

Standardised Evaluation of Ajwain Aqueous Extract Antioxidant Properties and Creation of Herbal Formulation

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Abstract—Objectives: The EBC promotes the scientific evaluation of herbal medications in the conventional pharmaceutical environment.

Methods: In the current study extracts and formulations were prepared and characterized. These include the extraction (seeds, thickeners and preservatives) and preparation of a peel-off mask. Different extracts are obtained using selective solvents and subjected to safety and efficacy studies, reflecting the potential use of ajwain in pharmaceuticals and cosmetics.

Result: Extract yield was dark brown 13% having ajwain smell and Saponins test was performed on it. It continues to be YES for flavonoids, steroids, glycoside and alkaloids. RF Value: 0.54 OF Toluene: ethyl acetate (7:3). The lotion, identified as a brownish-white cream with a slight vanilla smell, was good for 6 weeks. The values ranged at pH, viscosity and spread ability 5.5–6.5, 147.5–190 cps, and 7.05–7.89 g/cm/s, respectively. The black peel-off face mask was odourless. The formulated peel has moisture content of 14.42%. The PH was seen to be 5.15. The spread ability is 1.9 ± 0.5 cm.

Conclusion: Ajwain extract, because of its antioxidant activity, which has a rich phytochemical in its composition, may also be utilized as a therapeutic agent. It acts as a scavenger of active species that induce oxidative stress, a factor in many diseases. Both formulations yielded acceptable results for topical applications with a recommendation for finding a safe dose for efficacy.

Index Terms—Ajwain extract, Antioxidant, Charcoal, Preservatives, Emulsifiers.

I. INTRODUCTION

A. Herbal Medicine

A key element of all traditional medicinal systems is the use of herbs, which prioritizes overall health over particular diseases or ailments^{1,2}. Although they may have fewer adverse effects than chemical medications,

herbal remedies are more affordable and more effective than allopathic ones for some conditions. Compared to pharmaceutical medications, herbal remedies take longer to start working and comprise a variety of elements that must be compatible with the body and free of allergies^{3,4}. Drug delivery systems are technologies created for the targeted delivery of pharmaceuticals. Biomedical engineers have made significant contributions to our understanding of the physiological barriers to efficient drug delivery, leading to the development of innovative therapeutic delivery systems^{5,6}. A topical drug delivery system applies medication to the skin, typically in the form of lotions, gels, patches, or powders, primarily formulated as creams or ointments⁷.

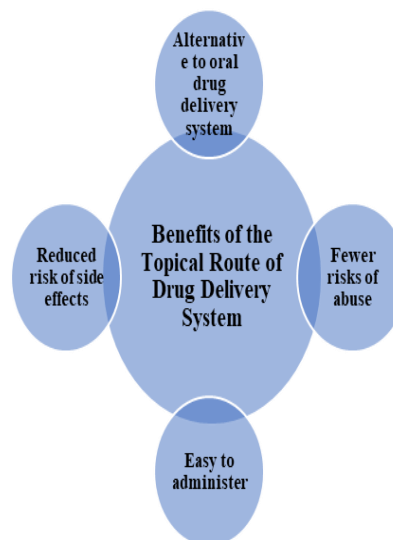


Fig No.1 Benefits of the Topical Route of Drug Delivery System

B. Extraction

Using a selected solvent of choice to remove inert material and obtain the intended therapeutic fraction, standardized extraction techniques are employed. The

crude extract can be fractionated for modern medicines, formulated into dosage forms, or used as a medicinal agent^{8,9}.

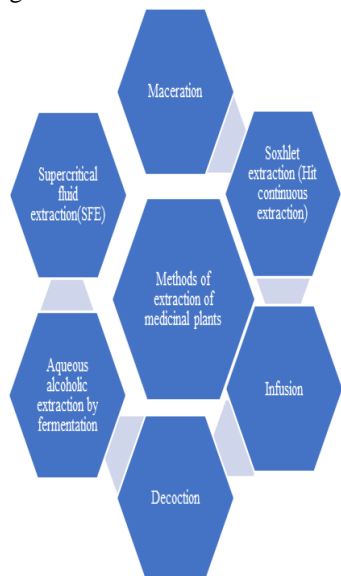


Fig no.2 Methods of extraction of medicinal plants
Cosmetic Formulations

The development of new cosmetics based on the unique properties of plant stem cells and the study of the effects of these extracts and phytohormones on animal skin have been a focus for decades. This in minireview addresses the latest evidence-based information of cosmetic uses of plant stem cells and highlights relevant hurdles to overcome prior to the envisagement of effective plant stem cell-derived

topical cosmetics that would lead at least to significant dermatological benefits^{10,11,12}.

