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Ayurvedic Formulation and Evaluation of *Citrus medica* Liniment by Hydrodistillation Method

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ABSRACT:

Citrus medica (citron) is an important Ayurvedic plant with established antimicrobial, analgesic and anti-inflammatory properties. Liniments are topical preparations used to relieve joint pain, muscle aches and spasms. To extract Citrus medica essential oil using hydrodistillation, formulate an Ayurvedic liniment, and evaluate its physicochemical properties and safety. Citrus medica peels were subjected to hydrodistillation using a Clevenger apparatus. The essential oil was incorporated into a soft-soap–based alcoholic liniment combine with , eucalyptus oil, camphor, and menthol. The formulation was assessed for pH, viscosity, specific gravity, solubility, and skin irritation. Standard pharmacopeial methods were used for evaluation. The essential oil obtained was pale yellow with a strong aromatic odour. The formulated liniment showed a pH of 5.8, viscosity 220 cps, and specific gravity 0.97. The formulation was miscible with alcohol and immiscible with water. No skin irritation was observed. The liniment demonstrated good physical stability and acceptable sensory characteristics. The C. medica liniment prepared via hydrodistillation is safe, stable, and suitable for topical application. Its properties support potential use in joint pain. Further in-vivo and clinical evaluations are recommended.

Keywords: Citrus medica, liniment, hydrodistillation, essential oil, Ayurveda, topical formulation, joint pain, Arthritis**.**

INDRODUCTION

AYURVEDIC FORMULATION:

An Ayurvedic liniment formulation using Citrus medica (Bilanga/Bijora) involves extracting its beneficial properties and combining them with other ingredients to create a topical preparation for pain relief and other ailments. Evaluation would include assessing the physical properties, chemical composition, and therapeutic efficacy of the final product.

CITRUS MEDICA:

Citrus medica L. (citron) is one of the earliest domesticated citrus species and possesses significant therapeutic relevance in Ayurveda. Its peel is rich in limonene, γ-terpinene, citral and other terpenoids known for antimicrobial, analgesic and anti-inflammatory activities.

LINIMENT:

Liniments are solutions or mixtures of substances in oil, alcoholic soap solutions, or emulsions and may contain suitable antimicrobial preservatives.

These preparation that may be liquid or semi solid are intended for external application and should be so labeled.

They are rubbed onto the affected area ; because of this were once called embrocation . They are applied with friction and rubbing of the skin ,the oil or soap base provides for ease of application and massage.

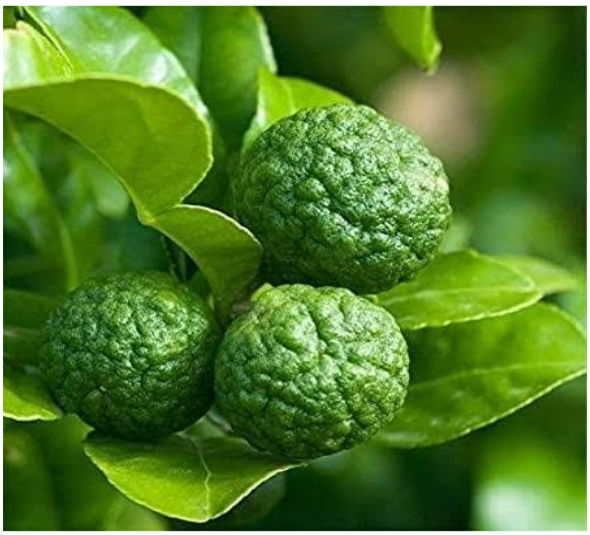
Ayurvedic liniments are widely used for treating arthritis, muscle pain and joint stiffness.

HYDRODISTILLATION:

Hydrodistillation is a classical method used for essential oil extraction and provides high-purity volatile compounds. A Clevenger apparatus is used. Although citron peel oils have been studied for therapeutic applications, liniment formulations using standardized extraction methods remain underexplored. The present study aims to formulate a C. medica liniment using hydrodistilled essential oil and evaluate its physicochemical characteristics and safety.

