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Formulation and Evaluation of Herbal Cream Using Aegle Marmelos Essential Oil

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ABSTRACT
This study aimed to formulate and evaluate an herbal cream utilizing the essential oil extracted from Aegle marmelos (bael) leaves. Aegle marmelos is a medicinally significant plant with a rich history in traditional medicine, known for its diverse pharmacological activities, including antimicrobial and anti-inflammatory properties attributed to its phytochemical constituents like citral. The essential oil was extracted from fresh Aegle marmelos leaves via steam distillation using a Clevenger apparatus. An oil-in-water (o/w) emulsion-based herbal cream was formulated incorporating the extracted essential oil as the active ingredient, along with other natural excipients such as beeswax, coconut oil, aloe vera gel, and glycerine. The formulated cream was evaluated for various physicochemical parameters, including physical appearance (colour, odour, texture), wash ability, pH, spread ability, homogeneity, greasiness, and phase separation. An initial irritancy test was also performed to assess skin compatibility. The results of the evaluation indicated that the formulated herbal cream exhibited desirable physical properties, was easily washable, had a skin-friendly pH, and demonstrated good spread ability and homogeneity. The cream showed no signs of phase separation upon preliminary observation. The irritancy test revealed no immediate adverse reactions on the skin. This study provides a preliminary basis for the potential topical application of Aegle marmelos essential oil in a cream formulation, warranting further investigation into its efficacy and stability for specific dermatological applications

Keywords: Aegle marmelos, Bael, Essential oil, herbal cream, phytochemicals , Morphology, chemical constituents, activities

I. INTRODUCTION

Many plants have been utilised for medical purposes for thousands of years. The medicinal plants perform very important role in the lives of populations worldwide. Around 85 percent of the world's population, either fully or partially depends on traditional medicine for basic health care. These plants are used in Ayurveda, Siddha and other healing systems. Our ancient literature has highlighted their characteristics and applications for curing different ailments, such as the Rigveda, Yajurveda, Charaka Samhita, and Sushruta Samhita, Astanga Hridaya[1].

In India, rural communities know around 25,000 potent plant based remedies that are employed in traditional medicine. Many plants and trees exist in ayurveda, but few people know their benefits. A significant amount of the basic and applied research is required to validate and use of plants in phyto-pharmaceutical chemistry. The potential use of higher plants as a source of new medication is still underutilized. For example a plant known as Aegle marmelos has been used to treat various infections traditionally. The main aim of this review is to know the phytochemical parameters, traditional and innovative application of A. marmelos. The Aegle marmelos is normally called as bael. In ancient eras, the aegle marmelos held great importance. Various writings depict the numerous roles of this plant. Bael is a deciduous sacred tree linked to a deity and possesses valuable medicinal qualities. This tree is commonly found in temples dedicated to Shiva and Vishnu. It is thought that the trifoliate leaves symbolize Brahma and Shiva. The spear-shaped leaves are believed to evoke the trishul (weapon) of Lord Shiva.[2].

This plant originates from the Indian subcontinent, which includes Bangladesh, Thailand, Sri Lanka, India, and Nepal. In India, it is present in nearly all states, including West Bengal, Kerala, Madhya Pradesh, Himachal Pradesh, and Jammu & Kashmir. It is also found in Egypt, Malaysia, Myanmar, and various other Asian nations.[3], [4], [5], [6].

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It is a deciduous tree of medium size. It is a subtropical plant that can be cultivated anywhere in the world and can adapt to a wide variety of environments. The plant has a wide range of adaptation to different soils and environments , and it can grow up to 1200 meters above sea level in ideal conditions[7]. However , it has been observed that trees can grow up to 1500 meters in Nepal spanning from the hills to the terai region. The wide distribution of A. marmelos can be attributed to its versatility, hardiness, and the valuable medicinal and nutritional properties[8].

Bael is rich in phytochemicals such as alkaloids, tannins, essential oils, gums, resins, coumarin, and polysaccharide, making it beneficial for a variety of diseases[4], [5]. This plant has important potential to cure the disease like diabetes, cholesterol, diarrhoea, dysentery, cancer, cardio protective, peptic ulcer, inflammation, anti-bacterial, anti-fungal, radio protective, antipyrtic, constipation, respiratory infection, antioxidant, wound healing hypoglycaemic, anti- lipidemic, and many more[2], [3], [4], [5], [6], [7], [9]. The bael also has possible inclusion in dietary plans focused on managing or preventing diabetes and its related issues[5].When compared to other plants, it has a substantially higher nutritional value. It is also quite important in terms of the environment. It functions as a climatic cleaner, releasing a higher percentage of oxygen than other trees[7].

Moreover, the plant Bael is potential in cancer prevention and treatment is an emerging area of interest. It can inhibit tumor growth and enhance the efficacy of conventional chemotherapeutic agents [5].