C. Benefits of herbal peel-off face mask:

A patient-friendly substitute for oral antibiotics, the peel-off mask lowers dosage schedules while eliminating waste products, dead skin, and blackheads while boosting metabolism and enhancing skin health.^{13,14}.

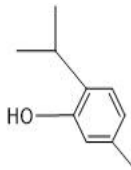
D. Need

- One major advantage of medicinal plants is that they are safe because they are in balance with nature and have few negative effects.
- Phytochemicals found in herbs, such as flavonoids, terpenoids, alkaloids, phenols, tannins, sesquiterpene lactones, and saponins, contribute to their therapeutic properties.
- Herbal remedies have shown encouraging potential, and the effectiveness of several herbal products has been demonstrated.

E. Materials

This recipe uses Ajwain extract, distilled water, glycerin, cocoa butter, acacia gum, charcoal, and propyl and methylparaben as active ingredients. Glycerin stabilizes the skin, while olive oil provides nourishment and soothing. Acacia gum thickens, charcoal purifies, and paraben prolongs shelf life.

Drug profile

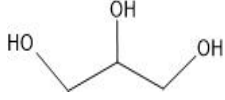
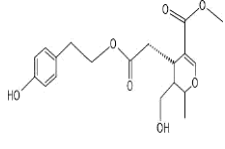
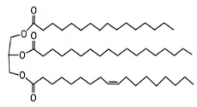
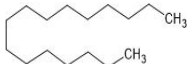
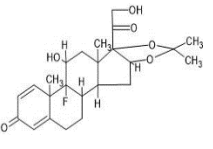
Common Name	Scientific Name	Biological Source & Family	Chemical Constituents	Structure	Ref
Ajwain, Bishop's weed	Trachyspermum ammi	Dried ripe seeds of <i>Trachyspermum ammi</i> , Apiaceae.	Essential Oils, Fixed Oils.		15

Macroscopic Characteristics

1. Colour: Yellow brown/ pale brown
2. Odour: Aromatic
3. Shape: Small oval-shaped seed-like fruit
4. Taste: Pungent

Excipient Profile:

For Lotion:

Name	Chemical component	Molecular formula & weight	Structure	Density (g/cm ³) (g/mL)	Category	Ref.
Glycerin	Oils/Fats, Fatty Acids, Esters, Glycerin.	C ₃ H ₈ O ₃ 92.024 g/mol		1.261	Humectant	16
Olive oil	Triacylglycerol, Free fatty acid Glycerol, Sterols, and Tocopherols	CH ₃ CH(NH ₂)COOH 1382.2 g/mol		0.917	Emollient	17
Cocoa Butter	Triglycerides, Fatty Acids, Squalene,	861.4 g/mol		0.9	Moisturizer	18
Cetyl Alcohol	1-hexadecanol	C ₁₆ H ₃₄ O 242 g/mol		0.811	Surfactant	19
Emulsifying Wax	Natural oils, Glyceryl Stearate, Tocopherol.	C ₂₄ H ₃₁ FO ₆ 434.50 g/mol		0.9	Emulsifier	19

For peel-off mask:

Name	Chemical component	Molecular formula & weight	Structure	Density (g/cm ³) (g/mL)	Category	Ref
Polyvinyl Alcohol	Ethylene	[C ₂ HCH(OH)] _n 44.05 g/mol		1.19	Film Former	20
Gum Acacia	L-arabinose, L-rhamnose, D-glucuronic	C ₁₂ H ₃₆ 180.41 g/mol		1.3-1.5	Thickener	21
Charcoal	Hydrogen, Methane,	C ₇ H ₄ O		Less than 1	Cleanser	22

F. Microscopy:

A sharp blade was used to cut thin slices of the transverse section (T.S.) after the seeds had been immersed in water in a petri dish for a few minutes. Slides were then made after the sections had been stained with various chemicals. After mounting the prepared glass slides onto the microscope stage, they were examined at a magnification of 10X. The structures that were seen were documented.