PLANT PROFILE

CITRUS MEDICA



MEDICA'S SCIENTIFIC

CLASSIFICATION :

Synonyms : Citron, Wild Lemon, Bijapura, Limbu, Nimbu

Biological source	citron
Family	Rutaceae
Kingdom	Plantae
Subkingdom	Tracheobiota
Division	Magnoliophyte
class	Magnoliopsida
order	Sapindales
Genus	Citrus

ORGANOLEPTIC CHARACTERS:

Colour -green when unripe and turns to lemon yellow when ripe

Odour -strong aromatic

Taste -acidic to slightly sweet

Shape- oblong to ellipsoid

Diameter -11.85 cm

Length- 22.34 cm

Base Shape- truncate

Axis- hollow

Apex Shape- mammiform

PHARMACOLOGICAL PROPERTIES OF PLANT :

- Analgesic action
- Anti cancer action
- Anti diabetic
- Hypocholesterolemic
- Hypholipidemic activity
- Anti-microbial activity

ANALGESIC ACTION:

BIO ACTIVE COMPONENTS

* The observed pain-relieving action of C. medica Linn is likely attributed to its.

flavonoids EX: naringenin and eriocitrin:

* terpenoids EX: limonene.

* phenolic composites,

* which are known to possess analgesic properties.

* Reducing inflammation and effecting the nervous system such as arthritis.

CHEMICAL CONSTITUENTS:

Limonene:

* A major component of the oil, known for its potential anti-inflammatory, antioxidant, and antimicrobial properties.

γ-Terpinene:

* Another significant component with potential antioxidant and antimicrobial activity.

Citral:

* A mixture of isomers, geranial and neral, with potential antimicrobial and anti-inflammatory properties.

Other terpenes:

* α-Pinene, β-Pinene, Myrcene, and others, which may also contribute to the oil's therapeutic effects.

METHOD OF PREPARATION:

Step 1:Extraction of citrus oil

Prepare the peels: Wash and dry the citron peels, then chop them into smaller pieces to increase surface area for extraction.

Set up the hydrodistillation apparatus: A Clevenger apparatus is commonly used. It consists of a flask for heating the peels and water, a condenser to cool the steam, and a graduated tube to collect the essential oil, which separates from the water due to density differences.

INGREDIANTS	MASTER FORMULA 1000ML	WORKING FORMULA 10ML
API	650ml	6.5ml
Soft Soap	90gm	0.9gm
camphor	50gm	0.5gm
Purified water	q.s	q.s
Methyl paraben	q.s	q.s

INGREDIENTS AND THERE USES:

Soft soap : emulsifying agent, lubricant, Skin permeation enhancer, detergent.

Menthol : cause a cooling feeling on skin and help relieve pain or itching.

Camphor : provide a mild analgesic , Rubefacient , counter irritant effect.

Methyl paraben: preservative

Hydrodistillation: Add the 250g of chopped peels to the flask with water (the ratio of water to peels can vary, but a common ratio is 3:1 or 4:1 v/w). Heat the flask gently, and the steam will carry the volatile compounds (essential oil) into the condenser. The condensed liquid is collected, and the essential oil separates from the water.

Step 2:Liniment preparation

Procedure:

• Take the required quantity of soft soap in the mortar and add water in thrice the quantity as soft soap.

• Triturate to make a soapy solution.

• Take the required quantity of essential oil (citrus medica oil 4.5-5ml, eucalyptus oil 1ml, mint oil 1ml) in a dry measure glass and dissolve camphor in it.

• Add this solution drop by drop in the mortar and triturate continuously and rapidly till the primary emulsion is formed.

• Add a small quantity of water.

• Methyl paraben used as a preservative.

• transfer it to the previously calibrated round vertically ribbed and blue and amber colored bottle.

• Adjust to the required volume by adding water, attach the cork and label it.

Storage: It should be store in a well closed Amphor coloured glass container dark in a cool place**.**

USES OF LINIMENT:

Liniment of essential is used externally in a patient suffering from anti-inflammatory, analgesic, myalgia, fibrositis.

Muscle and joint pain: Liniments can alleviate pain, stiffness, and swelling caused by sprains, strains, or overuse.

Arthritis: They can help manage pain and inflammation associated with conditions like osteoarthritis and rheumatoid arthritis.

Backache: Liniments are often used to provide soothing relief from minor back pain.

Sports injuries: Many individuals use liniments to soothe sore muscles and reduce feelings of fatigue and tightness after physical activity.

General discomfort: Liniments that contain counterirritants, like capsaicin, produce a hot or cool sensation to distract the nerves from the deeper pain.

Mechanism of action:

These ingredients work by stimulating nerve endings in the skin, creating a warming or cooling sensation that can distract from the pain signals deeper in the muscles and joints. Some ingredients also possess anti-inflammatory properties, further aiding in pain relief.