The plant of aegle marmelos contains the different type of chemical constituents from them the citral also present in the leaves of the plant. The citral (chemically known as 3,7-dimethyl-2,6-octadienal) is an aromatic bioactive compound can be found in the essential oils extracted from lemongrass, citrus fruits, verbena (Verbena officinalis),ginger and also in Aegle marmelos[10] .Then the preparation of a vanishing cream by using the citral may work as the antifungal cream topically.The extract which is obtained from the leaves of plant aegle marmelos consists of various phytoconstituents like limonene, β- Pinene, β-Caryophyllene etc., which show various activity.

Creams are classified as semisolid emulsions that are designed for external application and can be either water in oil (w/o) or oil in water (o/w) in type. Cream falls into one of two categories: water in oil emulsion or oil in water. It is applied to the skin's outside or superficial layer, and its primary function is to stay there for a longer amount of time. A skin cream's purpose is to protect the skin from various weather conditions and environmental factors while also providing a calming effect. There are different types of cream like cleansing, cold, foundation, vanishing, night, massage, hand and body creams[11].

Advantages of cream

- Cream moisturizes the skin.
- Easy to apply and shows a fast site of action on skin.
- Helps in skin protection also.
- They can help to soften and improve the skin texture also.

Disadvantage of cream

- Short time of action.
- Easily removed when it comes in contact with sweat and water.
- Sometime not good for oily skin.
- May cause allergic reaction in case the skin is sensitive in nature.

Classification of cream

The creams are classified on various bases, one of which is that they are classified according to their ingredients and formulation . therefore according to this the creams are of two types:-

a) Chemical Based Cream
b) Herbal Based Cream

Hearbal Based Cream:-

Herbal extracts are being utilized in cosmetic formulations to enhance appearance and beauty. Cosmetics made from herbs are categorized according to the body part or organ for which they are intended, such as cosmetics for the skin, hair, nails, teeth, and mouth, as well as the dose form, such as cream, powder, soaps, solutions, etc. Semi-solid emulsions called creams are meant to be applied to the skin or mucous membranes. A vanishing cream is a type of low-fat moisturizer that melts into the skin. [12], [13]. It leaves nothing behind and softens skin.Herbal creams are a popular option for people looking for a more natural approach to skincare because they emphasize the use of nature's cures rather than harsh chemicals or preservatives that synthetic skincare products may contain.

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Advantage of herbal cream:-

- They are chemical free products.
- The ingredients are easily available and present in a Variety of plant.
- Cheap cost.
- Easy to manufacture.
- They have fewer side effects and are safe for use.
- They are eco friendly and sustainable.

Disadvantage of herbal cream:-

- They show their result very slowly.
- Certain herbs may cause allergic reaction in some people.
- They are not always suitable for all skin types.
- High chance of contamination and have a short life cycle.

Reason for selecting Aegle marmelos for study:-

- The plant species needs to be studied for in future reference.
- The various parts of the plant are used locally by the population of the Asian Himalayans region for treatment of various disease like jaundice, fever and skin diseases etc_.
- The Plant has good antibacterial and antifungal activities.

The study of plant Aegle marmelos is ongoing by the scientist of various regions of the world and this species is available from the region of the Indian subcontinent. So, the plant needs to be studied so that more information can be available in the future, because of the latest trend on the use of plant due to their less side effects.

Propagation methods of Aegle marmelos:-

We can propagate Aegle marmelos by seed propagation, vegetative propagation (cutting), or air layering method. These are the various methods used to cultivate the plant. From the above methods the seed propagation is the simplest and easy method, in which firstly the seeds of the plant are collected from the ripe fruits and then the seeds are soaked into the water for 24 hours before sowing. After that sow the seeds in a well drained soil(depth about 1-2 cm). Keep the soil moist and provide partial sunlight. The germination takes around 15_30 days. Once the plant has grown large enough, then transplant them into the ground. The seedling trees start Bearing fruits at the age of 7-8 years.

Synonyms:-

Table No. 1 : synonyms of Aegle marmelos.

Languages	Synonyms	reference
Hindi	Bel, Bael, Sri phal , Villi	[3], [7], [14]
English	Bael fruit, Ball tree, Bela tree	
Gujrati	Bilvaphal, Billi, Bilivaohal	
Telugu	Bilvam, Bilva pandu, Maradu pandu	
Bengali	Bela, Bael, Sri phal	
Panjabi	Beel, Bil	
Urdu	Bel, Bael	
Chinese	Mu ju, Yin du gou qi	
Japanese	Berunoki, Igure marumerozu	
Thai	Mapin, Matum	
Nepali	Belapatra, Belpatra	
Javanese	Modjo	

Botanical Classification:-

Table No.2: Botanical classification of Aegle marmelos

Class	Botanical description	Reference
Kingdom	Plantae	[9], [14], [15]
Order	Sapindales	
Family	Rutaceae	
Sub family	Aurantioideae	
Genus	Aegle	

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Species	Aegle marmelos	
Botanical name	Aegle marmelos	

Morphology (Plant Description):-The tree of Aegle marmelos is about 12-15 meters tall with a fully developed trunk[2], [3]. The spiny branches are present on the trunk. The plant also contains a transparent gummy sap which exudes from the wounded branch (it has a sweet taste at the initial stage & then becomes irritating to the throat).

