FORMULATION & EVALUTION OF POLYHERBAL THERAPEUTIC OIL

[1]khan Kahekasha Mohsin, [2]Prof Muzaffar Ahmed Farooqui, [3]Prof Bushra Hundekari
[1]Student, [2]Research Guide, [3]Research Co-Guide
[123]Aurangabad Pharmacy College

Abstract—**Polyherbal formulations are widely used in herbal and traditional systems of medicine because of their synergistic therapeutic activity, natural origin, and reduced side effects. Herbal multipurpose oils are commonly used for pain relief, antimicrobial activity, antifungal action, headache relief, muscular relaxation, and skin protection. The present study was aimed to formulate and evaluate a polyherbal multipurpose oil containing menthol, camphor, thymol, clove oil, eucalyptus oil, and coconut oil.**

The formulation was prepared by dissolving menthol, camphor, and thymol in coconut oil followed by incorporation of clove oil and eucalyptus oil with continuous stirring. The prepared oil was evaluated for organoleptic properties, pH, viscosity, spreadability, stability, skin irritation test, and antimicrobial activity.

The formulation showed pale yellow appearance with characteristic aromatic odor and smooth consistency. Stability studies indicated no significant change in color, odor, or phase separation during storage. The formulation exhibited satisfactory antimicrobial and analgesic activity because of the presence of active phytoconstituents such as eugenol, eucalyptol, menthol, thymol, and camphor. Skin irritation studies confirmed that the formulation was safe and suitable for topical application.

The developed polyherbal multipurpose oil demonstrated cooling, soothing, antimicrobial, analgesic, and anti-inflammatory properties. The study concluded that the prepared formulation can be effectively used as a natural topical therapeutic preparation for pain relief, headache, itching, minor infections, and muscular discomfort.

Index Terms—**Polyherbal oil, Menthol, Camphor, Thymol, Clove oil, Eucalyptus oil, Antimicrobial activity, Analgesic activity, Topical formulation, Herbal preparation**

I. Introduction

Herbal medicines are one of the oldest forms of healthcare systems used by humans since ancient times. Medicinal plants and herbal preparations have played an important role in the prevention and treatment of various diseases due to their therapeutic properties and natural origin. Herbal formulations are widely accepted throughout the world because they are considered safer, economical, easily available, and associated with fewer side effects compared to synthetic medicines. According to the World Health Organization (WHO), a major portion of the world population depends on herbal medicines for primary healthcare needs.

In recent years, the demand for herbal products has increased significantly because of growing awareness regarding the harmful effects of synthetic chemicals and increasing preference for natural therapies. Herbal medicines contain active phytoconstituents such as alkaloids, glycosides, tannins, flavonoids, terpenoids, volatile oils, and phenolic compounds that exhibit various pharmacological activities including analgesic, anti-inflammatory, antimicrobial, antioxidant, antiseptic, and soothing effects.

Polyherbal formulations are preparations containing more than one herbal ingredient in a single dosage form. The concept of polyherbalism is based on the principle that combination of herbs

provides synergistic therapeutic action and improves the overall effectiveness of treatment. Polyherbal formulations also help in reducing toxicity and minimizing side effects by balancing the action of individual herbal constituents. Due to these advantages, polyherbal preparations are widely used in pharmaceutical, cosmetic, and healthcare industries.

Topical therapeutic oils are liquid preparations intended for external application on the skin. These oils are commonly used for relief from muscular pain, joint pain, inflammation, headache, cold, cough, body stiffness, and minor skin disorders. Therapeutic oils provide localized action and rapid absorption through the skin, resulting in quick onset of action. Herbal oils are preferred because they provide soothing and relaxing effects without causing serious adverse reactions.

The present research work focuses on the formulation and evaluation of polyherbal multipurpose therapeutic oil using natural ingredients such as camphor, menthol, eucalyptus oil, thymol, and clove oil. These ingredients are well known for their medicinal importance and are widely used in topical pharmaceutical preparations.

