Innovation Unleashed: "A Comprehensive Review of Fast Dissolving Film for Convenient Drug Delivery"

Sarika Gupta[1*], Dashrath Singh[2], Pravin Gupta[3]

[1*] Research Scholar, Department of Pharmaceutics, Mangalayatan University, (Institute of Biomedical Education and Research), Aligarh- (281204). India

[1*]Associate Professor, Department of Pharmacy, Agra Public College of Higher Education & Research Centre, Agra-(282007). India

[2]Department of Pharmaceutics, Mangalayatan University, (Institute of Biomedical Education and Research), Aligarh- (281204). India

[3]Shakuntala Devi College of Pharmacy, Kakyoli Nawabganj, Farrukhabad- (209501). India

*Corresponding Author

Sarika Gupta

Email ID: sarikagupta7017@gmail.com

Orcid ID: 0009-0007-7043-9384

Abstract

Fast-dissolving films (FDFs) offer numerous advantages over traditional drug delivery systems. FDFs are thin, flexible films that disintegrate or dissolve rapidly in the oral cavity leading to faster onset of action and improved therapeutic outcomes. Delivering the drug directly to the blood circulation via oral mucosa absorption. This mode of drug intake enhances bioavailability as well as the patient is compliant and no water is required during the swallowing it. FDFs can be manufactured using various techniques such as solvent casting, hot melt extrusion, and inkjet printing. FDFs offer a convenient and discreet alternative to conventional dosage forms, particularly beneficial for pediatric, geriatric, and mentally impaired patients. This review discusses the formulation considerations for FDFs, including the selection of film-forming polymers, plasticizers, and taste-masking agents. Ongoing research efforts are focused on improving the mechanical properties and taste-masking capabilities and incorporating strategies for advanced drug delivery such as controlled release and targeted delivery into FDFs.

Keywords: *Quick-dissolve strip, oral mucosa, high solubility, bioavailability, patient compliance, evaluation techniques*

I. Introduction

The drug taken by oral route is the most convenient and preferred route of administration among the various other delivery systems like ease of administration, offer great patient compliance and non-invasive. [1] More than 70% of drugs are available in the market in oral dosage form due to pain avoidance and versatile for various types of drug candidates [2]. Reduced bioavailability by oral way may be the product of low solubility, low intestinal absorption, degradation of GI lumen, poor membrane permeation, pre-systemic metabolism, clearance of pre-mucosal and pre-systemic elimination [3]. Dysphagia is commonly found among all age groups. Due to this problem, approximately 50% of the population, mainly pediatric and geriatric patients, tend to avoid taking oral solid dosage preparations due to fear of choking. [4],[5],[6]. For example, a daily dose of antidepressant may not be able to be swallowed by a very elderly patient. An eight-year-old with allergies could use a more convenient dosage form than an antihistamine syrup. A schizophrenic patient in the institutional setting can hide a conventional tablet under his or her tongue to avoid their daily dose of an atypical antipsychotic. A middle-aged woman undergoing radiation therapy for breast cancer may be too nauseous to swallow her H2-blocker. saquinavir, a highly potent HIV protease inhibitor, whose minimum effective concentration is only 100 ng/ml [7]. but to achieve this concentration, the oral dose required is 1200 mg/day (taken as six 200-mg capsules). The reason behind this is the very poor oral bioavailability of saquinavir due to extensive hepatic first-pass metabolism. In the oral delivery of drugs, fast-dissolving films are the innovative method. [8] An oral fast-dissolving film dissolves rapidly to release the medication for absorption oromucosally [9]. They can quickly be administered without water, making them particularly suitable for pediatrics and geriatric patients. [1],[10],[11]