Figure No.1: Aegle marmelos tree

Leaves

The leaves of aegle marmelos are about 2 to 3 inches in the length. Leaves are alternate Trifoliate petiolate. They are composed of 3 to 5 oval, pointed, shallowly toothed leaflets. The terminal one is with a longer petiole than the other[2], [3], [6], [9].

The flowering occur generally in the month of April and May[3]. The flowers are generally in the clusters of 4-7. Each flower has 5 recurved fleshy petals; green outside and yellow is inside. Stamens are present inside the flower. The flower is 2 cm huge, sweet- scented, lax, erect[7].

Fruits

Fruits are about 5-20 cm in diameter, generally round oval or oblong in shape. The outer cover is hard and the inner pulp is soft gray- green in colour. After maturation fruits turn yellow. In the pulp 10 -15 flattened- oblong seeds are present[3].

Seeds

Seeds are about 1cm long, bearing adhesive, woolly hairs and each enclosed in a sack of transparent mucilage that solidifies on drying.10 – 15 flattened- oblong seeds are present in one pulp of the plant Aegle marmelos[3], [9]

Bark

The bark is pale brown, smooth or finely fissured and flaking, armed with long straight spines, 1.2 to 2.5 cm singly or in pair. The slimy sap coming out from cut parts known as gum. The gum is also described as a clear, gummy sap, resembling gum Arabic.

Flowers

Table No.3:- morphological characteristics.

Characteristics	Description	Reference
Odour	Aromatic	[2]
Taste	Mucilaginous	
Shape & size	Sub-spherical berry, 5-10 cm I diameter	
Epicarp	Hard, woody, externally reddish- brown, smooth or granular	
Mesocarp & endocarp	Consist of pulp which is reddish- brown and made up of 10 to 12 carpals. Each carpel contains several seeds with oblongs, flats, multicellular, woolly white hairs.	

Nutritional Composition of plant :-

Table no.4:- Nutritional composition of A. marmelos per 100gm.

Components	Composition	Reference
Major Components	**Composition per 100gm**	
Water	60 – 65mg	
Sugar	11 – 17mg	
Carbohydrates	9 -21mg	
Fibres	5mg	

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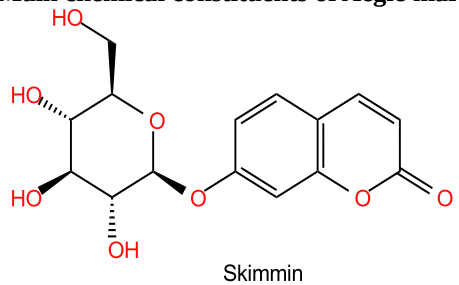
Minor components	Composition per 100gm	
Glucose	1.15mg	
Amino acids	1.7mg	
Niacin	1.10mg	
Thiamine	0.13mg	[15]
Ascorbic acid	8mg	
Riboflavin	1.19mg	
B- carotene	55mg	
Minerals	**Composition per 100gm**	
Calcium	80mg	
Phosphorous	52mg	
Copper	0.21mg	
Potassium	610mg	
Iron	0.60mg	

Varieties of Aegle marmelos:-

In the recent past, some important varieties of the bael have been developed through selection at ICAR Institutes and agriculture universities, cultivated in different parts of India. These varieties are Goma Yashi, Thar Divya, Thar Neelkanth, Thar Srishti, Nb-5, NB-7, NB-9, NB-16, Pant APama etc. Among them the Goma Yashi is the predominant ruling variety in western, southern, and central India owing to its attractive fruits and pulp colour, seeds, and mucilage whereas NB-9, NB-5 are prominent northern India[16].

