© MAY 2026 | IRE Journals | Volume 9 Issue 11 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I11-1718193

Oral Fast Dissolving Films of Promethazine Hydrochloride Using Natural Surfactants: Formulation Strategies, Evaluation, and Therapeutic Perspectives

ABHISHEK MAURYA[1], VAIBHAV SINGH[2]
[1]*Research Scholar, M. Pharm, Pharmaceutics*
[2]*Assistant Professor, SHEAT College of Pharmacy*

Abstract*—Oral fast dissolving films (OFDFs) have emerged as a patient-centric drug delivery platform designed to overcome limitations associated with conventional oral dosage forms. These thin polymeric films rapidly disintegrate in the oral cavity without the need for water, offering rapid onset of action, improved bioavailability, and enhanced patient compliance, particularly in pediatric, geriatric, and dysphagic populations. Promethazine hydrochloride, a first-generation antihistamine with potent antiemetic activity, is widely used in the management of nausea, vomiting, motion sickness, and allergic conditions; however, its conventional formulations suffer from delayed onset, first-pass metabolism, and palatability issues. This review critically examines the formulation and evaluation of OFDFs of promethazine hydrochloride with special emphasis on the application of natural surfactants. The article discusses formulation principles, selection of polymers and excipients, manufacturing techniques, physicomechanical and biopharmaceutical evaluation parameters, stability considerations, and regulatory perspectives. The potential advantages of natural surfactants over synthetic counterparts in terms of safety, biocompatibility, and sustainability are highlighted. Current challenges, future prospects, and translational opportunities of OFDF technology for promethazine hydrochloride are also addressed.

Keywords*— Oral fast dissolving films, Promethazine hydrochloride, Natural surfactants, Solvent casting, Patient compliance, Bioavailability

I. INTRODUCTION

The oral route remains the most preferred mode of drug administration owing to its convenience, safety, cost-effectiveness, and high patient acceptance. Nevertheless, conventional oral dosage forms such as tablets and capsules present significant challenges for specific patient groups, including pediatric, geriatric, bedridden, and dysphagic patients. Difficulty in swallowing (dysphagia), fear of choking, and the need for water during administration often compromise adherence to therapy. Moreover, conventional solid oral dosage forms typically exhibit delayed onset of action due to the requirement for disintegration and dissolution in the gastrointestinal tract.

In response to these limitations, novel drug delivery systems have been developed to enhance therapeutic outcomes and patient compliance. Among these, oral fast dissolving films (OFDFs), also known as oral thin films or mouth dissolving films, have gained considerable attention. OFDFs are ultra-thin polymeric strips that disintegrate or dissolve rapidly when placed on the tongue or oral mucosa, releasing the drug for absorption through the oral or gastrointestinal mucosa. Their ability to provide rapid drug release, precise dosing, and ease of administration has positioned OFDFs as an attractive alternative to conventional oral dosage forms.

Promethazine hydrochloride is a phenothiazine derivative with antihistaminic, antiemetic, sedative, and anticholinergic properties. Despite its wide clinical utility, conventional promethazine formulations are associated with drawbacks such as extensive first-pass metabolism, delayed onset of action, bitter taste, and reduced patient acceptability. The development of promethazine hydrochloride as an OFDF represents a promising strategy to address these challenges by enabling rapid disintegration, faster onset of action, and improved bioavailability.

Surfactants play a pivotal role in OFDF formulations by enhancing wetting, solubilization, and dissolution of poorly soluble drugs. In recent years, there has been growing interest in the use of natural surfactants, derived from renewable sources, as safer and more biocompatible alternatives to synthetic surfactants. This review focuses on the formulation and evaluation of promethazine hydrochloride OFDFs using natural surfactants, consolidating current knowledge and identifying future research directions.

© MAY 2026 | IRE Journals | Volume 9 Issue 11 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I11-1718193

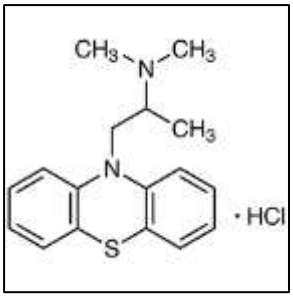

Fig.1 Chemical Structure of Promethazine hydrochloride

Table 1. Comparison of Conventional Oral Dosage Forms and Oral Fast Dissolving Films (OFDFs)

Parameter	Conventional Tablets / Syrups	Oral Fast Dissolving Films
Requirement of water	Required	Not required
Onset of action	Delayed	Rapid
Patient compliance	Low–moderate	High
Suitability for pediatric/geriatric patients	Limited	Excellent
Risk of choking	Present	Absent
First-pass metabolism	Significant	Reduced
Portability	Moderate	Excellent
Dose accuracy	Variable (syrups)	High

II. ORAL FAST DISSOLVING FILMS: CONCEPT AND ADVANTAGES

Oral fast dissolving films are thin, flexible, polymer-based dosage forms designed to rapidly dissolve in the oral cavity upon contact with saliva. Typically, OFDFs have a thickness ranging from 50 to 200 μm and an area of 2–8 cm^2, depending on the dose and formulation requirements.

