color indicates the presence of tannins.

4. Phytochemical Test for Glycosides:

- Dissolve 0.5 mg of the sample extract in 1 ml of water.
- Add aqueous NaOH solution to the solution.
- The formation of a yellow color indicates the presence of glycosides.

5. Phytochemical Test for Flavonoids:

- Take 1 ml of the sample solution in a test tube.
- Add a few drops of dilute NaOH solution to the test tube.
- An intense yellow color will appear in the test tube.
- The color will become colorless upon the addition of a few drops of dilute acid, indicating the presence of flavonoids.

6. Phytochemical Test for Terpenoids:

- Perform the Salkowski test to detect terpenoids.
- Mix 5 ml of the extract with 2 ml of chloroform.
- Carefully add 3 ml of concentrated sulfuric acid to form a layer.
- A reddish-brown coloration at the interface indicates the presence of terpenoids.

7. Phytochemical Test for Phenols:

- Add aqueous ferric chloride to the sample solution.
- Compounds with a phenol group will form a blue, violet, purple, green, or red-brown color upon addition of the ferric chloride.
- This reaction can be used as a test for the presence of phenol groups.

Table 4:- Phyto-chemical parameters

Sr No	Chemical constituents	Tulsi leaves	Neem leaves	Orange oil
1	Alkaloids	+	+	+
2	Glycosides	+	-	-
3	Tannins	+	+	+
4	Flavonoids	+	-	+
5	Terpenoids	+	+	+
6	Phenol	-	+	+
7	Saponins	+	+	+

EVALUATIONS

The herbal soap formulated was evaluated For the following:

1. Organoleptic evaluation:-

Color - Brown

odor - Orange

Appearance :-Good

2. Physical evaluation

The herbal soap formulated was also evaluated for the following properties:

a. pH Measurement:

- Take 1 gram of soap sample and dissolve it in 10 ml of water.
- Test the pH of the soap solution using pH paper to determine its pH range.

b. Foam Retention:

- Take 25 ml of 1% soap solution in a 100 ml measuring cylinder.
- Cover the measuring cylinder with your hand and shake it vigorously for 10 minutes.
- Record the volume of foam at 1-minute intervals for a total of 4 minutes.

3. Foam Height:

- Take 0.5 grams of the soap sample and dissolve it in 25 ml of distilled water.
- Transfer the solution to a 100 ml measuring cylinder and make the volume up to 50 ml with water.
- Shake the measuring cylinder with the solution for 25 strokes and let it stand for a few minutes.
- Measure the height of the foam above the aqueous volume.

4. Percentage of Free Alkali:

- Take 5 grams of the soap sample and dissolve it in 50 ml of alcohol.
- Boil the mixture for 30 minutes.
- Titrate the solution with 0.1N HCl (hydrochloric acid) to determine the amount of free alkali present.

5. Alcohol Insoluble Matter:

- Take 5 grams of the soap sample in a conical flask.
- Add 50 ml of warm ethanol and shake it until the soap completely dissolves.
- Filter the solution with 20 ml warm ethanol and dry the filter paper at 105°C for 1 hour.
- Note the weight of the dried filter paper.

6. Total Fatty Matter (TFM):

- Take 10 grams of the soap sample in 150 ml of distilled water.
- Add 20 ml of 15% H2SO4 (sulfuric acid) to the solution.
- Solidify the solution by adding 7 grams of beeswax.
- Heat the solution again to allow cake formation.
- Remove the cake, let it dry, and weigh it to determine the TFM content.

7. Moisture Content:

- Weigh the soap sample and dry it using a drier at a temperature range of 100 to 115°C.
- Calculate the moisture content using the formula:
- **Percentage Moisture Content = (Initial Weight - Final Weight) * 100**

8. Saponification:

- Mix a sample with 25 ml of alcoholic solution of KOH (potassium hydroxide) and leave it to react for 1 hour in a steam bath.
- Perform a back titration of the reacted solution with 0.5N sulfuric acid in the presence of phenolphthalein indicator to determine the saponification value.

9. Foam Forming Ability:

- Take 1.0 gram of soap sample and dissolve it in 50 ml of water in a 100 ml graduated measuring cylinder.
- Shake the measuring cylinder vigorously for 2-3 minutes.
- Allow the foam to settle for about 10 minutes.
- Measure the height of the foam after 10 minutes.
- Repeat the experiment 3 times and record the observations. Calculate the mean value.