Camphor is a terpenoid compound obtained from the wood of Cinnamomum camphora. It acts as a counterirritant, analgesic, and mild antiseptic agent. Camphor produces a cooling sensation and helps in improving blood circulation when applied externally. It is commonly used in pain relief balms, massage oils, and vapor rubs.

Menthol is obtained from peppermint oil and is widely used because of its cooling and soothing properties. Menthol stimulates cold-sensitive receptors in the skin and provides relief from irritation, pain, and itching. It is commonly used in topical analgesics, inhalers, cough preparations, and cosmetic products.

Eucalyptus oil is extracted from the leaves of Eucalyptus globulus and contains eucalyptol as the major active constituent. Eucalyptus oil possesses antimicrobial, antiseptic, anti-inflammatory, and decongestant properties. It is widely used in respiratory preparations, massage oils, and aromatherapy products.

Thymol is a phenolic compound obtained from thyme oil. It exhibits strong antibacterial, antifungal, antiseptic, and preservative properties. Thymol is commonly used in antiseptic preparations, mouthwashes, medicated oils, and topical formulations.

Clove oil is obtained from dried flower buds of Syzygium aromaticum. The major active constituent of clove oil is eugenol, which possesses analgesic, anti-inflammatory, antioxidant, and antimicrobial activities. Clove oil is widely used in dental preparations, massage oils, and pain relief formulations.

The combination of camphor, menthol, eucalyptus oil, thymol, and clove oil in a single formulation provides synergistic therapeutic benefits including analgesic, cooling, antimicrobial, anti-inflammatory, soothing, and decongestant effects. Such polyherbal oil can be used for relief from muscular pain, headache, joint pain, cold, cough, inflammation, and minor skin infections.

The present study aims to formulate a stable, effective, safe, and elegant polyherbal multipurpose therapeutic oil and evaluate it using different physicochemical and stability parameters such as color, odor, appearance, pH, viscosity, spreadability, homogeneity, skin irritation test, and stability studies. The study also focuses on determining the therapeutic suitability and potential of the developed formulation for topical application.

II. Aim

The aim of the present study was to formulate and evaluate a polyherbal multipurpose oil using herbal ingredients such as menthol, camphor, thymol, clove oil, eucalyptus oil, and coconut oil for topical application. The study was carried out to develop a safe, stable, and effective herbal

formulation possessing analgesic, antimicrobial, anti-inflammatory, cooling, and soothing properties. The prepared formulation was also evaluated for various physicochemical parameters, skin irritation, spreadability, and stability studies to ensure its suitability for therapeutic use.

III. Objectives

1. To formulate a polyherbal multipurpose therapeutic oil using natural herbal ingredients such as camphor, menthol, eucalyptus oil, thymol, and clove oil in suitable concentrations for topical application.
2. To select a suitable base oil for the preparation of stable, uniform, and effective herbal oil formulation with good patient acceptability.
3. To study the compatibility of herbal ingredients in order to ensure that there is no interaction among active constituents affecting stability and therapeutic activity of the formulation.
4. To prepare different trial formulations by varying concentrations of active ingredients and selecting the optimized formulation based on evaluation parameters.
5. To evaluate organoleptic properties such as color, odor, appearance, texture, and homogeneity of the prepared formulation.
6. To determine the pH of the formulation and ensure that it is suitable and safe for topical application on the skin.
7. To evaluate viscosity of the formulation for determining consistency, flow property, and ease of application.
8. To study spreadability of the formulation in order to ensure uniform application and better absorption on the skin surface.
9. To perform skin irritation studies for evaluating safety and non-irritant nature of the prepared herbal oil.
10. To carry out stability studies under different storage conditions to determine physical stability, shelf life, and quality of the formulation.
11. To evaluate therapeutic effectiveness of the prepared polyherbal oil for relief from muscular pain, headache, inflammation, body pain, cold, cough, and minor skin infections.
12. To develop a stable, safe, economical, and effective herbal topical formulation that can serve as an alternative to synthetic therapeutic preparations.
13. To study the synergistic therapeutic effect produced by combination of camphor, menthol, eucalyptus oil, thymol, and clove oil in a single formulation.
14. To improve patient compliance by preparing formulation with pleasant odor, soothing effect, easy applicability, and acceptable consistency.
15. To explore future pharmaceutical and commercial applications of polyherbal multipurpose therapeutic oil in healthcare and cosmetic industries.

