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Formulation and Evaluation of Anti-Acne Herbal Cream

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Abstract- — Approximately 85% of teenagers suffer from acne vulgaris, which can last until adulthood. Teenagers see doctors approximately two million times a year, and the US spends more than $1 billion on acne treatments directly. There are many different therapy options for acne vulgaris, such as hormonal, anti- androgen, or anti seborrheic medications, as well as retinoids, isoprenoids, keratolytic soaps, alpha hydroxy acids, azelaic acid, and salicylic acid. All of these techniques do have some negative effects, though, and it's unclear exactly how they fit into therapy. This paper not only presents the potential causes of acne vulgaris, medications that can treat it, and recently released research on the usage of medicinal herbs to treat the condition were examined. Topical formulations (herbal cream) have been developed containing Ocimum sanctum (Tulsi) extract, Aloe barbadensis miller (Aloe-vera Gel), Melaleuca Oil (Tea Tree Oil). These medicinal herbs and essential oil (TTO) show anti-bacterial activity against acne causing bacteria like Propionibacterium and staphylococcus aures. Various batches containing above Herbs and Essential oil are prepared and their comparative studies are performed. Certain evaluation tests are performed like Irritancy, Washability, pH, Greasiness to check whether cream is suitable for human skin. In the end anti-bacterial activity of the cream was carried out using agar well diffusion method against staphylococcus aures.

Keywords— Acne vulgaris, Aloe barbadensis miller, Ocimum sanctum, Melaleuca Oil P. Acne, staphylococcus aures

I. INTRODUCTION

Acne vulgaris, also known as acne, is a skin ailment that impacts practically everyone. Male chemicals produced by both genders' adrenal glands are the main cause of it, and it typically affects adolescents and young adults. Usually, the face, chest, and back are where it is seen. Pain, pustules (pimples), papules, discomfort, erythema, and loss of function are some of the symptoms. In a recent assessment, acne was found to account for 5.3% of all skin diagnoses. It is widely recognised as the second most frequent skin disorder.1

When the sebaceous organs linked to the pores responsible for transferring dead cells to the skin's surface are impeded, acne may result. Usually, this blockage leads to bacterial colonisation and attack on the sebum, which causes whiteheads and blackheads before the body's defence mechanism tries to fight back and causes inflammation and scars. Propiobacterium acnes and Staphylococcus epidermidis use sebum fatty substances to form unsaturated lipids, which attract neutrophils, and play important roles in inflammatory acne and shallow illness.2

Factors responsible for acne:

- Propionibacterium acnes (P. acne)
- Altered follicular keratinization Inflammation
- Androgen-induced enhanced sebum hyper-production
- Medications.
- Due to the Cosmetics Used
- Stress
- Hormonal Changes and Menstruation
- Squeezing the Pimples
- Diet
- Genetics
- Over Washing the Face with Cleansers

Treatment of acne

- Mild acne: Benzoyl peroxide
- Moderate acne: Topical retinoids/ antibiotics
- Severe acne: Hormonal therapy

Common pus forming bacteria that cause acne inflammation include S. epidermidis and P. acnes, which are Gram-positive, anaerobic bacteria. By stimulating complements and converting sebaceous triglycerides into fatty acids that irritate the follicular wall and adjacent dermis, P. acnes contributes to the development of inflammatory acne.3

Numerous disorders, including acne, are known to be directly or indirectly caused by oxidative stress. Reactive oxygen species are the cause of oxidative stress. Acne is caused by damaged sebaceous gland follicular walls that release sebum,

which includes reactive oxygen species like hydroxyl, superoxide, and nitrous oxide. The occurrence of irritation during the acne infection is caused by these free radicals. Antioxidant molecules made artificially have a negative side effect.4

Herbal sources are a good way to replace antioxidants since they help to heal the damage that these free radicals have produced.5

Researchers are becoming more and more interested in finding and creating natural treatments for a range of illnesses. The current study sheds insight on prospective plant extracts that may be investigated for the treatment of acne and the creation of novel medications to circumvent the side effects and drug resistance of existing acne treatments.6

The pharmaceutical industry has developed a number of treatments, including anti- acne tablets, lotions, moisturisers, and creams, to address this issue. One kind of semisolid emulsion that is intended for external application is cream, which can be either water in oil (w/o) or oil in water (o/w).