Table 2. Physicochemical and Pharmacokinetic Profile of Promethazine Hydrochloride

Parameter	Description
Drug class	First-generation H1 antihistamine
Chemical class	Phenothiazine derivative
Molecular formula	$C_{17}H_{20}N_2S \cdot HCl$
Molecular weight	320.88 g/mol
Appearance	White to pale yellow crystalline powder
Oral bioavailability	25–30%
Half-life	5–14 hours
Protein binding	76–93%
Major metabolism	Hepatic (first-pass)
Therapeutic uses	Antiemetic, antihistaminic, sedative

2.1 Advantages of OFDFs

- Rapid disintegration and dissolution without the need for water
- Faster onset of therapeutic action
- Improved bioavailability by reducing first-pass metabolism
- Accurate dosing compared to liquid formulations
- Enhanced patient compliance, especially in pediatric and geriatric patients
- Portability and convenience of administration
- Reduced risk of choking

2.2 Limitations of OFDFs

Despite their advantages, OFDFs also present certain challenges, including limited drug loading capacity, sensitivity to moisture, taste-masking requirements, and the need for specialized packaging to maintain stability.

III. PROMETHAZINE HYDROCHLORIDE: DRUG PROFILE

Promethazine hydrochloride is a first-generation H1-antihistamine belonging to the phenothiazine class. It exhibits antiemetic, sedative, antiallergic, and anticholinergic effects.

3.1 Pharmacological Actions

Promethazine exerts its antiemetic effect primarily by blocking H1 receptors and dopamine receptors in the

chemoreceptor trigger zone (CTZ) of the central nervous system. It also possesses mild anticholinergic and antiserotonin activity, contributing to its broad therapeutic profile.

3.2 Pharmacokinetics

Following oral administration, promethazine is well absorbed but undergoes extensive first-pass hepatic metabolism, resulting in low systemic bioavailability. Peak plasma concentrations are typically achieved within 2–3 hours. The drug is highly protein-bound and widely distributed, including across the blood–brain barrier. The elimination half-life ranges from 5 to 14 hours.

3.3 Therapeutic Uses

- Prevention and treatment of nausea and vomiting
- Motion sickness
- Allergic conditions
- Sedative and preoperative medication

3.4 Rationale for OFDF Formulation

The OFDF formulation of promethazine hydrochloride aims to provide rapid onset of action, improved bioavailability, better patient compliance, and enhanced palatability compared to conventional dosage forms.

IV. ROLE OF SURFACTANTS IN OFDFs

Surfactants are surface-active agents that reduce interfacial tension and enhance wetting, solubilization, and dissolution of drugs. In OFDFs, surfactants facilitate rapid hydration of the film matrix and improve drug release.

4.1 Natural Surfactants

Natural surfactants are derived from biological sources and include phospholipids (e.g., lecithin), saponins, fatty acid esters, and polysaccharide-based materials. These agents offer advantages such as biodegradability, low toxicity, and environmental sustainability.

4.2 Advantages over Synthetic Surfactants

- Improved biocompatibility
- Reduced irritation potential
- Better patient acceptability
- Alignment with green chemistry principle

V. POLYMERS AND EXCIPIENTS USED IN PROMETHAZINE OFDFs

5.1 Film-Forming Polymers

Common polymers employed in OFDFs include hydroxypropyl methylcellulose (HPMC), polyvinyl alcohol (PVA), pullulan, and gellan gum. HPMC is particularly favored due to its excellent film-forming ability, mechanical strength, and rapid hydration.

5.2 Plasticizers

Plasticizers such as polyethylene glycol (PEG 400), glycerin, and propylene glycol are added to improve film flexibility and prevent brittleness.

5.3 Sweeteners and Flavors

Taste-masking agents, including sucrose, sucralose, and flavoring agents, are essential for improving palatability, especially for bitter drugs like promethazine.

VI. MANUFACTURING TECHNIQUES

6.1 Solvent Casting Method

The solvent casting technique is the most widely used method for preparing OFDFs. It involves dissolving the polymer, drug, and excipients in a suitable solvent, casting the solution onto a flat surface, and drying to form a uniform film.

6.2 Other Techniques

Alternative methods include hot-melt extrusion, semi-solid casting, and electrospinning, though their application in promethazine OFDFs remains limited.

VII. EVALUATION PARAMETERS

7.1 Physicochemical Properties

- Thickness
- Weight uniformity
- Surface pH
- Transparency

7.2 Mechanical Properties

- Tensile strength
- Folding endurance

7.3 Drug Content Uniformity

Uniform distribution of promethazine within the film matrix is essential for dose accuracy.