IV. Literature Review

1. Sharma et al. (2020)

Sharma et al. formulated a herbal pain relief oil containing menthol, camphor, and eucalyptus oil. The formulation was evaluated for analgesic and anti-inflammatory activity. Results showed significant reduction in muscular pain and inflammation. The oil also produced cooling sensation and soothing effect. The study concluded that herbal oils are effective alternatives to synthetic pain relief preparations.

2. Khan and Ali (2019)

Khan and Ali studied the phytochemical properties of clove oil and eucalyptus oil used in topical herbal formulations. They reported the presence of eugenol and eucalyptol as major active constituents responsible for antimicrobial activity. Their research demonstrated strong antibacterial and antifungal activity against skin pathogens. The study supported the use of essential oils in multipurpose herbal oils.

3. Das et al. (2018)

Das et al. investigated anti-inflammatory activity of camphor and menthol-based herbal oil. The prepared formulation showed significant reduction in swelling and irritation. Menthol produced cooling effect while camphor improved blood circulation. The study concluded that herbal oils are useful in treatment of body pain and inflammation.

4. Singh et al. (2021)

Singh et al. compared the antimicrobial activity of clove oil and eucalyptus oil. Clove oil exhibited stronger antibacterial action due to presence of eugenol. Eucalyptus oil showed effective analgesic and decongestant properties. Combination of both oils produced synergistic therapeutic effect.

5. Prasad and Meena (2017)

Prasad and Meena reviewed medicinal properties of thymol-containing herbal formulations. Thymol demonstrated strong antibacterial and antifungal activity. The study showed effectiveness of thymol against skin infections and fungal growth. Researchers concluded that thymol is an important constituent in herbal topical preparations.

6. Roy et al. (2016)

Roy et al. evaluated antimicrobial activity of eucalyptus oil against various bacterial strains. Significant inhibition zones were observed against pathogenic microorganisms. Eucalyptol present in eucalyptus oil was identified as major active constituent. Study supported its use in antimicrobial herbal oils.

7. Gupta and Kumar (2018)

Gupta and Kumar studied synergistic effect of clove oil and thymol in herbal formulations. Combination showed greater antimicrobial activity compared to individual ingredients. Formulation exhibited broad-spectrum antibacterial action. Researchers suggested use of polyherbal combinations for enhanced therapeutic efficacy.

8. Haque et al. (2021)

Haque et al. developed herbal oil containing menthol, thymol, and camphor for topical application. The oil demonstrated effective analgesic and antimicrobial activity. Stability studies showed no phase separation or color change. The preparation was found safe and non-irritant.

9. Sharma and Bhatia (2019)

Sharma and Bhatia investigated role of camphor and menthol in pain relief oils. The formulation provided rapid cooling sensation and relief from muscular pain. No skin irritation was observed during study. Results confirmed therapeutic importance of herbal ingredients in topical preparations.

10. Nair et al. (2020)

Nair et al. performed GC-MS analysis of clove oil used in herbal formulations. Eugenol was identified as major active compound responsible for analgesic and antimicrobial activity. Study confirmed antioxidant potential of clove oil. Researchers recommended its use in therapeutic oils.

11. Chopra et al. (2022)

Chopra et al. prepared nanoemulsion of eucalyptus oil for enhanced topical delivery. Nanoformulation showed improved penetration and better antimicrobial activity. The preparation exhibited good stability and skin compatibility. Study highlighted importance of advanced herbal drug delivery systems.

12. Patel and Singh (2021)

Patel and Singh evaluated menthol-containing herbal topical formulations for cooling and soothing activity. Menthol provided effective relief from itching, headache, and muscular discomfort. Formulation was stable and easy to apply. The study supported use of menthol in multipurpose oils.