Cream is classified as an oil and water emulsion. Its key advantage is that it lasts longer at the application site. It is applied to the skin's outermost or most superficial layer. The cream's functions include protecting the skin from the elements, healing infections, removing tans and acne, and soothing the skin.

Water-in-Oil (W/O): "Water-in-oil" (W/O) products are creams composed of microscopic water droplets dispersed within a continuous oily phase. The type of emulsion known as water-in-oil (W/O) is produced when an oil functions as both the dispersion phase and the dispersion medium.

Oil-in-Water (O/W): An O/W emulsion is one in which the oil is dispersed throughout the aqueous phase in the form of droplets. The tiny oil droplets that make up Oil-in-Water (O/W) creams are distributed continuously.7

Skin cream protects the skin against different environmental conditions, weather and gives soothing effect to the skin. The purpose of skin cream is to give anti-acne effect, like moisturizer, reduce inflammation and skin irritation, reduce skin diseases like eczema, psoriasis, dry skin, wrinkles, rashes etc. and also adding glow to the face. Three herbal ingredients that are used in the preparation are Aloe Vera gel, Tulsi, Tea Tree oil.8

Tulsi (Ocimum sanctum Linn.):

It is the most important herb in Ayurveda, and scientific studies are now verifying its health benefits. There is growing evidence that Tulsi's special mix of pharmacological activities can manage stress related to the body, mind, metabolism, and chemicals. Tulsi's broad-spectrum antimicrobial activity, which includes activity against a range of human and animal pathogens, suggests it can be used as a hand sanitizer, mouthwash and water purifier as well as in animal rearing, wound healing, the preservation of food stuffs and herbal raw materials and travellers' health. Cultivation of Tulsi plants has both spiritual and practical significance that connects the grower to the creative powers of nature, and organic cultivation offers solutions for food security, rural poverty, hunger, environmental degradation and climate change. The use of Tulsi in daily rituals is a testament to Ayurvedic wisdom and provides an example of ancient knowledge offering solutions to modern problems.9

Aloe Vera Gel:

Human health places a high value on the usage of natural treatments, especially in the form of medications and cosmetics. Researchers are constantly looking for new botanical compounds that have biological activity.10

Many cultures have long employed aloe vera (also known as Aloe Barbadensis Miller, Liliaceae) for medicinal purposes. Aloe vera gel (AVG), a mucilaginous tissue found in the centre of A. vera leaves, is used to make cosmetics and some therapeutic items. Its pharmacological functions include antibacterial, anti-inflammatory, and wound-healing properties. Ayurvedic formulation with antibacterial activity against P. acnes included A. vera together with a few other herbal extracts. This gel, along with six other herbal extracts, were used in another Ayurvedic composition that shown clinical success in treating acne vulgaris.11

Tea Tree Oil:

The majority of the cyclic monoterpenes found in Melaleuca alternifolia, or tea tree oil, are hydrocarbons and 50% are oxygenated. Terpinen-4-ol, the active component of tea tree oil, attenuates the effects of broad-spectrum antibacterial activity.12

TTO has a wide range of pharmacological action including antibacterial, anti-fungal 13, anti-inflammation, antioxidant, anti-tutorial, and immune regulation effects. Numerous clinical trials on tea tree oils have indicated improved effectiveness in treating a variety of conditions, including onychomycosis, tinea, molluscum contagiosum, oral candidiasis, and acne.14

It is well known that terpinen-4-ol inhibits the synthesis of prostaglandin E2, IL-8, IL-10, IL-1, and tumour necrosis factor (TNF). The formation of superoxide by monocytes is inhibited by the water-soluble portions of TTO, terpinen-4-ol and a-terpineol, but not by oxygen species-producing neutrophils. Furthermore, terpinen-4-ol regulates plasma extravasation and vasodilation.

Of all of the properties claimed for TTO, its antimicrobial activity has received the most attention. The earliest reported use of the M. alternifolia plant that presumably exploited this property was the traditional use by the Bundjalung Aborigines of northern New South Wales. Crushed leaves of “tea trees” were inhaled to treat coughs and colds or were sprinkled on wounds, after which a poultice was applied. In addition, tea tree leaves were soaked to make an infusion to treat sore throats or skin ailments. The oral history of Australian Aborigines also tells of healing lakes, which were lagoons into which M. alternifolia leaves had fallen and decayed over time.

