INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

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Research Article

Formulation and Evaluation of Antispasmodic Effervescent Tablets from Extracted Thymol

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ARTICLE INFO

Published: 1 Jun 2026
Keywords:
Thymol, Ajwain, Trachyspermum ammi, Effervescent Tablets, Antispasmodic, Herbal Formulation.
DOI:
10.5281/zenodo.20491928

ABSTRACT

The present study focused on the formulation and evaluation of herbal antispasmodic effervescent tablets containing thymol extracted from Trachyspermum ammi (Ajwain). Thymol is a naturally occurring monoterpene phenol known for its antispasmodic, antimicrobial, antioxidant, and anti-inflammatory activities. The objective of the study was to develop a stable, effective, and patient-friendly effervescent dosage form that provides rapid relief from gastrointestinal spasmodic conditions. Thymol was extracted from crushed ajwain seeds by reflux extraction using ethanol and water as solvents. The extracted thymol was incorporated into effervescent tablets using citric acid and sodium bicarbonate as effervescent agents, along with excipients such as HPMC, sucrose, starch, and sodium starch glycolate. The prepared tablets were evaluated for preformulation and post-formulation parameters, including bulk density, tapped density, angle of repose, hardness, thickness, friability, pH, and effervescence time. The formulated tablets showed satisfactory evaluation results with a bulk density of 1.60 g/cc, tapped density of 1.50 g/cm³, angle of repose of 38°, hardness of 4 kg/cm², friability of 0.067%, and effervescence time of 53.9 seconds. The formulation demonstrated acceptable physicochemical properties and rapid effervescence, indicating good patient compliance and therapeutic potential. The study concludes that thymol extracted from ajwain can be successfully formulated into stable herbal antispasmodic effervescent tablets.

INTRODUCTION

Gastrointestinal spasms are commonly associated with abdominal pain, indigestion, irritable bowel syndrome, intestinal colic, and other digestive disorders. These conditions arise due to the involuntary contraction of smooth muscles in the gastrointestinal tract, resulting in discomfort and pain. Antispasmodic agents are widely used to

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

relieve such conditions by relaxing smooth muscle contractions.

Herbal medicines have gained significant importance in recent years because of their safety, affordability, and reduced adverse effects compared to synthetic drugs. Among various herbal constituents, thymol has attracted considerable attention because of its potent pharmacological activities. Thymol is a monoterpene phenolic compound primarily obtained from *Trachyspermum ammi* (Ajwain) and *Thymus vulgaris* (Thyme). It possesses antimicrobial, antifungal, antioxidant, anti-inflammatory, and antispasmodic properties.

Ajwain belongs to the family Apiaceae and is commonly used in traditional Indian medicine for the treatment of digestive disorders, cough, indigestion, and flatulence. The major active constituent present in ajwain is thymol, which contributes to its therapeutic effects. Thymol exerts antispasmodic action mainly by relaxing gastrointestinal smooth muscles through calcium channel modulation and inhibition of acetylcholine-induced contractions.

Effervescent tablets are specialized oral dosage forms that rapidly disintegrate in water and release carbon dioxide gas due to the reaction between acids and bicarbonates. These formulations improve patient compliance, provide a rapid onset of action, and are especially suitable for geriatric and pediatric patients who experience difficulty swallowing conventional tablets.

The present study was aimed at developing and evaluating herbal antispasmodic effervescent tablets containing thymol extracted from ajwain seeds.

2. AIM AND OBJECTIVES

Aim

To formulate and evaluate herbal antispasmodic effervescent tablets containing thymol extracted from *Trachyspermum ammi*.

Objectives

1. To extract thymol from ajwain seeds using suitable extraction techniques.
2. To formulate effervescent tablets containing extracted thymol.
3. To evaluate the prepared tablets for physicochemical properties.
4. To develop a stable and patient-friendly herbal dosage form.
5. To provide rapid relief from gastrointestinal spasmodic conditions.

3. LITERATURE REVIEW

Several studies have reported the pharmacological importance of ajwain and thymol.

1. Gurdip Singh et al. reported that ajwain essential oil contains thymol as the major constituent along with p-cymene and γ-terpinene. The study demonstrated significant antioxidant and antimicrobial activity of ajwain oil.

2. Boskabady et al. reviewed the pharmacological effects of *Carum copticum* and reported its bronchodilator, antihypertensive, antispasmodic, and antimicrobial properties.

3. Begrow et al. studied the impact of thymol on antispasmodic activity and ciliary clearance and confirmed its smooth muscle relaxant activity.

4. Gujar and Wagh demonstrated microwave-assisted extraction methods for the isolation of

thymol from *Trachyspermum ammi* seeds and reported improved extraction efficiency.

5. Recent reviews on effervescent tablets highlighted advantages such as rapid drug release, improved patient compliance, enhanced palatability, and ease of administration.

Previous studies on herbal effervescent formulations suggest that herbal active compounds can be effectively incorporated into modern pharmaceutical dosage forms to improve therapeutic efficacy and patient acceptability.

