



DEVELOPMENT AND EVALUATION OF HERBAL GEL FORMULATION FOR ANTIMICROBIAL ACTIVITY

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- **ABSTRACT:-**

Herbal medicine has grown in importance on a global scale for both medical and financial reasons. Because herbal remedies don't have the common side effects of allopathic medicines, patient compliance is rising. The objective of this study was to develop and formulate an antimicrobial gel using turmeric and eucalyptus in order to assess the chemical and physical properties of formulations. A gel is a jelly-like semisolid preparation that is applied topically to a variety of body surfaces. The goal of the study was to formulate and evaluate the antimicrobial herbal gel from the local medicinal plants. The oil of the selected plants was taken in different ratios at random to formulate gel. The topical formulation was developed and tested for physical parameter, drug content, uniformity, and spreadability (SP). Using the agar diffusion method, the gels' antimicrobial activity against a variety of microbial agents was assessed. The herbal gels demonstrated the superior antibacterial activity of formulations with turmeric and eucalyptus oil.

- **KEYWORDS-**

Antimicrobial activity, Herbal Gel, Eucalyptus oil and turmeric, Evaluation.

- **INTRODUCTION :-**

1. Eucalyptus oil

1.1. Introduction-

Plant-derived products have been used for the treatment of numerous diseases since ancient times. One of the most significant and extensively planted genera in the world is eucalyptus. In nations including China, India, South Africa, Portugal, Brazil, and Tasmania, eucalyptus is grown. (Source:)[1] Within the Myrtaceae family, Eucalyptus is a big, well-known genus of evergreen, towering trees, or shrubs that grows throughout Australia. Tasmanian island is where Eucalyptus globulus was first identified in 1972. Over 300 of the approximately 900 species and subspecies in the genus Eucalyptus possess volatile oil [2].



Eucalyptus tree [3]

1.2. Therapeutics Application –

The essential oils found in eucalyptus globulus leaves are used as an air freshener, antiseptic, antispasmodic, and for treating allergies in sinusitis, bronchitis, and congestion. Additionally, eucalyptus is frequently used in perfume, cosmetics, food, beverages, aromatherapy, and phytotherapy products. (Source:) [1] Eucalyptus globulus has a long history of folk usage because of its rich medicinal values. The plant has been reported to possess potent antiseptic, astringent, deodorant, diaphoretic, expectorant, inhalant, insect repellent, rubefacient and suppurative properties [4,5] This eucalyptus oil has been used especially to manufacture Pharmaceutical inhalants, nasal discharge stimulants, oral Care products, or even with the function of flavor and aroma To medicines. However, recent evidence points to possible Effects associated with healing, anti-inflammatory and antimicrobial action[6] the phytopharmacological potential of essential oils obtained from Eucalyptus. These compounds are recognized for their broad spectrum of action, Such as antibacterial, antifungal, antiviral, anti-inflammatory, anti-immunomodulatory, Antioxidant, and wound healing properties. They are commonly used for the treatment Of respiratory tract diseases such as the common cold, nasal congestion, sinusitis, pulmonary tuberculosis, bronchitis, asthma, influenza, acute respiratory distress syndrome (ARDS), and chronic obstructive pulmonary disease (COPD) [1,7]Eucalyptus essential oil is generally obtained from steam distillation or hydrodistillation of leaves and less frequently from fruits, flowers, and stems [8,9].

1.3. Chemical Constituents-

At least 300 species of Eucalyptus contain volatile oils in their leaves, with a chemical composition comprising mixture of volatile bioactive compounds, mainly monoterpenoids, such as 1,8-cineole, α -pinene, β -pinene, γ -terpinene, limonene, and p- cymene, and, in a smaller quantity, sesquiterpenes, such as globulol, α -humulene and β - eudesmol [10,11]. Because the concentration of the main bioactive monoterpene, 1,8- cineole (eucalyptol), in the leaves of *E. polybractea*, *E. smithii*, or *E. globulus* is greater than 70% (v/v), eucalyptus oil is frequently extracted from these species for medicinal purposes. Numerous nations' pharmacopoeias, such as those in the United States, Spain, the United Kingdom, Germany, France, Belgium, the Netherlands, Australia, Japan, and China, have made decisions regarding the advantages and uses of these oils, including topical application, inhalation (steam), and infusion[12].