Use of the oil itself, as opposed to the unextracted plant material, did not become common practice until Penfold published the first reports of its antimicrobial activity in a series of papers in the 1920s and 1930s. In evaluating the antimicrobial activity of M. alternifolia oil and other oils, he made comparisons with the disinfectant carbolic acid or phenol, the gold standard of the day, in a test known as the Rideal-Walker (RW) coefficient. The activity of TTO was com- pared directly with that of phenol and rated as 11 times more active.15
Applications of Tee Tree Oil:

Antioxidant Activity
One function of tea tree oil is antioxidants. The antioxidants that can be obtained from crude TTO are c-terpinene, a-terpinene, and a-terpinolene. Their anti-oxidant function goes as follows: a-terpinene before a-terpinolene over c-terpinene.16
Antibacterial Activity:

Terpinen-4-ol exhibits high efficacy against methicillin-resistant Staphylococcus aureus (MRSA) and coagulase-negative staphylococcus (CONS). TTO's effects against S. aureus bacteria were similar to topical mupirocin's at a dose of 10%.17

Drug and Excipients Profile
Aloe vera:

Fig.1: Aloe vera

Synonyms: Aloe vera, also known as the "burn plant," is a succulent plant species that has been used for centuries for its medicinal properties. It belongs to the genus Aloe.

Biological Source: Aloe perry Baker, Aloe vera Linn or Aloe barbadensis Mil and Aloe ferox Miller, belonging to family Liliaceae.

Geographical Source: Aloe vera is native to the Arabian Peninsula, specifically the dry regions of the Arabian desert. It is believed to have originated in the southern part of the Arabian Peninsula, where the climate is hot and arid. However, aloe vera is now cultivated in many regions around the world, including Africa, the Mediterranean region, India, Mexico, and various tropical and subtropical areas. It is often grown in warm climates with well-draining soil, as it thrives in such conditions.

Uses: Aloe vera gel is commonly used topically to soothe and moisturize the skin. It is effective in treating sunburns, minor burns, cuts, insect bites, and other skin irritations. Aloe vera can help reduce dandruff, soothe scalp irritation, and add shine to the hair. Consuming aloe vera juice or supplements may support digestive health. Aloe vera contains compounds that can help alleviate digestive issues such as constipation, indigestion, and irritable bowel syndrome (IBS). Aloe vera gel has wound-healing properties and can accelerate the healing process for minor wounds, cuts, and abrasions.

Chemical Constituents: Aloin, emodin, acemannan, saponins and β-sitosterol

Chemical Structure:

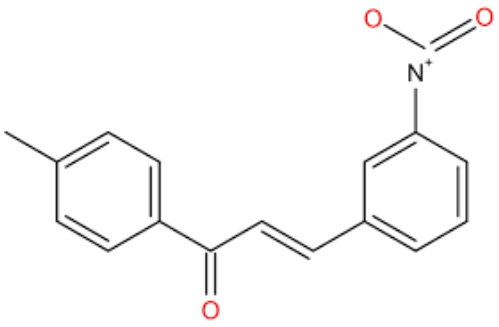


Fig. Chemical structure of Aloe vera

- Chemical formula: C16H13NO3
- Density: 1.2±0.1 g/cm3
- Molar mass: 267.279
- Melting point: 210.2±21.5 °C

Tulsi:

Synonyms: Holy basil, Ocimum tenuiflorum or Ocimum sanctum.

Fig.2: Tulsi

Biological Source: Ocimum sanctum Linn., belonging to family Labiatae.

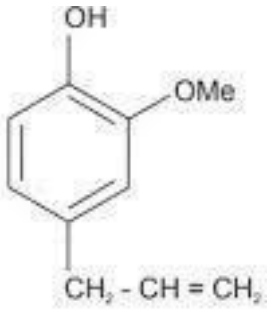
Geographical Source: Tulsi, also known as holy basil, is native to the Indian subcontinent, particularly to the tropical regions of India. It thrives in warm climates with ample sunlight and well-drained soil. Additionally, tulsi is cultivated in other tropical and subtropical regions around the world, including Southeast Asia, Africa, and the Caribbean, where the climate conditions are suitable for its growth.