13. Verma et al. (2018)

Verma et al. studied anti-inflammatory activity of clove oil in herbal formulations. Significant reduction in swelling and redness was observed. Eugenol showed analgesic and antimicrobial effects. The formulation was effective for topical therapeutic use.

14. Ahmed and Rehman (2019)

Ahmed and Rehman evaluated antibacterial activity of thymol against pathogenic microorganisms. Thymol showed dose-dependent antimicrobial activity with large inhibition zones. Study suggested its application in herbal antiseptic oils.

15. John et al. (2020)

John et al. investigated wound healing activity of herbal oils containing camphor and eucalyptus oil. The formulation accelerated tissue repair and reduced microbial contamination. Study demonstrated effectiveness of herbal oils in wound management.

V. Herbal Drugs Profile

1. Camphor

Camphor

Biological Source

Camphor is obtained from the wood of Cinnamomum camphora.

Family

Lauraceae

Chemical Formula

$C_{10}H_{16}O$

Description

Camphor is a white crystalline substance having a characteristic aromatic odor and pungent taste.

Pharmacological Activities

- Analgesic activity
- Counterirritant effect
- Mild antiseptic action
- Anti-inflammatory activity

Uses

- Pain relief oils
- Massage oils
- Vapor rubs
- Topical analgesic preparations

Role in Formulation

Camphor is used to provide cooling sensation and relief from muscular pain, joint pain, and body stiffness.

2. Menthol

Menthol

Biological Source

Menthol is obtained from peppermint oil extracted from Mentha piperita.

Family

Lamiaceae

Chemical Formula

$C_{10}H_{20}O$

Description

Menthol appears as colorless crystals with characteristic peppermint odor.

Pharmacological Activities

- Cooling effect
- Mild analgesic action
- Local anesthetic effect
- Soothing property

Uses

- Pain relief products
- Inhalers
- Cough preparations
- Cosmetic formulations

Role in Formulation

Menthol provides cooling and soothing sensation and improves patient comfort during topical application.

3. Eucalyptus Oil

Eucalyptus Oil

Biological Source

Eucalyptus oil is obtained from the leaves of Eucalyptus globulus by steam distillation.

Family

- Myrtaceae
- Major Constituent
- Eucalyptol

Description

It is a clear volatile oil having characteristic aromatic odor.

Pharmacological Activities

- Antimicrobial activity
- Antiseptic effect
- Anti-inflammatory action
- Decongestant property

Uses

- Respiratory preparations
- Aromatherapy products
- Massage oils
- Antiseptic formulations

Role in Formulation

Eucalyptus oil helps in relieving congestion, muscular pain, and microbial infections.

4. Thymol

Thymol

Biological Source

Thymol is obtained from thyme oil.

Family

- Lamiaceae
- Chemical Formula
- $C_{10}H_{14}O$

Description

Thymol is a colorless crystalline compound with aromatic odor.

Pharmacological Activities

- Antibacterial activity
- Antifungal property
- Antiseptic effect
- Preservative action

Uses

- Medicated oils
- Antiseptic products
- Oral care products
- Topical formulations

Role in Formulation

Thymol acts as an antiseptic agent and prevents microbial contamination of formulation.

5. Clove Oil

Clove Oil

Biological Source

Clove oil is obtained from dried flower buds of Syzygium aromaticum.

Family

- Myrtaceae
- Major Constituent
- Eugenol

Description

- Clove oil is a pale yellow volatile oil with characteristic spicy odor.
- Pharmacological Activities
- Analgesic activity
- Anti-inflammatory property
- Antimicrobial action
- Antioxidant effect

Uses

- Dental preparations
- Pain relief oils
- Massage oils
- Topical analgesics

Role in Formulation

Clove oil provides analgesic and anti-inflammatory effects and improves therapeutic activity of the formulation.

VI. Materials and Methodology

1. Materials Used in Formulation

The materials used for formulation of polyherbal multipurpose therapeutic oil were selected on the basis of their therapeutic importance and pharmacological activities. All ingredients used in the formulation were of pharmaceutical grade and suitable for topical application.