- β- Carotene
- Vitamin A
- Psoralen
- Marmeline
- Aurapten
- Luvangetin
- Umbeliferone
- Citral
- Aegelinosides A
- Leucocyanin
- Rutin
- Phytol
- Alpha- sitosterol

Main chemical constituents of Aegle marmelos :-



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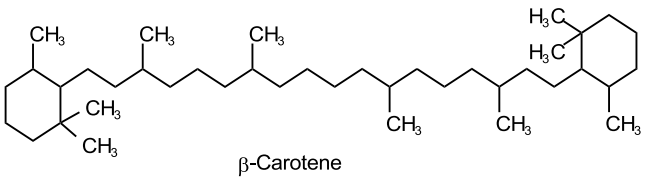
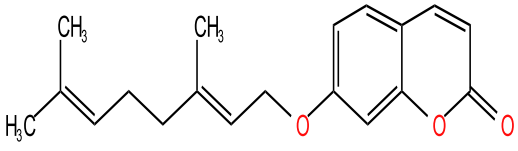
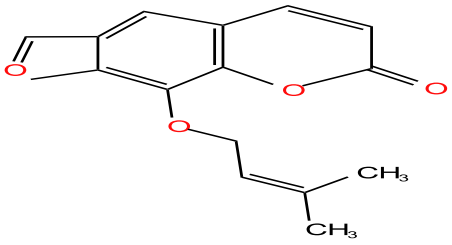


β-Carotene



Marmin



Marmelide

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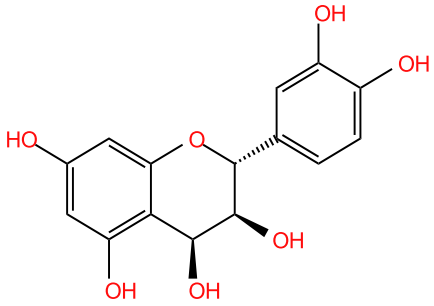
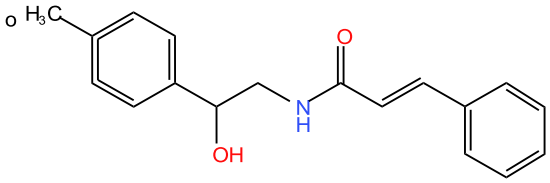
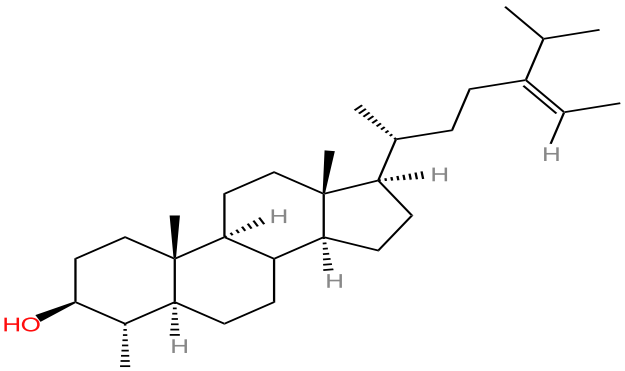


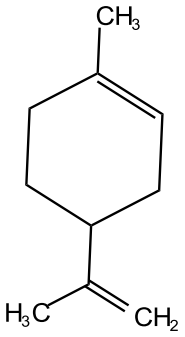
Leucocyanidin



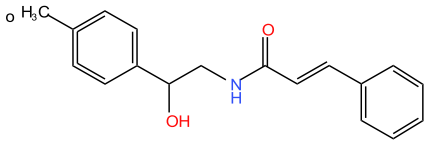
Aegelinosides A



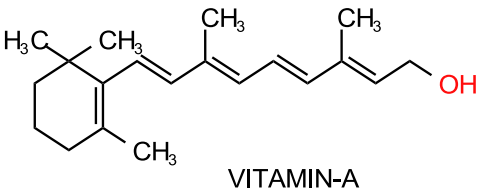
Alpha sitosterol



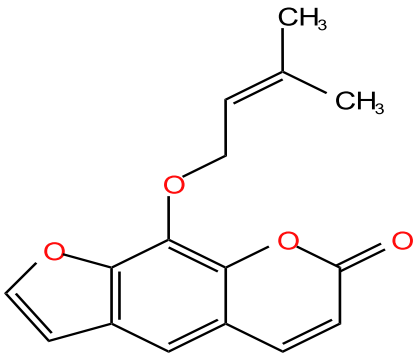
D-limonene



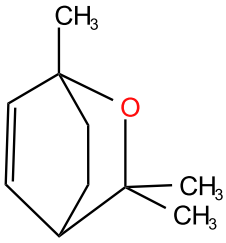
Aegelinosides A



VITAMIN-A



Imperatoin



Cineol

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Phytochemistry:-

The phytochemistry of the plant aegle marmelos has drawn a lot of attention from researchers since these substances could be essential to determining the plant therapeutically potential and creating the novel therapeutic agents. The numerous Indian scientists have made substantial contributions to the identification and separation of its chemical components. The various parts of plant(like fruits, roots, bark, leaves, etc_) have been studied for their phytochemical composition[8]. Bale fruit pulp contains flavonoids, steroids, terpenoids, tannins, lignins, inulin, proteins, carbohydrates, amino acids, fats, reducing sugar, and oils.[17].