Uses: It is used to treat various ailments, including respiratory disorders such as coughs, colds, bronchitis, and asthma. Tulsi is also used to alleviate digestive issues, including indigestion, bloating, and gas. Tulsi is known for its immune-boosting properties, making it beneficial for overall immune health. It contains antioxidants and bioactive compounds that help strengthen the immune system and protect the body against infections and diseases.

Chemical Constituents: Eugenol, Oleanolic acid, Rosmarinic acid and Camphene.

Chemical Structure:

- Chemical formula: C15 H31 CO2 C30 H61
- Density: 0.95-0.960
- Melting point: 64.00C



Eugenol

Tea Tree Oil:

Fig.3: Tea Tree Oil

Synonyms: Melaleuca oil, Australian tea tree oil, Melaleuca alternifolia oil.

Biological Source: Leaves of the Melaleuca alternifolia tree.

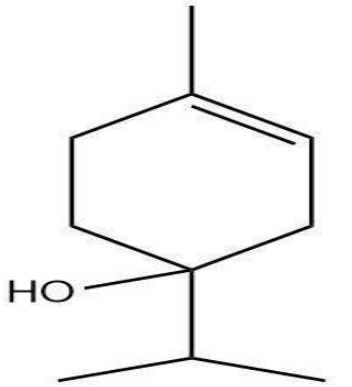
Geographical Source: The primary geographical source of tea tree oil is Australia, particularly in the northeastern region of New South Wales. This area is known for its vast expanses of Melaleuca alternifolia trees, from which tea tree oil is extracted. Additionally, tea tree oil is also produced in smaller quantities in other regions with suitable climates and soil conditions for growing tea tree plants, such as parts of Africa and Asia.

Uses: Tea tree oil is known for its antibacterial and antifungal properties, making it effective in treating acne, pimples, and blemishes It can also soothe minor skin irritations, insect bites, and cuts, promoting faster healing. It can help reduce scalp itchiness and flakiness while promoting healthy hair growth. Some shampoos and hair products contain tea tree oil as an active ingredient. It is used as a natural antiseptic for minor cuts, wounds, and abrasions. It helps prevent infection and promotes healing without irritating the skin. Tea Tree oil is a popular ingredient in acne treatments and facial cleansers due to its ability to kill acne-causing bacteria and reduce inflammation. It can be applied topically to affected areas to help clear up breakouts and prevent future acne flare-ups.

Chemical Constituents: Terpinen-4-ol, Alpha-terpineol and Terpinolene

Chemical Structure:

- Chemical formula: C10H18O
- Density: 0.906 g/cm³
- Melting point: -7°C to 7°C



terpinen-4-ol

Liquid Paraffin:

Fig.4: Liquid Paraffin

Synonyms: Liquid paraffin is also called as paraffinum liquidum.

Geographical Source: Liquid paraffin is the extracted from petroleum, a naturally occurring hydrocarbon, from underground reservoirs located in regions with significant oil reserves. It is mainly found in the Middle East, North America, Russia, and various other countries with substantial oil deposits.

Uses: Liquid paraffin is widely used in pharmaceutical products, including laxatives, ointments, creams, and lotions. It helps moisturize and soften the skin, making it a common ingredient in lotions, creams, moisturizers, and lip balms. It is used in food processing as a lubricant, release agent, and coating. Liquid paraffin is used in veterinary medicine as a laxative for animals to relieve constipation and to help expel ingested foreign objects. It may also be applied topically to soothe skin conditions in animals. It is used in the textile industry as a lubricant and softener for fibers and fabrics.

- Chemical formula: CnH2n+2
- Density: 0.8 g/cm3
- Boiling point: 370 °C (698 °F)

Bees Wax:

Fig.5: Bees Wax

Synonyms: White wax, yellow wax and Apis mellifera wax.

Geographical Source: Beeswax, cera alba, cera flava, white, and yellow. Beeswax is the refined wax extracted from the honeycomb of Apis mellifera Linn, the hive bee, and other Apis species in the Apidae family. It is mostly found in Africa, India, Jamaica, Egypt, France, Italy, and California, among other places.