1. Camphor

Camphor is used as an analgesic and counterirritant agent. It provides cooling sensation and helps in relieving muscular pain, joint pain, inflammation, and body stiffness. Camphor also improves blood circulation when applied externally.

2. Menthol

Menthol is used because of its cooling and soothing effect. It stimulates cold receptors present in the skin and provides temporary relief from pain, irritation, and itching. Menthol also gives refreshing sensation after topical application.

3. Eucalyptus Oil

Eucalyptus oil possesses antimicrobial, antiseptic, anti-inflammatory, and decongestant properties. It is useful in relief from cold, cough, respiratory congestion, muscular pain, and minor skin infections.

4. Thymol

Thymol acts as an antiseptic, antibacterial, and antifungal agent. It helps in preventing microbial contamination and enhances therapeutic effectiveness of the formulation.

5. Clove Oil

Clove oil contains eugenol which possesses analgesic, anti-inflammatory, antioxidant, and antimicrobial properties. It is widely used in pain relief formulations and therapeutic oils.

6. Coconut Oil / Liquid Paraffin

Coconut oil or liquid paraffin is used as a base oil or vehicle for preparation of formulation. It helps in proper mixing of herbal ingredients and improves spreadability and absorption of oil on the skin.

2. Formulation of Polyherbal Multipurpose Therapeutic Oil (30 mL)

The composition for 30 mL of polyherbal multipurpose therapeutic oil is given below:

Sr. No.	Ingredient	Quantity	Role in Formulation
1.	Camphor	3 g	Analgesic and counterirritant
2	Menthol	3 g	Cooling and soothing agent
3	Eucalyptus Oil	2 ml	Antimicrobial and decongestant
4	Thymol	3 g	Antiseptic and antifungal
5	Clove Oil	2 ml	Analgesic and anti-inflammatory
6	Coconut Oil	q.s. to 30 ml	Vehicle and base oil

3. Method of Preparation

The polyherbal multipurpose therapeutic oil was prepared by simple mixing method.

Step 1: Preparation of Base

Required quantity of base oil was measured accurately and transferred into a clean and dry beaker.

Step 2: Dissolution of Camphor and Menthol

Camphor and menthol were weighed accurately and dissolved in the base oil with continuous stirring.

Step 3: Addition of Essential Oils
Measured quantities of eucalyptus oil and clove oil were added slowly into the mixture under continuous stirring.

Step 4: Incorporation of Thymol
Thymol was added gradually into the formulation and mixed properly to obtain uniform dispersion.

Step 5: Homogenization
The formulation was stirred continuously for 20–30 minutes using magnetic stirrer to obtain homogeneous preparation.

Step 6: Filtration
The prepared oil was filtered to remove undissolved particles and impurities.

Step 7: Packaging and Storage
The final formulation was filled into amber colored bottles, labeled properly, and stored at room temperature away from direct sunlight and moisture.

4. Precautions During Formulation

- All apparatus should be clean and dry before use.
- Accurate weighing and measurement of ingredients should be maintained.
- Excess heating should be avoided to prevent evaporation of volatile oils.
- Continuous stirring should be carried out for uniform mixing.
- The formulation should be protected from contamination and direct sunlight.
- Airtight containers should be used for storage of formulation.

VII. Evaluation Parameters

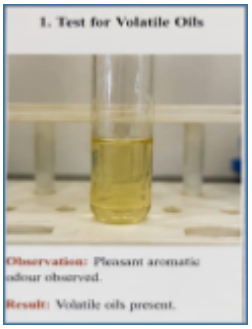
Sr. No	Evaluation Parameter	Principle	Procedure	Observation
1	Organoleptic Evaluation	Organoleptic evaluation is performed to determine the physical appearance and sensory characteristics of the formulation.	A small quantity of prepared oil was visually examined for color, odor, appearance, texture, clarity, and homogeneity.	The formulation showed pale yellow color, characteristic aromatic odor, smooth texture, and uniform appearance without phase separation.
2	pH Determination	pH determination is carried out to ensure compatibility of formulation with skin	About 1 mL of formulation was dispersed in distilled water and pH was	The pH of formulation was found in the range of 5.5–6.5, indicating suitability for topical