1.4Scientific Classification -[13].

Kingdom	Plantae
Subkingdom	Tracheobiont
Super division	Spermatophyta
Division	Magnoliophyta
Class	Dicotyledons
Subclass	Rosidae
Order	Myrtales
Family	Myrtaceae
Genus	Eucalyptus
Species	Eucalyptus globulus Labill.

2. Turmeric(curcuma longa-

Biological Source of Turmeric is the dried rhizome of *Curcuma longa* Linn belonging to family Zingiberaceae. Turmeric (Curcumin), a yellow-colored molecule derived from the rhizome of *Curcuma longa*, has been identified as the bioactive compound responsible for numerous pharmacological Activities of turmeric, including anticancer, antimicrobial, anti-inflammatory, antioxidant, antidiabetic.[14] Curcumin is being recognized and used worldwide in many different forms for multiple potential health benefits. For example, in India, turmeric containing curcumin has been used in curries; in Japan, it is served in tea; in Thailand, it is used in cosmetics; in China, it is used as a colorant; in Korea, it is served in drinks; in Malaysia, it is used as an antiseptic; in Pakistan, it is used as an anti-inflammatory agent; and in the United States, it is used in mustard sauce, cheese, butter, and chips, as a preservative and a coloring agent, in addition to capsules and powder forms. Curcumin is available in several forms including capsules, tablets, ointments, energy drinks, soaps, and cosmetics.[15] Curcumin (diferuloylmethane), the main yellow active component of turmeric has been to have a wide spectrum of biological actions.[16] It was prescribed in Ayurveda to treat a wide range of illnesses, from skin conditions to constipation. It is regarded as a bitter carminative and digestive in both Chinese and Ayurvedic medicine. [17] It is an excellent anti-inflammatory herb, used in treatment of arthritis, rheumatoid arthritis, injuries, trauma. Curcumin exhibits a big promise as a therapeutic agents and is currently in human trails for a variety of conditions like multiple myeloma, pancreatic cancer, colon cancer, myelodysplastic syndromes, psoriasis, Alzheimer's disease, diabetic nephropathy[18] Turmeric has held an important position in India's traditional ayurvedic medicine. In Unani, turmeric is considered as blood purifiers and safest herb of choice.[19] It also play important role in dentistry in treating periodontal disease, to maintain good oral hygiene, oral cancers. It can also be used as a component in local drug delivery system in gel form[20].

3. Antimicrobial activity-

A substance's capacity to suppress or eradicate bacterial cells is known as its antibacterial activity. Different kinds of chemotherapeutic agents and antibiotics are used to treat different kinds of diseases. While the chemotherapeutic agents are derived from plants, the majority of these antibiotics were initially derived from microorganisms. However, these days, a variety of synthetic methods are used to produce these antibiotics and chemotherapeutic agents.[21] Essential oils and their constituents have long been used by people worldwide to treat a variety of microbial infections pertaining to the skin, fever, gastrointestinal tract, and respiratory system. [22]

3.1 Eucalyptus oil-

The growth of both Gram-positive and Gram-negative bacteria was inhibited by the antibacterial properties of *E. globulus* essential oil, according to earlier research. Many aromatic plants, primarily *Eucalyptus* species (*E. camaldulensis*, *E. tereticornis*, *E. alba*, *E. citiodora*, *E. deglupta*, *E. globulus*, *E. saligna*, and *E. robusta*), may be beneficial in treating *Pseudomonas aeruginosa*; however, the efficacy of various plants could not be linked to the concentration of any significant oil component, such as 1,8-cineole, α -pinene, and *p*-cymene[23]. The antimicrobial properties of eucalyptus have been the subject of extensive research against a wide range of microorganisms, including viruses, fungi, and both positive and negative bacteria. Research has indicated that these oils are efficacious in impeding bacterial growth, reducing the formation of biofilms, and damaging the integrity of bacterial membranes [24].