Uses: Beeswax is a common ingredient in cosmetics and skincare products such as lip balms, lotions, creams, and ointments. It acts as a natural emulsifier, thickener, and moisturizer, helping to lock in moisture and protect the skin from environmental damage. It can be used to coat cheese, fruits, and vegetables to extend their shelf life and prevent moisture loss. It forms a protective barrier that helps maintain freshness and flavor while allowing the food to breathe. It is used in traditional medicine and herbal remedies for its soothing and protective properties. It can be applied topically to soothe minor skin irritations, burns, and insect bites, or used as a base for herbal salves and balms.

- Chemical formula: C15 H31 CO2 C30 H61
- Density: 0.95-0.960 g/cm3
- Boiling point: 64.00C

Rose water

Fig.6: Rose Water

Synonyms: Rose floral water, Rose hydrosol

Geographical Sources: Rose water is produced from the distillation of rose petals with water. Bulgaria is renowned for its rose cultivation, particularly in the Rose Valley region. Rose water is highly prized for its superior quality and fragrance. Rose water is found in Bulgaria, Turkey, Iran, Morocco, India and France. The Rosa demascena variety, commonly known as the Bulgarian or Damask rose, is used to produce rose water through steam distillation.

Uses: Rose water is a popular ingredient in skincare products due to its hydrating, soothing, and toning properties. It can be used as a facial toner to refresh the skin, tighten pores, and restore the skin's pH balance. Rose water can also be added to facial masks, moisturizers, and cleansers to enhance their efficacy and provide a gentle, floral scent. It can be used in haircare routines to condition and nourish the hair and scalp. It can help hydrate dry, brittle hair, reduce frizz, and promote hair growth. Rose water can be applied directly to the hair or mixed with other haircare ingredients such as oils or shampoos. Rose water is often used as a natural fragrance in perfumes, colognes, and body sprays. Its delicate floral scent is favored by many and can be used as a personal fragrance or added to homemade beauty and skincare products to impart a natural, floral aroma.

Melting Point: 1260C
Methyl Paraben:

Fig.7: Methyl Paraben

Synonyms: Methyl 4-hydroxybenzoate, Methyl ester of p-hydroxybenzoic acid

Geographical Sources: Methyl paraben is a synthetic compound that is not sourced from geographical locations like

natural substances. Instead, it is produced through chemical synthesis in manufacturing facilities worldwide.

Uses: Methyl paraben is widely used in cosmetics, skincare products, haircare products, and personal care items such as lotions, creams, shampoos, conditioners, and makeup. It helps prevent the growth of bacteria, fungi, and other microorganisms, extending the shelf life of these products and ensuring their safety and stability. It is also used as a preservative in pharmaceutical formulations such as topical creams, ointments, and oral medications to prevent microbial contamination and degradation. It helps maintain the efficacy and safety of pharmaceutical products during storage and use. It is commonly found in processed foods, beverages, sauces, condiments, and baked goods.

- Chemical formula: C8H8O3
- Density: 1.23 g/cm3
- Molar mass: 152.15 g/mol
- Melting point: 126 °C

Borax:

Fig.8: Borax

Synonyms: Sodium borate, Sodium tetraborate, Disodium tetraborate, Sodium borate decahydrate, Sodium biborate, Sodium borate, pentahydrate.

Geographical Sources: Borax is a mineral that occurs naturally and is found in many different parts of the world. The Boron Mine, commonly referred to as the Boron Pit and situated in Boron, California, is the biggest and most well-known source of borax in the United States. Rio Tinto Minerals runs this mine, which is a major global supply of borax.

Uses: Borax is used as a preservative in various products to inhibit microbial growth and extend shelf life. It is commonly found in cosmetics, personal care products, and food items such as caviar and fish roe. It is used as an insecticide to control pests such as ants, cockroaches, and silverfish. It disrupts the digestive system of insects and acts as a desiccant, causing dehydration and death. Borax can be sprinkled in areas where pests are present or mixed with bait to attract and eliminate insects.

- Mol. formula: $Na_2[B_4O_5(OH)_4] \cdot 8H_2O$
- Density: 1.73 g/cm3
- Molar mass: 381.37 g/mol
- Melting point: 743 °C.