Bioactive compounds including p-cymene, 1-dodecanol, cyclooctasiloxane, dotriacontane, phthalic acid, hexadecanoic acid, cyclodecasiloxane, oleic acid, octadecanoic acid, alpha-neodene, phenol, nonahexacontanoic acid, nonacosane, benzoic acid, 13-docosenoic acid, retinoid, and farnesyl acetone were detected by GCMS profiling of an alcoholic extract of A. marmelos leaves[14].

Table No.5:- Phytochemical present in different part of Aegle marmelos and their medicinal use.

Plant parts	Major phytochemical constituents	Medicinal value	Reference
Fruits	Terpenoids (Marmelosin , Luperol), Coumarins (Marmin , Marmelide), Alkaloids (Ageline, Aegelenine)	Antibacterial, antiulcer, heartbeats inhibitors, antiviral	[7]
Leaves	Flavonids(Rutin), Essential Oils, Alkaloids (Aegeline, Aegelenine), citral	Antiseptic, Cardio protective, antioxidant	
Roots	Terpenoids, Alkaloids	Anthelminthic	
Seeds	Fatty Acid, Amino Acids, Akimmianine	Anticancer, antipyretic	
Bark	Cumarins, Alkaloids	Abortifacient	

The main phytochemical present in the Plant of Aegle marmelos:-

Alkaloids:-

Alkaloids are naturally occurring, physiologically active secondary metabolites of plants that contain nitrogen. Marmeline (Z)-N-[2-hydroxy-2-[4-(3-methylbut-2-enoxy) phenyl]ethyl] is present in A. marmelos. Phenylethyl cinnamides (N-2-[4-(30)), Ethyl cinnamamide , O-3,3-(dimethylallyl)harfordinol,N-2-methyoxy-2-[4-(3',3'-dimethylallyloxy)phenyl],ethyl cinnamamide and 3-phenylprop2-enamide are also present in the plant[18]. The plant's antidiabetic qualities are caused by phenylethylcinnamides that were extracted from A. marmelos leaves and have α-glucosidase inhibitory activity. The visual system, prefrontal cortex, thalamus activity, insecticidal, demulcent, antiplasmodic, hepatoprotective, and anti-inflammatory properties are all enhanced by these alkaloid chemicals.[4]

Tannin:-

The amount of tannin in plants varies depending on the season and the specific type. Wild varieties of A. marmelos can have as much as 9% tannin, whereas cultivated versions typically have less. A. marmelos leaves contain skimmianine, a unique tannin compound. Tannins are well-known for their health benefits, such as protecting against mutations and cancer, preventing oxidative damage to cells from lipid peroxidation, and offering antimicrobial, fever-reducing, anti-methamphetamine, and cooling effects.[4]

Steroids:-

Steroids constitute an important category of secondary metabolites present in Aegle marmelos. These organic compounds are characterized by a distinctive structure composed of four fused carbon rings and are essential for numerous physiological functions. Research has discovered steroidal compounds in various parts of Aegle marmelos, such as the fruit, leaves, and bark.

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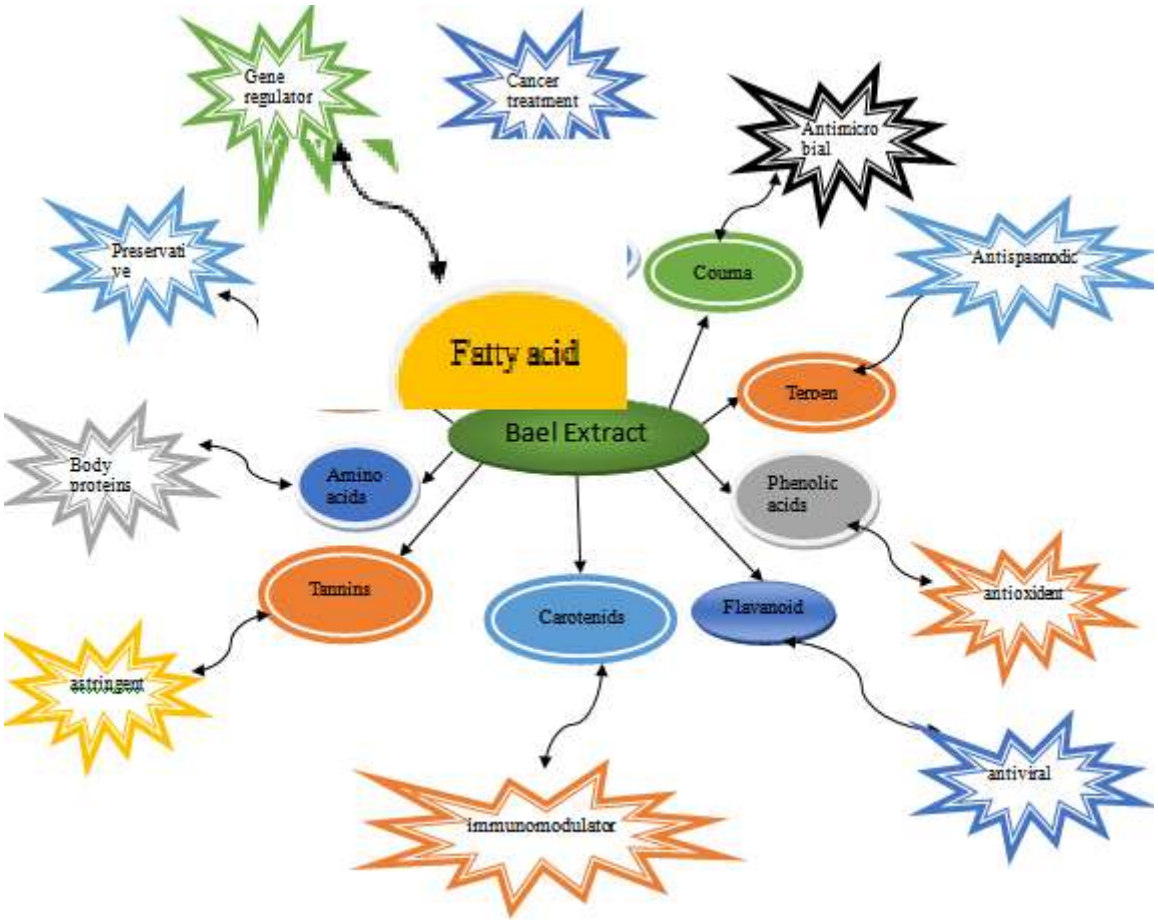