7.4 In Vitro Disintegration and Dissolution Studies

Rapid disintegration (typically within 5–30 seconds) and efficient drug release are critical quality attributes of OFDFs.

VIII. STABILITY STUDIES

Stability studies under accelerated conditions (40°C/75% RH) are conducted to assess the physical, chemical, and mechanical stability of OFDFs. Optimized formulations of promethazine OFDFs have demonstrated minimal changes in drug content and dissolution profile over storage periods.

IX. REGULATORY AND QUALITY CONSIDERATIONS

OFDFs are regulated as oral solid dosage forms and must comply with pharmacopeial and regulatory guidelines related to content uniformity, dissolution, stability, and packaging.

X. CHALLENGES AND FUTURE PERSPECTIVES

Despite promising results, challenges such as scalability, moisture sensitivity, and limited drug loading remain. Future research should focus on advanced natural surfactants, taste-masking technologies, and in vivo performance evaluation.

XI. CONCLUSION

Oral fast dissolving films represent a versatile and patient-friendly platform for the delivery of promethazine hydrochloride. The incorporation of natural surfactants offers significant advantages in terms of safety, biocompatibility, and dissolution enhancement. Continued research and development in this area are expected to facilitate the successful translation of promethazine OFDFs from laboratory to clinical application.

REFERENCES

[1] Bruschi M L., Osvaldo F: Oral bioadhesive drug delivery systems, Drug development and industrial pharmacy 2005; 293-310.

[2] Bhatt DC, and GP Agrawal: Approach to the Formulation of Promethazine hydrochloride. Eastern Pharmacist 1995; 145-247.

[3] Desai SA, Kharade and Petkar KC: Oro dissolving tablet of Promethazine HCl, Indian journal of pharmaceutical education research 2006 ,40(3) 172-174.

[4] Kulkarni AS, Deokule HA, Mane MS and Ghadge DM : Exploration of different polymers for use in the formulation of oral fast dissolving strips" Journal of Current Pharmaceutical Research 2010; 2(1): 33 35.

[5] Gavaskar B, Vijayakumar S, Sharma G and Rao YM : Overview on fast dissolving films. International Journal of Pharmacy and Pharmaceutical Sciences 2010; 29-33.

[6] Kaur R, Bala R: Exploration of Different Polymers and Optimization of Concentration of Plasticizer in the Formulation of Oral Fast Dissolving Strips. IJPRBS, 2012; 1(2): 94-101.

[7] Naziya KN, Raghavendra RB: Overview on Fast Dissolving Oral Films. Int. J. Chem. Pharm. Sci 2013; 63-75.

[8] Sri KV, Ravishanker D, Rohini D, Subbarao M: Formulation and in vitro evaluation of Sumatriptan succinate oral thin films. Indo American Journal of Pharmaceutical Research. 2013; 3(4):3016-3025.

[9] Chaudhari VA, Sarode SM, Sathe BS, Vadnere GP: Mucoadhesive buccal drug delivery system: a review. Int J Pharm Sci. 2014; 142-59.

[10] Madhavi, S., & Joshi, M. (2019). "Formulation and Evaluation of Oral Fast Dissolving Films of Anti-Emetic Drugs." *Asian Journal of Pharmaceutical Sciences*.

[11] Ghoshi S, Dangi S. Development of fast-dissolving films of promethazine hydrochloride. Int J Pharm Sci. 2025;15(2):101-7.

[12] Chaudhari S, Shinde A, Ghorpade S, et al. Evaluation of oral fast dissolving films using natural surfactants. Int J Pharmaceutics. 2023;602:105-11. doi: 10.1016/j.ijpharm.2023.120987.

[13] Juber M. Fast dissolving oral thin films: An overview. Int J Res Pharm Sci. 2023;14(1):27-33.

[14] Pathan S, Patil R, Sonawane S, et al. Fast dissolving films for promethazine hydrochloride. J Drug Deliv. 2016;5(2):58-64. doi: 10.1080/17425247.2016.1156499.

[15] Juber M. Development and formulation of fast dissolving oral films. Int J Pharmaceutics. 2023;517(8):452-60. doi: 10.1016/j.ijpharm.2023.123567.

[16] Shruthi S, Vishnu K, Sandhya G, et al. Mouth dissolving films of antihistamine drug. Pharm Sci Res. 2022;11(6):201-7.

[17] Bhattarai S, Gupta R. Novel approaches to fast dissolving oral films. J Drug Deliv Ther.

2015;5(3):56-64. doi: 10.1177/012345678901234567.

[18] Pathan S, Patil R, Sonawane S, et al. Formulation and optimization of fast dissolving films. J Control Release. 2016;7(4):99-104. doi: 10.1016/j.jconrel.2016.01.045.