II. MATERIAL AND METHODS

Collection of plant material:
Aloe vera and Tulsi were collected from botanical garden of KSSCOP College of Pharmacy, Shikrapur, Pune.

Excipients and herbal ingredients with their roles.

Role of ingredients:

Table. 1: Role of Ingredients

Sr. No	Ingredients	Roles of Ingredients
1	Aloe vera Gel	Anti-ageing, anti-inflammatory, anti-microbial, moisturizer, reduce acne and pimples.
2	Tea Tree Oil	Antimicrobial activity, relieves skin dryness, itching and redness
3	Tulasi extract	Antibacterial activity, adds glow to the face.
4	Beeswax	Emulsifying agent
5	Liquid paraffin	Lubricating agent
6	Borax	Alkaline agent
7	Propyl paraben	Preservative
8	Distilled water	Vehicle
9	Rose water	Fragrance

Extrraction Process
Extraction of Aloe Vera Gel:
These are young, healthy, mature aloe vera leaves that have been gathered and cleaned with water. The leaves are properly dried in a hot air oven, and then a sterile knife is used to cut the outer portion of the leaf longitudinally. Aloe Vera gel's colourless tissue is another feature. Clear aloe Vera gel, the

filter product, was prepared by filtering out the matter tissue using a sterile knife and then using a waste cloth to remove any fibres and contaminants from the filtrate.

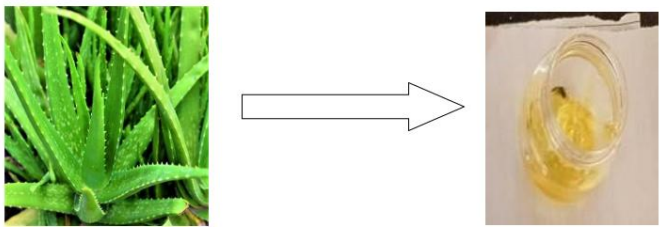


Fig.9: Extraction of Alo Vera

Extraction of Tulsi Leaves:

The fresh leaves of Ocimum sanctum were dried in shade & powdered. The powdered plant material is soaked in ethanol in closed container stand for 48 hrs. Decant and strain the soaked mass is formed then this colloidal dispersion is filter through a suitable apparatus, Then the solution was heated on water bath at 80 to 100degrees Celsius. for few minutes and then concentrated up to 5 ml and filtered using a muslin cloth to remove impurities. Then the filtrate or the filter product in which a clear solution or clear extract of Tulsi leaves was used in the preparation. Thus ethanolic extract of Tulsi was prepared using maceration extraction method.

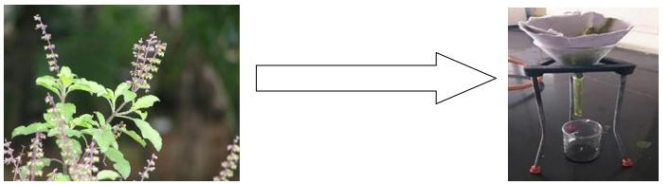


Fig.9: Extraction of Tulsi

Experimental Work

Formulation of Cream:

- Heat liquid paraffin and beeswax in a borosilicate glass beaker at 75 ℃ and maintain that heating temperature. (Oil phase).
- In another beaker, dissolve borax, methylparaben in distilled water and heat this beaker to 75 ℃ to dissolve borax and methylparaben and to get a clear solution. (Aqueous phase).
- Then add a measured amount of aloe Vera gel, Tulsi extract and Tea Tree Oil to oily phase and stir it.
- Then slowly add this aqueous phase to heated oily phase.
- Then add few drops of rose water as a fragrance.
- Put this cream on the slab and add few drops of distilled water if necessary and mix the cream in a geometric manner on the slab to give a smooth texture to the cream and to mix all the ingredients properly.
- This method is called as slab technique or extemporaneous method of preparation of cream.