Figure No. 2:- Chemical composition &function of Aegle marmelos[19]

Macroscopic examination of Aegle marmelos

The macroscopic examination of Aegle marmelos consist of external structure details. The macroscopy of the plant is different in the different region and these evaluations is shown in below table:-

Table No.6:- macroscopic examination of plant

Part of plant	Shape	Size	colour	texture
Leaves	Trifoliate	5-10cm	Dark green	Glossy, leathery
Flower	Star shaped(5 petals)	3-5 cm	White - pale yellow	Fleshy
Fruit	Round, oval	10-30 cm	Yellowish green or brownish	Outer skin is hard and woody
Bark	Fissured, armed with long straight spines	4-8 mm thick	Brown or grayish	Rough, grayish

Traditional use of Aegle marmelos:- The Bael is a native plant of India subcontinent. It is used from the traditional time in the India. In Hinduism the Part of bael plant is used in various places like for cultural use , medicinal use, culinary and ritual purpose. According to traditional beliefs that the plant of bael nears the home brings prosperity and protects the inhabitants from the evil influences. In ayurveda , the extract of Aegle marmelos is used as an antidote for the snake poison[1][1]. The bael is highly valued in the traditional ayurvedic medicine. The various parts (fruit , leaves, seeds and bark etc_) are used for various health promoting properties and some of them are shown in the table.

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Table No.7:- Traditional use of plant

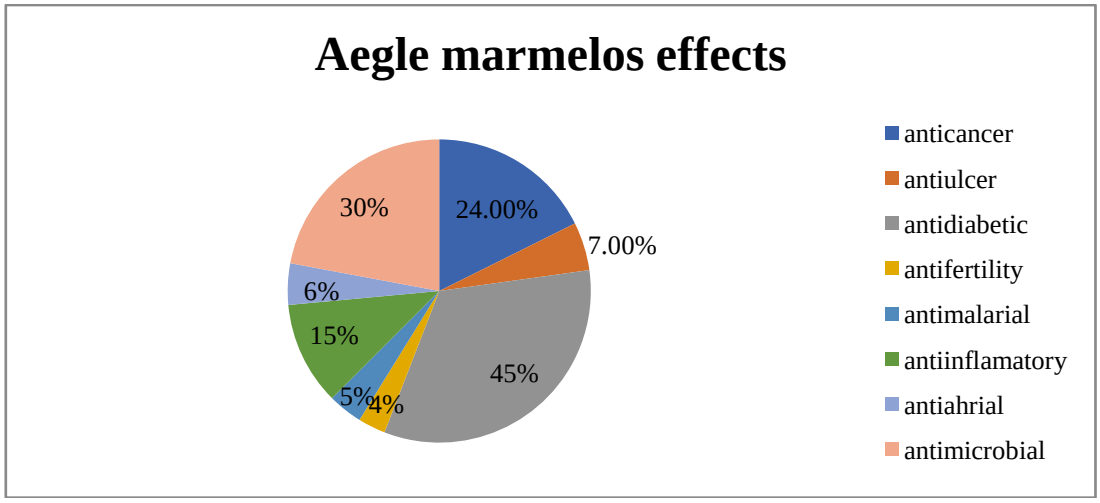
Part of plant	Traditional use	Reference
Leaves	Jaundice, Healing of wound, deafness, leucorrhoea, Conjunctivitis	[20], [21]
Unripe fruit	Astringent, Digestive, Stomachic, dysentery	
Ripe fruit	Dyspepsia	
Seeds	Gums from seeds House hold glue	
Roots	Fever remedies, antiulcer, hyperchondriasis	
Flower	Expectorant, oil from flower use as preparation of scent	