4. MATERIALS AND METHODS

4.1 Materials

The materials used in the study included:

1. Carom seeds –

Biological name: Trachyspermum ammi (L) Sprague

Family: Apiaceae (formerly Umbelliferae)

Biological Source: Dried Seed

Extract – Thymol Chemical

formula: C10H14O

Molecular weight: 150.22g/mol

Chemical nature: Monoterpene phenol

2. Citric acid Chemical nature:

It is a weak organic acid

Source: lemon juice

Biological name: Citrus limon

Family: Rutaceae

Molecular weight: 192.14g/mol Chemical formula: C6H8O7

3. Sodium bicarbonate

Molecular weight: 84.01g/mol

Chemical formula: NaHCO3

Chemical nature: It is a weak base (mildly alkaline salt)

Sr. No.	Ingredient	Quantity
1	Thymol Extract	50 mL
2	Citric Acid	30 g
3	Sodium Bicarbonate	30 g
4	Sucrose	25 g
5	Salt	5 g
6	HPMC	5 g
7	Sodium Starch Glycolate	115 g

4.2 Extraction of Thymol

1. About 100 g of ajwain seeds were crushed into coarse powder using a mortar and pestle.
2. The powder was transferred into a round-bottom flask attached to a reflux condenser.
3. Equal quantities of water and ethanol/methanol were added.
4. Porcelain pieces were introduced to avoid bumping during heating.
5. Reflux extraction was carried out for 1 hour.
6. The extract was filtered to obtain a clear thymol-containing extract.

Fig no 1

4.3 Formulation of Thymol Granules

1. The filtered extract was mixed with sucrose and heated until a syrup consistency was obtained.
2. Citric acid was added to the cooled syrup.
3. HPMC and starch were incorporated as binders.
4. The mass was passed through a sieve to prepare granules.
5. Granules were dried properly.

Fig no 2

4.4 Preparation of Sodium Bicarbonate Granules

1. Sodium bicarbonate was mixed with rice starch and acacia gum.
2. Water was added to prepare a dough-like mass.
3. The mass was sieved to form granules.
4. Granules were dried completely.

(Fig no.3)

(Fig no.4)

4.5 Tablet Compression

Equal quantities of thymol granules and sodium bicarbonate granules were blended and compressed into tablets using a tablet compression machine. Each tablet weighed approximately 1 g.

Fig no 5

5. EVALUATION PARAMETERS

5.1 Preformulation Studies

A. Bulk Density

Bulk density was determined as the ratio of the mass of powder to the bulk volume occupied.

B. Tapped Density

Tapped density was measured after mechanically tapping the powder for a fixed number of times.

C. Angle of Repose

Angle of repose was determined to evaluate the flow properties of granules.

D. Carr's Compressibility Index

Carr's index was used to assess powder flowability and compressibility.

5.2 Evaluation of Tablets

A. Effervescence Time

The time required for complete disintegration and release of carbon dioxide in water was measured.

B. PH Determination

pH of tablet solution after dissolution was determined.

C. Hardness

Tablet hardness was measured using a hardness tester.

fig no 6

D. Thickness

The thickness of tablets was measured using vernier calipers.

E. Friability

The friability test was performed to evaluate mechanical strength.

Fig no 7

6. RESULTS AND DISCUSSION

6.1 Preformulation Studies

Parameter	Result	Standard
Bulk Density	1.60 g/cc	1.6–1.75 g/cc
Tapped Density	1.50 g/cm³	1.10–1.60 g/cm³
Angle of Repose	38°	Acceptable

The obtained bulk density and tapped density values indicated satisfactory packing properties of granules. The angle of repose showed acceptable flow behavior necessary for tablet compression.

6.2 Tablet Evaluation

Parameter	Result
Effervescence Time	53.9 sec
pH	Neutral
Shape	Round
Colour	White with slight brown tint
Hardness	4 kg/cm²
Thickness	7 mm
Friability	0.067%

The prepared tablets exhibited rapid effervescence and acceptable mechanical strength. Friability values were below the pharmacopoeial limit of 1%, indicating good tablet integrity. Neutral pH suggests suitability for oral administration without gastric irritation.

The rapid disintegration of tablets may enhance drug release and therapeutic efficacy. Effervescent formulations improve patient compliance due to pleasant taste and ease of administration.

7. CONCLUSION

The present study successfully formulated and evaluated herbal antispasmodic effervescent tablets containing thymol extracted from *Trachyspermum ammi*. The extraction process effectively isolated thymol from ajwain seeds, and the prepared tablets exhibited satisfactory physicochemical characteristics.

The formulation demonstrated acceptable hardness, low friability, rapid effervescence, and suitable pH, indicating good stability and patient acceptability. The developed herbal effervescent tablets may serve as a promising alternative to conventional synthetic antispasmodic formulations for the management of gastrointestinal spasmodic disorders.

Further pharmacological and clinical studies are recommended to establish therapeutic efficacy and long-term stability.

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HOW TO CITE: Sunita Shewalkar, Shriyog Suroshi, Arshahmad Shikalgar, Bharat Jagtap, Pratik Aghav, Pooja Prajapati, Formulation and Evaluation of Antispasmodic Effervescent Tablets from Extracted Thymol, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 6, 320-326. https://doi.org/10.5281/zenodo.20491928