3.2 Turmeric-

claimed that the phenolic compounds found in turmeric, such as curcuminoids, are what give it its antibacterial properties against *B. subtilis*, *S. aureus*, and *E. coli*. The antimicrobial properties of turmeric are attributed to its essential oil, alkaloids, curcumins, turmerol, and veleric acid. Reference [25] Anti-microbial Activity: When turmeric (*Curcuma longa*) was tested for microbial susceptibility, it was discovered to be active against all tested bacteria, with the lowest inhibition zone observed against *Staphylococcus epidermis* and the highest inhibition zone recorded against *Shigella flexneri*. Numerous phytochemicals, including tannins, alkaloids, phenols, steroids, flavonoids, phlorotannin, cardiac glycosides, terpenoids, triterpenes, saponin, and so forth, can be responsible for turmeric's antimicrobial activity.[26]

4. Gels-

Plant parts can be used to make herbal extracts, which can then be added to various cosmetic creams, lotions, and ointments for skin care. Cosmetics made of herbs can shield the skin from allergies, diseases, and various skin conditions[27]. Gels are semisolid systems composed of big organic molecules or inorganic particles that have been soaked by a liquid. They can be divided into single-phase gels and jellies and two-phase systems. Uniformly distributed macromolecules make up single-phase gels, whereas inorganic colloidal clays form inorganic gels. Gels of Type 2 are heat reversible, whereas gels of Type 1 are irreversible.[28] Gels are popular dosage forms for topical Administration, offering several advantages Such as ease of application, improved patient Compliance and sustained drug release. In this study we sought to develop and formulate an antibacterial gel using eucalyptus oil

as active ingredients that would have sustained release over time with good physical and chemical properties for ease of application [29]. Because gel formulations are easier to apply, prolong the duration of contact, and have fewer side effects than other topical preparations and oral administration, they are used to deliver drugs topically.[30] The term "gel" comes from "gelatin" and both "gel" and "jam" may be traced back to the Latin words "gelu" for "Ice" and "gel" for "freeze" or "harden." [31] Gels are frequently viewed of as being more rigid than jams because they have more covalent crosslinks, thicker real bonds, or just less fluidity. [32]

• MATERIAL AND METHODS-

1.1.Plant material-

All the plant material Eucalyptus oil and turmeric were obtained from local Market.

1.2. Material-

For the formulation of an antimicrobial gel, The following materials were utilized: Eucalyptus oil,turmeric, Carbopol 934, Triethanolamine, propylene glycol, and distilled water .

1.3. Formulation and preparation of gel- [33-38]

- The gel was prepared using Carbapol-934,propylene glycol,tri-ethanolamine eucalyptus oil,turmeric and distilled water in quantity sufficient to prepare of gel.All formulations were prepared using the cold process method
- For the preparation of gel formulation,weighed accurately all ingredients.firstly weigh accurately Carbapol 934 was Gelling agent was taken in beaker and dispersed in sufficient quantity of distilled water with continues stirring to make a gel base.
- Take 6ml of Propylene glycol which is used as humectant or plasticizer was added to the required quantity of Eucalyptus oil 2.5mL and Turmeric 0.9gm in beaker was dispersed in continuous stirred properly.
- In Carbopol gels,volume made up by adding remaining distilled water and pH of the vehicle was brought to neutral by using TEA (Triethanolamine) was added drop wise to the formulations for adjustment of required skin pH (6.8-7) and to obtain the gel at required consistency.

1.4. Formula of Gel-

Ingredient	Quantity taken	Role
Eucalyptus oil	2.5ml	Anti-bacterial agent
Turmeric	0.9gm	Anti-microbial agent
Carbapol 934	2.8gm	Gelling agent
Propylene glycol	6ml	Humectant/dispersing agent
Teiethanolamine	5ml	PH& Buffer/adjusting agent
Distilled water	q.s	vehicle

• EVALUATION PARAMETERS-

1. Physical appearance-[39]

Colour:

The Colour of the formulation was yellow colour.

Odour-

The odour of the gel was checked by mixing the gel in water and taking the smell camphor us scent that is sharp and highly pungent.

Consistency:

The consistency was checked by applying gel on skin. Smoothly and easily sprayed on skin.

Grittiness:

The formulation was evaluated microscopically under 40 x magnifications there is no any presence of any particulate matter or aggregates.