G. Thin Layer chromatography:

An affinity-based technique for compound separation and analysis, TLC is helpful for both qualitative and quantitative study of a variety of substances, including lipids, steroids, and pesticides. The components of the sample migrate according to their affinities for the phases, showing up as distinct patches with measurable retention factors (Rf).^{23,24}

H. Experimental:

Table no. 3. Selection of emollient and fragrance.

LOTION						
ACTIVITY	INGREDIENTS	C1	C2	C3	C4	C5
Antioxidant	Ajwain extract	1000 mg	1000 mg	1000 mg	1000 mg	1000 mg
Humectant	Glycerin	6500 mg	6500 mg	6500 mg	6500 mg	6500 mg
Base	Water	82.24ml	82.2ml	82.2ml	82.2ml	82.2ml

The presence of phytoconstituents was further identified by thin layer chromatography using pre-coated silica gel 60 F254 plates as stationary phase. The components were best resolved in the screening system toluene: ethyl acetate (7:3). The Rf value of each spot was calculated by this formula:

$$RF = \frac{\text{Distance travelled by solute}}{\text{Distance travelled by the solvent}}$$

I. Formulation

1. Procedure for lotion:

The manufacturing process involved combining the melted oil phase with the heated water phase. An aqueous extract of ajwain was then mixed with glycerine and added to the lotion base. Preservatives and fragrances were added after the mixture had cooled. After testing multiple batches, the best one was selected for final production.

Emollient	Paraffin oil	16000 mg	-	-	-	-
	Arachis oil	-	16000 mg	-	-	-
	Olive oil	-	-	16000 mg	16000 mg	16000 mg
Moisturizer	Cocoa butter	11.2g	11.2g	11.2g	11.2g	11.2g
Surfactant	Cetyl alcohol	3800 mg	3800 mg	3800 mg	3800 mg	3800 mg
Emulsifier	Emulsifying wax	4g	4g	4g	4g	4g
Preservative	Methylparaben Propylparaben	100 mg	100 mg	100 mg	100 mg	100 mg
Fragrance	Lemon oil	-	-	-	q.s	-
	Vanillin	q.s	q.s	q.s	-	q.s

2. Procedure for peel-off mask:

The formulation was prepared by weighting excipients, preparing a thickener and glycerine mixture, dissolving the film former in water, adding cetyl alcohol, glycerine, charcoal, and preservatives.

Table no. 4. Selection of film former, thickener and concentration of thickener.

ACTIVITY	INGREDIENT	F1	F2	F3	F4	F5	F6	F7
Antioxidant	Ajwain	1g	1g	1g	1g	1g	1g	1g
File former	Gelatin	6g	-	6g	6g	-	-	-
	Polyvinyl alcohol	-	6g	-	-	6.5g	6g	6g
Thickener	Xanthan gum	2g	2g	-	3g	-	-	-
	Gum acacia	-	-	-	-	3g	2.5g	2g
Surfactant	Cetyl alcohol	3g	3g	3g	3g	3g	3g	3g
Preservative	Methylparaben	0.5g	0.5g	0.5g	0.5g	0.5g	0.5g	0.5g
Cleansing agent	Charcoal	2g	2g	-	0.5g	0.5g	0.5	0.5
Base	Water	q.s	q.s	50ml-q.s	50ml-q.s	50ml-q.s	50ml-q.s	50ml-q.s

II. OPTIMIZATION

1. Lotion:

The formulation in the no. 1, C1, C2, C3, and C4, used different emollients out of which olive oil i.e., C4 had better consistency and absorbency.

In Tables C5 and C6, the fragrance was selected of which C6 showed good results and was non-irritant.

Table no. 5. Evaluation parameters

Evaluation parameters for lotion	Evaluation parameter for peel-off mask
Organoleptic characteristics	Organoleptic properties
Homogeneity	Consistency
pH Evaluation	Moisture content
Viscosity	Folding Endurance
Smoothness	pH

2. Peel-off face mask:

Formulations in Table F1, and F2, are made with different film formers and F2 i.e. PVA was selected because it showed better evaluation tests.

After that thickener was selected, F5 made the formulation too thick while F6 had better consistency.

Absorbency	Spread ability
Spread ability	Irritancy

Table no. 6. Evaluation of lotion.