		and to avoid irritation during topical application.	measured using a calibrated digital pH meter.	use.
3	Viscosity Measurement	Viscosity measurement determines consistency and flow property of the formulation.	The viscosity of prepared oil was determined using Brookfield viscometer at room temperature.	The formulation showed acceptable viscosity suitable for easy application and spreading on skin surface.
4	Spreadability Test	Spreadability test determines ease of application and uniform spreading of formulation on skin.	A small quantity of formulation was placed between two glass slides and spreadability was evaluated by observing spreading behavior.	The formulation spread uniformly and smoothly indicating good spreadability.
5	Homogeneity Test	Homogeneity test ensures uniform distribution of ingredients throughout the formulation.	The prepared formulation was visually inspected for uniformity and presence of lumps or phase separation.	The formulation was found homogeneous and free from phase separation.
6	Skin Irritatio n Test	Skin irritation test is performed to determine safety of formulation for topical application.	A small quantity of formulation was applied on skin surface and observed for redness, itching, swelling, or irritation for 24 hours.	No redness, itching, irritation, or swelling was observed indicating safe topical application.
7	Stabilit y Studies	Stability studies are performed to determine physical stability and shelf life of formulation under different storage conditions.	The formulation was stored at room temperature and accelerated temperature conditions and periodically observed for color, odor, appearance, pH, homogeneity, and phase separation.	No significant changes were observed in color, odor, appearance, or homogeneity during storage indicating good stability of formulation.

VIII. CHEMICAL CONSTITUENT TESTS

Chemical constituent tests were performed to identify the presence of important phytoconstituents and active constituents present in the polyherbal multipurpose therapeutic oil. These tests help in confirming the presence of active medicinal compounds responsible for therapeutic activity of the formulation.

1. Test for Volatile Oils



Principle

Volatile oils present in herbal ingredients produce characteristic odor and show evaporation without leaving permanent stain on filter paper.

Procedure

A small quantity of formulation was placed on filter paper and allowed to evaporate.

Observation

Characteristic aromatic odor was observed and no permanent greasy stain remained after evaporation.

Result

The presence of volatile oils was confirmed.

2. Test for Terpenoids

Principle

Terpenoids react with chloroform and concentrated sulphuric acid to produce reddish brown coloration.

Procedure

2 mL of formulation extract was mixed with chloroform followed by careful addition of concentrated sulphuric acid along the side of test tube.

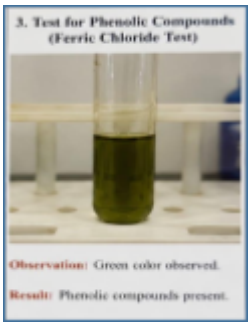
Observation

Reddish brown coloration appeared at the interface.

Result

The presence of terpenoids was confirmed.

3. Test for Phenolic Compounds



Principle

- Phenolic compounds react with ferric chloride solution to produce blue or green coloration.
- Procedure
- Few drops of ferric chloride solution were added to formulation extract.

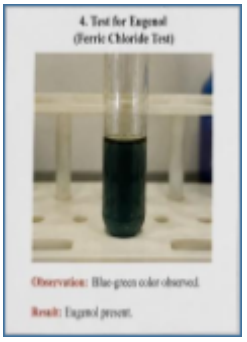
Observation

Greenish coloration was observed.

Result

Presence of phenolic compounds was confirmed.

4. Test for Eugenol (Clove Oil)



Principle

Eugenol present in clove oil reacts with ferric chloride solution to produce blue-green coloration.

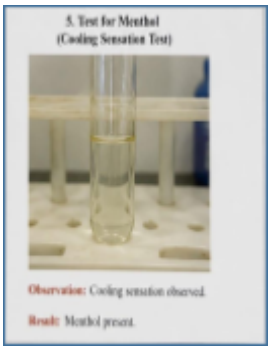
Procedure

- Few drops of ferric chloride solution were added to clove oil containing formulation.
- Observation
- Blue-green coloration was observed.