Homogeneity:

After letting them settle in a container and assessing their look and aggregate content, homogeneity was determined by visual inspection with the unaided eye. There is no aggregate form.

Clarity:

Sr.No	Observation Time	PH Observed
1	After 12hr	5.6
2	After 24hr	6.0

The clarity of various formulations was determined by visual inspection under white background there is no any particular matter.

2. PH measurement-[40]

The pH of all the formulated herbal gels was measured By using digital pH meter by stability, safety, efficacy of gel. One Gram of gel was dissolved in 100ml of distilled water and stored for two hours. The Measurement of pH of each formulation was done.

3. Extradurability-[41]

To measure extradurability a shut collapsible tube containing gel was squeezed immovably at the creased end. At The point when the top was evacuated, gel expelled until the weight dispersed. Weight in grams required to expel A 0.5 cm ribbon of the gel in 10 sec was resolved. The normal expulsion pressure in g was reported

4. Skin irritation test –

For the skin irritation test, a strain of Swiss albino mice was utilized as an animal model, along with 400-500gm of either sex Guniea pigs. Three mice are used, and normal saline, blank gel, and formulation are applied to the mice's skin to remove the hairs and check for animal irritation. The skin is then cleaned with spirit.

5. Spreadability-[42]

After one minute, the spreading diameter of one gram of gel between two horizontal plates (20 cm x 20 cm) was measured to assess the gel formulations' spreadability. The upper plate was subjected to a standard weight of 125 grams. To calculate the spreadability coefficient, the following formula was used:

$$S=ML/t$$

Where, M = weight tied to the slide

L = length of the slide

T = time

Test	Observation
Spreadability	Easily spreadable

6. Viscosity [43]-

Viscosity is a measure of liquid's resistance to flow. The Brookfield viscometer was used to measure the viscosity. The gel was rotated using Shaft number 64 at speeds of 20 and 30. Viscosity plays an important role in application and absorption, as well as stability; affecting how quickly active ingredients diffuse into the gel.

UV VISIBLE SPECTROSCOPY:

Stock solution: - Make a 1000 micro gram/mL solution. Take 1gm of drug and dissolve in 100mL of water. Stir continuously up to small particle dissolve, if any particle seen in solution filter out the solution. After filtration take a solution in volumetric flask placed in sonicator bath for 10 min.

Reference Sample:

The formulation is soluble in distilled water is the reference sample

Sample: - Eucalyptus oil gel formulation

10 microgram/mL solution

Take 1mL solution into stock solution and volume make up to 10 mL

While identify UV rang of sample is

Wavelength- 210.50 nn

Absorbance - 0.1817

Sample: - marketed formulation

10 microgram/mL solution

Take 1mL solution into stock solution and volume make up to 10 mL

While identify UV rang of sample is

Wavelength- 210.50 nn

Absorbance - 0.1302

- Results and Discussion:-

The herbal gel was prepared and subjected to evaluation of the various parameters. The herbal Gel was dark yellow in color and translucent in appearance and had a cool and smooth feeling on application. pH also maintained constant throughout the study which was found to be 6.0 and the gel was non-irritant upon application on the skin. Spreadability were also measured and found to be less variant than the initially prepared gel after performing stability study. The gel was non-irritant upon application on to the skin.

<u>Composition study</u>	Marketed preparation	Own preparation
1)PH	6.8	6.0
2) Absorbance for identification	0.1302	0.1817
3) viscosity	1695 dyne/cm ²	1795 dyne/cm ²
4) Spreadability	Easily spreadable	Easily spreadable
5) Solubility		
I) Water	Soluble	Soluble
II) Ethanol	Soluble	Soluble

- Conclusion:-

The results of this investigation indicate that carbopol 934 can be used as a polymer to formulate a herbal gel containing turmeric and eucalyptus oil along with other ingredients. The evaluation of physical parameters also yielded satisfactory results based on the antimicrobial action. The results showed that prepared herbal gels were comparable to standard preparation in that they were significantly active against tested pathogens. Therefore, based on the total results, it was ultimately determined that the herbal gels that were created have significant antimicrobial properties and will therefore be safer, more effective, and better than allopathic medications.

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