Pharmacological activity of the Aegle marmelos:-

Table No.8:-Pharmacological activity of Aegle marmelos

Pharmacological activity	Plant part involved	Mechanism	Reference
Antioxidant	Ripe and unripe fruits	Enzymatic antioxidants	[8], [14], [19]
Anticancer	Various part of plant	Immune system modulation	[14], [19]
Antimalarial	Leaves	In vitro activity against Plasmodium falciparum	[8]
Cardio protective	Unripe fruits	Reducing the cellular damage	[5]
antidiarrheal	Unripe fruit, pulp	Antiprotozoal activity	[1]
Antidiabectics	Fruits and seeds	Improve glucose regulation	[22]
Anti fertility	Leaves	Reduction of testis, epididymis and seminal vesicle.	[18]
Anti inflamator	Leave and ripe fruit	controll pro inflammation cytotoxin	[23]

The pharmacological activity of the plant Aegle marmecontroll pro inflammation cytotoxinlos plant have been reported scientifically and illustrated in the pie chart no. 1.[7], [22], [24]



Pie chart No.1 :- represents the effects of Aegle marmelos

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Market Formulation of Aegle marmelos:

Table No. 9 :- Market formulations.

Marketed formulation	Company name	
Ulco Bliss Tablet	Bliss ayurveda	[2]
Ojamin	Tates remedies	
Kof Rid Syrup	Ambika medico	
Entrosta Syrup	Ambica Medico	
Chyawanprash	Himalaya	
Leucare capsule	Shrey Nutraceuticals & Herbals	
Capsule BilvGiri	Ayurvedic Sanjevvani	
Leaf extract tablets	Baelmin	
Bael Tablet	Cura Ayurveda	

Formulation of herbal cream:-

A) Collection of plants leaves- The plant Aegle marmelos was the botanical plant which is selected for the preparation of herbal cream and it is taller woody plant. So we take out its green leaves (doesn not contain any type of disease).

B) Other plant material- a) Beeswax
b)Aloe Vera
c) Glycerine
d) Borax. etc____

C) Extraction of essential oil:-

1. **Method**:- Steam distillation
2. **Apparatus**:- Clevenger apparatus

✓ **Component** :- RBF, Condenser, Burette, Return tube

3. **Procedure**:-The leaves of the plant aegle marmelos is placed in the flask with water with sufficient quantity.

Then put the RBf in the Heating mentle for 5-6 hr. of reflux.

(Make sure that all the component of the apparatus are properly arranged for providing better reflux.

After the 5- 6 hr reflux, oil and water droplets are shown in the burette. Then collect the mixture and the seprate the oil and water phase by using the separating funnel and further perform the procedure.

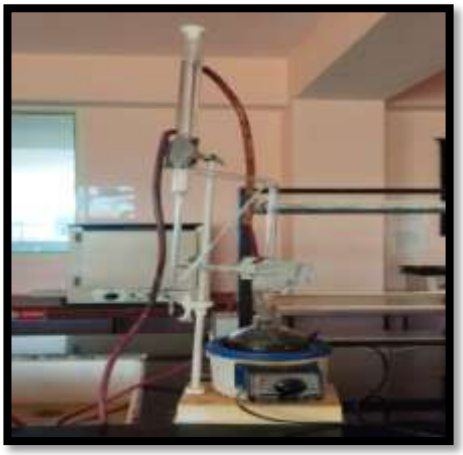

Fig. No.3 :- Assembly for extraction of ssential oil

After the 5- 6 hr reflux, oil and water droplets are shown in the burette. Then collect the mixture and the seprate the oil and water phase by using the separating funnel and further perform the procedure.

Fig. No.4 :-Separation of Essential oil

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D) Ingredients and their phase:-

Since the ingredients used in the formulation both (polar,non polar) in nature, so they are diffentiate in following table below:-

Table No.10:- Formulation & Composition of cosmetic cream

Sr. No.	Phase	Ingredients	Quantity(for50 gm)	Uses in formulation
1	Oil Phase	Essential Oil	1ml	Active Ingredient
		Coconut oil	7ml	Prevent skin dryness
		Beeswax	4 gm	Thickening agent
		borax	0.5 gm	Emulsifier
2	Water Phase	Aloe Vera gel	5gm	Hydrate the skin
		Distilled water	Quantity sufficient up to 50 gm	Solvent
		Glycerine	4ml	Humectants
		Rose Water	4ml	Fragrance & astringent effect
3	Preservatives & pH adjuster	Methyl paraben	0.15gm	Preservative
		Citric acid	0.5 gm	pH Adjuster

Method of Preparation of cream :-

1. Preparation of the oil phase:

Firstly take a clean beaker and add the coconut oil, bees wax and the essential oil according to the quantity written in above table.