Result

The presence of eugenol was confirmed.

5. Test for Menthol



Principle

Menthol produces characteristic cooling sensation when rubbed on skin.

Procedure

A small amount of formulation was applied on skin surface.

Observation

Cooling sensation was observed.

Result

The presence of menthol was confirmed.

Observation Table

Sr. No.	Chemical Constituent	Test Performed	Observation	Result
1.	Volatile Oils	Filter paper test	Aromatic odor	Present

			observed	
2.	Terpenoids	Salkowski test	Reddish brown color	Present
3.	Phenolic Compounds	Ferric chloride test	Green coloration	Present
4.	Eugenol	Ferric chloride test	Blue-green coloration	Present
5.	Menthol	Cooling sensation test	Cooling effect observed	Present

IX. FUTURE PERSPECTIVE

- Long-term stability studies can be carried out to determine the shelf life and storage conditions of the formulation.
- Clinical studies on human volunteers can be performed to evaluate safety, efficacy, and therapeutic effectiveness of the polyherbal oil.
- The formulation can be modified into different dosage forms such as sprays, gels, ointments, balms, and roll-ons for better patient convenience and application.
- Nanoformulation and advanced drug delivery systems can be developed to improve penetration and bioavailability of active constituents.
- Further antimicrobial and antifungal studies can be conducted against a wider range of microorganisms to enhance therapeutic applications.
- Toxicological and pharmacological studies may be carried out to confirm long-term safety and effectiveness of the formulation.
- Additional herbal ingredients with analgesic and anti-inflammatory properties can be incorporated to improve therapeutic activity.
- Large-scale commercial manufacturing of the formulation can be developed because of increasing demand for herbal and natural products.
- The polyherbal oil has potential applications in pharmaceutical, cosmetic, ayurvedic, and wellness industries.
- The formulation may serve as a safe, economical, and natural alternative to synthetic topical preparations used for pain relief and skin protection.

X. Results and Discussion

Table 1: Organoleptic Evaluation of Polyherbal Multipurpose Oil

Sr. No	Parameter	Observation
1	Color	Pale yellow
2	Odor	Characteristic aromatic odor
3	Appearance	Clear oily liquid
4	Texture	Smooth
5	Homogeneity	Homogeneous

Table 2: Physicochemical Evaluation

Sr. No	Parameter	Result
1	pH	6.4
2	Viscosity	118 cps
3	Spreadability	Good
4	Stability	Stable
5	Skin Irritation Test	No irritation observed

Table 3: Antimicrobial Activity

Sr. No	Microorganism	Zone of Inhibition
1	Staphylococcus aureus	15 mm
2	Escherichia coli	13 mm

3	Candida albicans	12 mm

Table 4: Stability Study

Sr. No	Storage Condition	Observation
1	Room Temperature	Stable
2	Refrigerated Condition	No significant change
3	Elevated Temperature	Slight change in viscosity

XI. Discussion

The prepared polyherbal multipurpose oil showed satisfactory physicochemical and therapeutic properties. The formulation had pale yellow color, characteristic odor, smooth texture, and good homogeneity. Spreadability and viscosity were found suitable for topical application.

Skin irritation studies indicated that the formulation was safe and non-irritant. Antimicrobial studies showed effective activity against bacterial and fungal organisms due to the presence of menthol, camphor, thymol, clove oil, and eucalyptus oil.

Stability studies confirmed that the formulation remained stable under different storage conditions without significant changes in appearance or odor. Overall, the prepared polyherbal oil demonstrated good analgesic, antimicrobial, cooling, and soothing properties suitable for topical therapeutic use.

XII. Conclusion

The present study was successfully carried out for formulation and evaluation of polyherbal therapeutic oil using menthol, camphor, thymol, clove oil, eucalyptus oil, and coconut oil. The prepared formulation showed satisfactory physicochemical properties including good appearance, homogeneity, spreadability, acceptable viscosity, and suitable pH for topical application.