Table 2: Ingredients and Formulation 1 (FH1)

Sr. No	Ingredients	FORMULATION 1 (FH1)
1	Aloe vera gel	0.5 ml
2	Tea tree oil	2.5 ml
3	Tulasi extract	1.0 ml
4	Beeswax	2 g
5	Liquid paraffin	8.0 ml
6	Borax	0.2 g
7	Methylparaben	0.02 g
8	Distilled water	QS
9	Rose water	QS

Table 3: Ingredients and Formulation 2 (FH2)

Sr. No	Ingredients	FORMULATION 2 (FH2)
1	Aloe vera gel	1.0 ml
2	Tea tree oil	1.5 ml
3	Tulasi extract	1.0 ml
4	Beeswax	4.0 g
5	Liquid paraffin	10 ml
6	Borax	0.2 g
7	Methylparaben	0.02 g
8	Distilled water	QS
9	Rose water	QS

Table 4: Ingredients and Formulation (FH3)

Sr. No	Ingredients	FORMULATION 3(FH3)
1	Aloe vera gel	2 ml
2	Tea tree oil	0.5 ml
3	Tulasi extract	1 g
4	Beeswax	2.5 g
5	Liquid paraffin	10 ml
6	Borax	1 g
7	Methylparaben	0.5 g
8	Distilled water	Q.S
9	Rose water	Q.S

III. RESULT AND DISCUSSION

Evaluation of Cream:

Physical Evaluation:

In this test color, odour, texture and state of cream are observed.

Table. 5: Physical Evaluation

Sr.No.	Parameters	Formulation (FH1)	Formulation (FH2)	Formulation (FH3)
1	Colour	White	White	White
2	Odour	Unpleasant	Pleasant	Pleasant
3	Texture	smooth	Rough	Smooth
4	State	Semi-solid	Semi-solid	Semi-solid

Irritancy: Mark 1cm2 area on left hand dorsal. Cream was applied on that area and note that time. After interval up to 5 hours it is checked for irritant effect, erythema and edema if any then reported.

Table 6: Irritancy

Sr. No	Formulation	Irritant Effect	Erythema	Edema
1	FH1	Nil	Nil	Nil
2	FH2	Yes	Yes	Nil
3	FH3	Nil	Nil	Nil

Washability:

Apply small amount of cream on hand and wash it under running tap water.

Table 7: Washability

Sr. no.	Formulation	Washability
1	FH1	Washable
2	FH2	Easily Washable
3	FH3	Easily Washable

pH:

Take 0.5g of cream and dispersed it in 50ml distilled water. Then check it's pH by using digital pH meter.

Table 8: PH

Sr. no.	Formulation	pH
1	FH1	7.80
2	FH2	7.91
3	FH3	7.62

Phase separation:

Prepared cream is kept in tightly closed container at room temperature away from sunlight and observed for 24 hours for phase separation.

Table 10: Phase separation

Sr. no.	Formulation	Phase separation
1	FH1	Phase separation
2	FH2	No phase separation
3	FH3	No phase separation

Spreadability:

Spreadability is carried out for formulations that is FH3. The cream sample is placed between two glass slides of uniform thickness by placing 100gm weight for 5 minutes then weight was added to weighing pan. The lesser time taken for the separation of both the slides better the spreadability. Therefore, according to statement FH has better spreadability.

Table 11: Spreadability

Sr. no.	Formulation	Time	Spreadability (g x cm /sec)
1	FH1	5	2.20
2	FH2	5	2.10

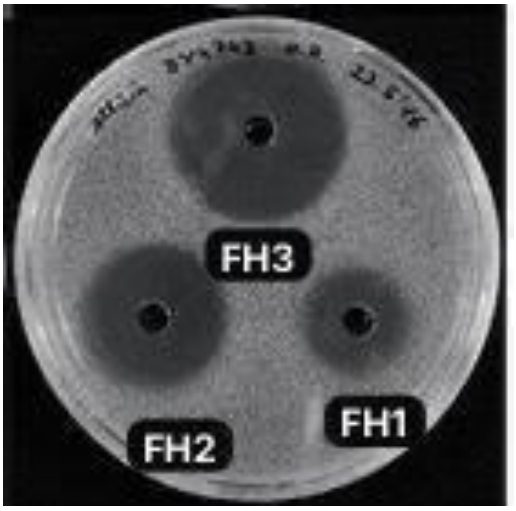
3	FH3	5	2.14

Greasiness:
The cream is applied in the form of smear on the surface of skin and observed if smear was oily or grease like. According to result, we can say that all three formulations FH were non-greasy.