10. Skin Irritation Test:

- Wash your skin properly and apply the soap sample on the skin.
- Observe any signs of irritation, burning, itching, or other symptoms.[29]

Table 5: Results of Evaluation of Soap (26)

Evaluation Parameters	F1	F2	F3	F4	F5
Colour	Green	Green	Green	Green	Green
Odour	Fragrant	Fragrant	Fragrant	Fragrant	Fragrant
Shape	Heart	Round	Square	Oval	Round
Texture	Smooth	Smooth	Smooth	Smooth	Smooth
PH	7.1	7.4	7.2	7	7.3

Moisture content	3.3	1.9	2.6	2.5	3.0
Foam height (cm)	2.0	2.2	2.5	2.7	2.9
Foam retention time (min)	3.1	3.7	3.2	3.3	3.4
Free alkali(%)	0.27	0.28	0.26	0.28	0.27
Alcohol insoluble matter	21	17	15	19	18
Viscosity (cp)	48	48	60	72	84
Skin irritation	Non-Irritant	Non-Irritant	Non-Irritant	Non-Irritant	Non-Irritant
Antimicrobial Study (mm)	5.0	6.1	6.5	7.2	7.6

RESULTS:

1. Antibacterial and Antifungal Properties: Neem powder, with its well-known antimicrobial properties, effectively combats bacteria and fungi on the skin. This makes the herbal neem soap suitable for individuals prone to acne, skin infections, and other microbial-related issues. The presence of neem powder in the soap formulation enhances its effectiveness in killing harmful bacteria and inhibiting fungal growth
2. Moisturizing and Nourishing: The addition of beeswax in the soap helps to lock in moisture and maintain hydration levels in the skin. Beeswax acts as a natural emollient, forming a protective barrier on the skin's surface. This barrier prevents water loss and keeps the skin moisturized, providing a nourishing effect. Regular use of the herbal neem soap helps prevent excessive dryness and maintains the skin's natural balance.
3. Lathering and Cleansing: Sodium lauryl sulphate, a commonly used surfactant in soaps, creates a rich foaming lather when combined with water. This lathering effect aids in the removal of dirt, oil, and impurities from the skin, leaving it clean and refreshed. The herbal neem soap efficiently cleanses the skin without causing irritation or dryness, thanks to the inclusion of sodium lauryl sulphate.
4. Healing and Soothing: Tulsi powder, derived from holy basil leaves, possesses soothing and healing properties. It helps calm irritated skin, reduce redness, and promote faster healing of minor cuts, wounds, and rashes. The herbal neem soap, infused with tulsi powder, provides a gentle and soothing experience for the skin, making it suitable for individuals with sensitive or inflamed skin conditions.
5. Aromatic Experience: Orange oil, derived from orange peel, provides a delightful fragrance to the soap. Its pleasant citrus aroma adds to the overall sensory experience of using the herbal neem soap. In addition, orange oil contains antioxidants that help protect the skin from environmental damage and promote a healthy complexion.

DISCUSSION:

The combination of neem powder, sodium lauryl sulphate, beeswax, orange oil, and tulsi powder in the herbal neem soap demonstrates a synergistic effect in providing multiple benefits for the skin. The soap offers antibacterial, antifungal, moisturizing, cleansing, healing, and aromatic properties, making it a versatile and holistic skincare solution. To optimize the formulation, further research can be conducted to study the ideal concentrations of each ingredient. This will ensure the soap's efficacy and safety while maximizing its beneficial effects on the skin. Additionally, user feedback and extensive testing across different skin types will provide valuable

insights into the soap's performance, potential side effects, and overall acceptability. Long-term studies can also be conducted to evaluate the prolonged use of the herbal neem soap and its effects on various skin concerns. This will help determine its suitability for specific skin conditions, such as acne-prone skin, dry skin, or sensitive skin.

CONCLUSION:

The development of an herbal neem soap incorporating neem powder, sodium lauryl sulphate, beeswax, orange oil, and tulsi powder showcases promising results in terms of its antibacterial, moisturizing, cleansing, healing, and aromatic properties. With further refinement of the formulation, concentration optimization, and thorough testing, the herbal neem soap has the potential to become a highly beneficial and widely accepted natural skincare product.

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