Heat the mixture to 60 to 70 to melt the beeswax completely.

Add the borax (0.5gm) to the oil phase while stirring to ensure proper emulsification.

(Maintain the temperature at 60- 70 %)

2. Preparation of the water phase:

In a separate beaker, take distilled water in small quantity and heat it to 60-70 .

Add the aloe vera gel, glycerine, and rose water(all ingredients in sufficient quantity as shown in table) into the heated distilled water with continuous sirring.

3. **Emulsification Process:**

Slowly add the heated oil phase into the water phase with the continuous stirring.

Use a mechanical stirrer to blend the mixture properly until a uniform emulsion form.

4. **Cooling and final adjustments:**

Allow the mixture to cool down to room temperature while stirring occasionally.

Add methyl paraben (0.15 gm) as preservative and mix well.

Adjust the pH by adding the citric acid (0.5 gm) gradually while checking the pH to maintain the skin compatibility (around 5.5- 6.5). [11], [26], [27]

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Fig. No.5:- Herbal cream

Evaluation of cream: -

A) Physical properties

The physical properties of the formulated cream were observed in the term of colour, odour, and appearance.[11]

B) Washability test

In this test, apply a small amount of cream to the hands and washing with the tap water.[14]

C) pH determination

Firstly take 0.5 gm of prepared cream and dispersed it in 50 ml distilled water. Then check the pH by using digital pH meter and documented the finding.[28]

D) Spreadability

A sufficient quantity of the sample is placed between two glass slides, and a weight of 100 grams is exerted on the slides for 5 minutes. The spreadability can be represented by the formula, S= m*l/t, where m denotes the weight applied to the upper slide, l signifies the distance moved on the glass slide, and represents the duration taken. [28]

E) Irritancy test

Mark the designated area of 1 cm^2 on the left dorsal surface. Then apply the cream to that marked area and record the time. Afterward, evaluate for any signs of irritation, erythema, and edema at intervals up to 24 hours, and document the findings.

F) Microbial test

Scoop a small quantity of cream and put it in foil. Then, examine it under a microscope.[29]

G) Homogeneity Test

The uniformity of the herbal cream was evaluated based on the visual appearance and feel.

H) Greasiness

The cream was spread on the skin surface as a smear and observed to determine if the smear appeared oily or greasy.

I) Phase separation

The prepared cream form the essential oil was kept in a closed container at a temperature of 25 to 100^0c separate from the sunlight. Then the phase separation was checked after 18- 24 hr.[11], [26], [27]

Table No. 11:- Evaluation test with results:-

Sr. no.	Evaluation test	Results
1	Physical evaluation test	Colour :-Light white Odour :- pleasant Texture :- smooth
2	Wasability test	Easily washable with water
3	pH determination test	5.5 – 6.5 (ideal for skin)
4	Spreadability	Easily spreadable, uniform application
5	Irritancy	No irritation, suitable for all skin type
6	Microbial test	No microbial growth
7	Homogeneity test	Completely homogeneous
8	Greasiness	Absorbs well in skin, less greasy
9	Phase separation	No phase separation

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II. CONCLUSION

This study successfully formulated an herbal cream incorporating the essential oil extracted from Aegle marmelos leaves. The evaluation of the formulated cream revealed promising physicochemical properties, including a suitable pH for topical application, good spreadability, and homogeneity. The absence of immediate skin irritation in the preliminary testing suggests potential tolerability. This research provides a foundational step towards exploring the therapeutic potential of Aegle marmelos essential oil in a convenient topical dosage form. Further in-depth studies are warranted to assess the cream's stability over time, evaluate its efficacy for specific skin conditions, and conduct comprehensive safety assessments. The development of this herbal cream aligns with the growing interest in utilizing traditional medicinal plants for skincare applications, potentially offering a natural alternative.

III. RESULT

The formulated herbal cream, incorporating Aegle marmelos essential oil, presented as a smooth, light yellow emulsion with a characteristic aromatic odour. It exhibited good washability with water and maintained a skin-compatible pH within the range of 5.5 to 6.5. The cream demonstrated favourable spreadability, allowing for easy application on the skin. Homogeneity testing indicated a uniform distribution of ingredients throughout the formulation. No significant greasiness was observed upon application. Furthermore, the cream showed no signs of phase separation after 24 hours at room temperature, suggesting preliminary stability. The initial skin irritancy test on a small area revealed no adverse reactions within the observation period. These preliminary results suggest the successful formulation of a potentially viable herbal cream base utilizing Aegle marmelos essential oil for topical application.

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