Table 12: Greasiness

Sr. no.	Formulation	Time
1	FH1	Non-greasy
2	FH2	Slightly greasy
3	FH3	Non-greasy

Anti-bacterial Evaluation:
The assessment of antimicrobial activity was carried out to determine its activity for Anti-Acne Cream. Using the agar well diffusion approach, it was executed. Using the zone of inhibition approach, the herbal anti-acne cream's antimicrobial activity was assessed.



Formulation	Inhibition zone	Activity classification
FH1	10 mm	Low
FH2	14 mm	Moderate
FH3	17 mm	Moderate

IV. CONCLUSION

From the present study, it can be concluded that the herbal anti-acne cream formulated using Tulsi extract, Aloe vera gel, and Tea Tree oil showed promising results in the treatment and management of acne vulgaris. The selected herbal ingredients exhibited significant antibacterial, anti-inflammatory, antioxidant, and skin-protective activities, which are highly beneficial in reducing acne lesions, bacterial growth, skin irritation, and inflammation.

Three formulations were prepared and evaluated, among which the FH3 formulation was found to be the most effective and stable.

The formulation showed satisfactory physicochemical properties including:

- Suitable pH
- Good consistency
- Smooth texture
- Excellent spreadability
- Good washability
- Absence of phase separation
- Physical stability at room temperature

The irritancy study confirmed that FH3 was safe for topical application as it produced no redness, itching, erythema, or irritation on the skin. Furthermore, the antimicrobial study demonstrated that the formulation effectively inhibited acne-causing bacteria, confirming its therapeutic potential as an anti-acne preparation.

Summary
Bee's wax, liquid paraffin, borax, methylparaben, distilled water, Rose water, Aloe vera gel, Tea Tree Oil and Tulsi extracts were used to make the cream base. The cream was made by homogeneously combining all of the excipients and the plant extracts using the mortar and pestle method. We made three batches using slab technique method. The result of the study indicates that the above cream containing Tulsi, Aloevera gel and Tea Tree Oil shows anti-bacterial activity against Acne causing bacteria. The first batch reported the irritancy, the second batch lacked in antimicrobial activity then others and the final batch showed all the properties which are required in Anti-Acne cream.

A variety of criteria, including appearance, pH and phase separation, were assessed for each batch. There was no phase separation and the formulation FH3 had a satisfactory appearance and pH. Additionally, during the irritancy examination, the formulation FH3 shown no redness, erythema, or irritation, and they were very easy to wash. At room temperature, all three of the FH3 formulations remained stable.

In conclusion, there were notable differences in the actions of the herbal components. We may infer from the data that the formulation FH3 was stable and that skin application is safe.

Future Scope

Growing Demand for Natural Products: With increasing awareness of the potential side effects of synthetic ingredients in skincare products, there's a growing demand for natural and herbal alternatives. Herbal anti-acne creams offer a safer option for consumers concerned about chemical exposure.

Research and Development: Ongoing research into herbal ingredients and their therapeutic properties can lead to the discovery of new compounds with anti-acne properties. Advances in extraction techniques and formulation technology allow for the development of more effective herbal formulations.

Customization and Personalization: Advances in technology, such as artificial intelligence and machine learning, enable the customization of skincare products based on individual skin types, concerns, and preferences. Herbal anti-acne creams can be tailored to address specific acne triggers and skin sensitivities.

Combination Therapies: Herbal ingredients can be combined with other active compounds, such as vitamins, minerals, and peptides, to enhance their efficacy against acne. Synergistic formulations that target multiple pathways involved in acne development may lead to more effective treatments.

Sustainability and Ethical Practices: Consumers are increasingly concerned about the environmental impact of skincare products and the ethical sourcing of ingredients. Herbal anti-acne creams derived from sustainably cultivated plants and produced using environmentally friendly practices appeal to eco-conscious consumers.

Clinical Validation: Continued clinical studies and trials can provide scientific evidence supporting the efficacy and safety of herbal anti-acne creams. Robust clinical data demonstrating their effectiveness in treating acne can increase consumer confidence and drive adoption.

Market Growth and Innovation: The herbal skincare market is expected to continue growing as consumers seek natural alternatives to conventional skincare products. This growth creates opportunities for innovation and investment in herbal anti-acne creams, leading to the development of novel formulations and delivery systems.

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