Test	C1	C2	C3	C4	C5
Appearance	Clumps	Separation of phases	Good	Good	Good
pH	5.85	6.14	5.5	3.4	5.66
Smoothness	Bad	Moderate	Good	Good	Good
Absorbance	Poor	Poor	Good	Moderate	Good
Irritancy	Non-reactive	Non-reactive	Non-reactive	Irritant	Non-reactive

Table no. 7. Evaluation of peel-off mask

Formulations	F1	F2	F3	F4	F5	F6	F7
Evaluation	Solidity on cooling	Too thick	Too thick	Flaky film	Did not spread evenly	Dying time extended	Good

III. RESULT AND DISCUSSION

1. Microscopy

From the transverse section of the fruit can be seen two supporting hexagonal bodies, by two carpophores; the epicarps are a single layer of tubular, tangentially elongated cells^{25,26}. The interior is mainly dominated

by endosperms which are tiny polygonal thin-walled cells containing embryos and oil globules. These mesocarps were made of tangentially elongated, rectangular to polygonal moderately thick-walled cells with vitae and carpophores as well as vascular bundles formed by groups of thick-walled radially elongated cells²⁷.

Table no. 8. Results of microscopy

Sr.no.	Reagents	Observation	Characterization
1.	Sudan red III	Red oil globules were seen	Oil globules present
2.	Safranin O	A pinkish-red network of oval-shaped radially elongated cells was seen.	Lignified cells present

2. Phytochemical Screening

Table no. 9. Result of phytochemical screening

	RESULT
Saponin	+
Alkaloid	+
Steroid	+
Glycoside	+
Tannin	+

Carbohydrates	-
Flavonoid	+
Protein	-

3. Extract Yield:

Extract yield was dark brown 13% having ajwain smell and was analyzed for Saponin, Flavonoids, Steroids, Glycoside and Alkaloid in its aqueous form.

4. TLC:

Table no. 10. Optimized TLC profile

Solvent system	Spot color	Rf value	Phytoconstituents
Toluene: Ethyl acetate (7:3)	Brown	0.54	Thymol, γ -terpenes

5. For Lotion:

It was brownish white in appearance and remained stable throughout the 6 weeks of study along with faint vanilla odour produced by its added fragrance. The viscosity was found to be 147.5 to 190 cps, spread ability ranged from 7.05 to 7.89 g.cm/s and the pH was found to be ranging from 5.5 to 6.5.

6. For peel-off face mask:

Black and odourless colour of the herbal peel-off face mask. As per the formula moisture content of formulated peel is 14.42% (Weight taken=0.721 gm, Dry weight=0.617 gm; Moisture= W-D/W*100) The PH was found to be 5.15. The spread ability was 1.9 ± 0.5 cm.

7. Optimization for lotion:

Table no. 11. Optimized batch for lotion

Ingredients	Quantity	Activity
Ajwain extract	1000 mg	Antioxidant
Glycerin	6500 mg	Humectant
Purified water	82.20 ml	Base
Olea europaea oil	16 ml	Emollient
Theobroma oil	11200 mg	Moisturizer
Hexadecanol	3800 mg	Surfactant
Emulsifier wax	3800 mg	Emulsifier
Methyl paraben	1000 mg	Preservative
Vanilla	q.s	Fragrance

8. Optimization for peel-off face mask:

Table no. 12. Optimized batch of peel-off face mask

INGREDIENTS	QUANTITY	ACTIVITY
Ajwain extract	1 gm	Antioxidant
Polyvinyl alcohol	6 gm	Film former
Gum acacia	1.0 gm	Thickener
Cetyl alcohol	3 gm	Surfactant
Methylparaben	0.25 gm	Preservative
Propylparaben	0.25 gm	Preservative
Charcoal	2 gm	Cleansing agent
Water	50 gm q.s.	Base

IV. CONCLUSION

The initial phytochemical screening was carried out in the current study. This could demonstrate that there are several constituents like saponins, alkaloids, flavonoids, glycosides and steroids. Flavonoid can work as an antioxidant. The outcome of type of study is the choice and formulation of optimum dose for therapeutic purpose. The component tested showed considerable antioxidant activity according to the results analyzed. Good physio-chemical parameters were observed in the both formulations.

V. ACKNOWLEDGEMENT

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Conflict of Interest

The authors declare they have no competing interests.

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