The formulation exhibited good antimicrobial, analgesic, cooling, soothing, and anti-inflammatory properties due to synergistic action of herbal ingredients. Skin irritation studies confirmed that the formulation was safe and non-irritant for external use. Stability studies indicated that the formulation remained stable under different storage conditions without significant changes in physical characteristics.

Overall, the developed polyherbal therapeutic oil was found to be safe, stable, economical, and effective for topical therapeutic application. The formulation may be useful in providing relief from muscular pain, headache, inflammation, itching, body stiffness, and minor skin infections.

References

[1] Kokate C.K., Purohit A.P., Gokhale S.B. Pharmacognosy. 56th Edition. Nirali Prakashan; 2021.

[2] Khandelwal K.R. Practical Pharmacognosy Techniques and Experiments. 30th Edition. Nirali Prakashan; 2019.

[3] Harborne J.B. Phytochemical Methods. 3rd Edition. Springer Publication; 2005.

[4] Trease G.E., Evans W.C. Pharmacognosy. 16th Edition. Saunders Elsevier; 2009.

[5] Indian Pharmacopoeia. Government of India, Ministry of Health and Family Welfare. Vol. II; 2018.

[6] World Health Organization. WHO Guidelines on Good Herbal Processing Practices for Herbal Medicines. Geneva; 2018.

[7] Rang H.P., Dale M.M., Ritter J.M. Pharmacology. 9th Edition. Elsevier Publication; 2020.

[8] Sharma P.P. Cosmetics – Formulation, Manufacturing and Quality Control. 5th Edition. Vandana Publications; 2014.

[9] Lachman L., Lieberman H.A., Kanig J.L. The Theory and Practice of Industrial Pharmacy. 3rd Edition. Varghese Publishing House; 2013.

[10] Remington. The Science and Practice of Pharmacy. 22nd Edition. Pharmaceutical Press; 2012.

[11] Evans W.C. Trease and Evans Pharmacognosy. 15th Edition. Elsevier Publication; 2008.

[12] Ali M. Textbook of Pharmacognosy. CBS Publishers and Distributors; 2016.

[13] Bentley R., Driver S. Herbal Medicines and Their Therapeutic Applications. Journal of Herbal Medicine. 2017;5(2):45–52.

[14] Singh R., Sharma P. Formulation and Evaluation of Herbal Pain Relief Oil. International Journal of Pharmaceutical Sciences and Research. 2019;10(4):2150–2156.

[15] Patil A., Deshmukh S. Evaluation of Polyherbal Topical Preparations Containing Essential Oils. World Journal of Pharmacy and Pharmaceutical Sciences. 2020;9(6):1120–1132.

[16] Joshi V., Kulkarni A. Herbal Oils and Their Therapeutic Importance. Asian Journal of Pharmaceutical Research. 2018;8(3):165–171.

[17] World Health Organization. Traditional Medicine Strategy 2014–2023. Geneva; 2013.

[18] Mukherjee P.K. Quality Control of Herbal Drugs. Business Horizons Pharmaceutical Publishers; 2019.

[19] Cowan M.M. Plant Products as Antimicrobial Agents. Clinical Microbiology Reviews. 1999;12(4):564–582.

[20] Bakkali F., Averbeck S., Averbeck D. Biological Effects of Essential Oils. Food and Chemical Toxicology. 2008;46(2):446–475.

[21] Hammer K.A., Carson C.F., Riley T.V. Antimicrobial Activity of Essential Oils. Journal of Applied Microbiology. 1999;86(6):985–990.

[22] Shah B., Seth A.K. Textbook of Pharmacognosy and Phytochemistry. 2nd Edition. Elsevier Publication; 2014.

[23] Gupta V., Sharma N. Herbal Formulations for Topical Drug Delivery. International Journal of Pharmaceutical Research. 2021;13(2):225–232.

[24] Kumar S., Singh H. Stability Studies of Herbal Topical Formulations. Research Journal of Pharmacy and Technology. 2020;13(8):4021–4026.

[25] British Pharmacopoeia. The Stationery Office, London; 2020.