EVALUATION :

Physicochemical evaluation;

1) pH measurement

Procedure :–

Using pH paper

1. Dip a strip of pH paper into the solution or place a drop of solution on the paper.

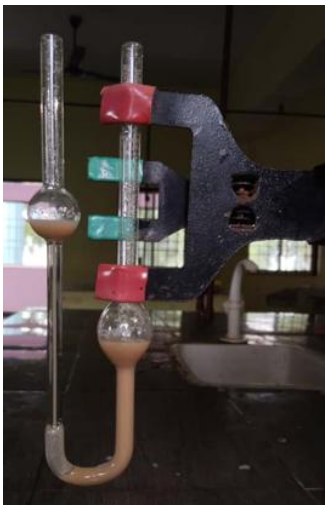
2. Observe the colour change.

3. Compare the colour to the provided chart to determine the pH value.

4. Final reading – Upto 5 (indicates the suitability for skin application)

VISCOSITY:

Viscosity was determined using a Ostwald viscometer at room temperature. The viscosity was found to be 220cps, ensuring the liniment has appropriate flow properties for easy application.



SPECIFIC GRAVITY:

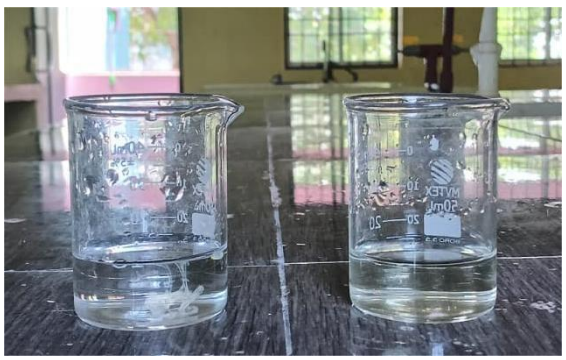
Specific gravity was measured using a specific gravity bottle. The value obtained was 0.97, indicating the less density of the formulation in comparison to water.

SOLUBILITY:

Take two beakers, in one beaker take 5ml water and another beaker take 5ml ethanol.

Add 1ml liniment in both beakers and check the solubility.

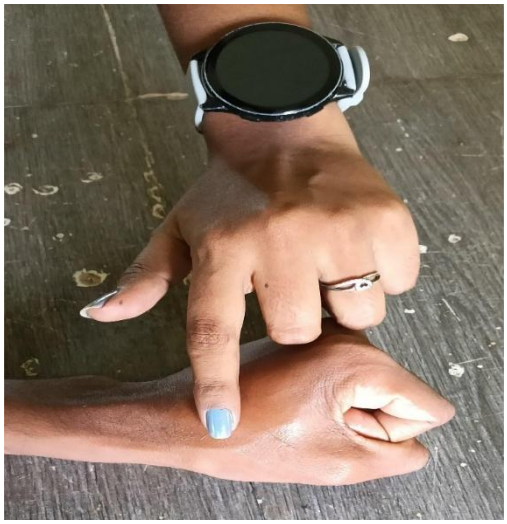
The liniment is miscible with ethanol and immiscible with water.



SKIN IRRITATION:

Method: A small amount of the liniment is applied to a small patch of skin on a human volunteer (with ethical approval).

Observation: The area is monitored for signs of irritation, such as redness, itching, or rashes, over a period of 24 to 72 hours.



Result: The absence of any reaction after a specified time, such as 5 hours, suggests the product is safe to use.

S.NO	TEST	RESULT
1	PH	5.8
2	Viscosity	220cps
3	Specific gravity	0.97
4	solubility	Miscible with ethanol; immiscible with water
5	Skin irritation	No side effect

RESULT AND DISCUSSION:

DISCUSSION:

The essential oil extracted through hydrodistillation exhibited characteristic citron aroma, consistent with previously reported compositions rich in limonene and citral. The liniment formulation demonstrated favourable physicochemical parameters. The pH was within skin-friendly range, and viscosity ensured easy applicability. Solubility results confirmed proper oil dispersion in an alcoholic medium, and absence of irritation confirmed preliminary safety. These findings align with literature indicating the therapeutic efficacy of C. medica extracts in pain relief, anti-inflammatory and antimicrobial activities.

CONCLUSION:

A stable Ayurvedic liniment using Citrus medica essential oil was successfully formulated and evaluated. The formulation demonstrated acceptable physicochemical properties and skin tolerability, supporting its potential use in musculoskeletal conditions. Further pharmacological and clinical studies are necessary to validate therapeutic efficacy.

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