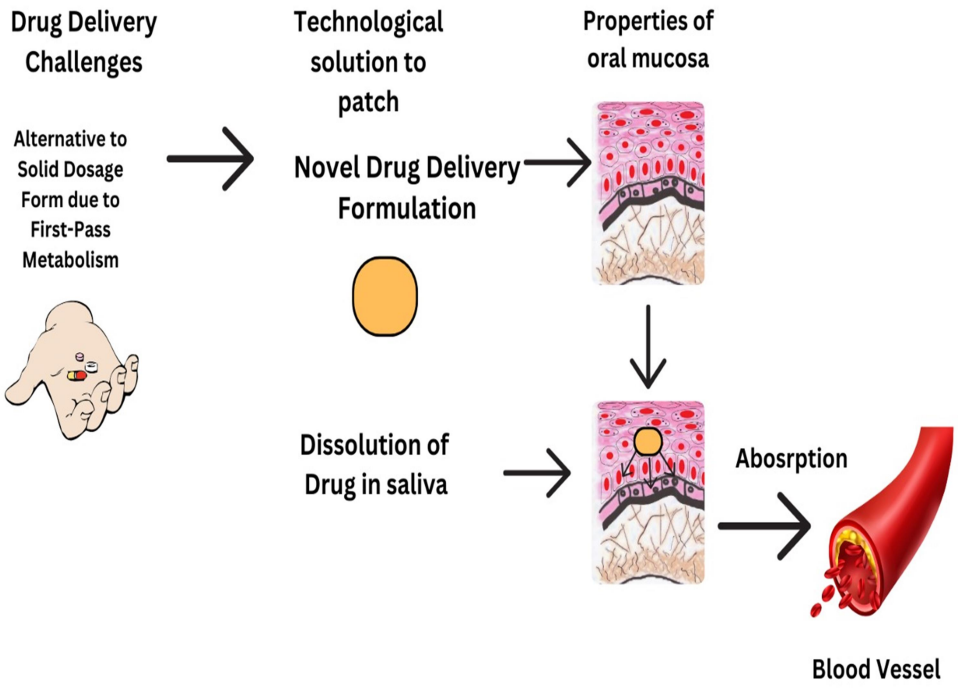

Figure 1: Absorption of drug through the mucous membrane

According to the ninth edition of the European Pharmacopoeia (Ph. Eur.), Oro dispersible films are formulations that are intended for the delivery of drugs by oral administration via the oral cavity. The Ph. Eur. states that FDFs mainly consist of a polymer with film-forming capacity, which serves as an active pharmaceutical ingredient or drug carrier. Plasticizers are also used to ensure the flexibility of the prepared films. Oro dispersible films are also defined as dosage forms that can be given to the patient without the use of water because FDFs consist of polymers that allow them to be broken down rapidly

by saliva and disintegrate in a few seconds, dissolving easily and being absorbed through the oral cavity or the tongue. [12],[13],[14]

Table 1. Fast Dissolving Patch of different drugs available as OTC or Rx products

S. No.	Product Name	References
1.	Listerine Pocket Paks® Oral Care Strips (OTC)	[15]
2.	Chloraseptic® Sore Throat Relief Strips (OTC), Triaminic Thin Strips®, (OTC), Theraflu® Thin Strips (OTC)	[5]
3.	Sudafed® Pe Quick Dissolve Strips (OTC)	[5]
4.	Gas-X Thin Strips®, Benadryl® Allergy Quick Dissolve Strips	[15]
5.	Pedia-Lax™ Quick Dissolve Strips (OTC)	[5]
6.	Ondansetron Rapid Film® (Rx), Risperidon HEXAL® SF (Rx)	[5]
7.	Niquitin® Strips (OTC), Zuplenz (Rx)	[5]
8.	Zolmitriptan Rapid Film® (Rx)	[5]
9.	Sildenafil Sandoz Oro dispersible Film® (Rx)	[5]
10.	Ivy Film®, Ivy Film Kiddies® (OTC)	[5]
11.	Clobazam OSF® (Rx)	[5]

The Food and Drug Administration (FDA) defined FDFs as dosage forms consisting of one or more APIs with an elastic nature so that, when placed on the tongue, they allow quick disintegration or dissolution by saliva [4]. Several other terms can be found in literature are oral strips, thin strips, fast-dissolving films, mouth-dissolving films, oral wafers [15]. Table 1 summarizes FDFs as over-the-counter (OTC) and prescription (Rx) preparations from different therapeutic classes. Interestingly, FDFs are a suitable dosage form not only for humans but they are also an alternative for animal oral drug administration, which is usually troublesome. FDFs are described as postage stamp-sized polymer films, with a thickness ranging from 12 to 100 µm and surface from 2 to 8 cm2 (commonly given dimensions in literature are 3 × 2 cm2, 2 × 2 cm2). FDFs contain one or more therapeutic substances that constitute up to 30 % of film mass [16]. Some benefits are shown by distinguishing fast-dissolving oral films from fast-dissolving tablets in Table 2.

Table 2. The difference between Fast Dissolving Oral Films and Fast Dissolving Tablets

S. No.	Fast Dissolving Oral Film	Fast Dissolving Tablet	References
1.	The large surface area gives greater dissolution	Less surface area gives lesser dissolution than FDOF	[17],[18]
2.	Fast-dissolving oral films are flexible.	Fast-dissolving tablet is brittle.	[17],[18]
3.	Low dose can also be incorporated in the formulation.	A low and high dose can be incorporated in the formulation.	[17],[18]
4.	Films are of thickness 0.015-.05 inches.	It is of the same size of a conventional tablet.	[17],[18]
5.	Patient compliance is more	Patient compliance is less than FDOF.	[17],[18]
6.	Low chance of choking.	It worried about choking.	[18],[19]
7.	Have greater durability than oral disintegrating tablet.	It has a lower level of durability than oral films.	[18],[19]

FDFs have been developed as a solution to the shortcomings encountered in other oral dosage forms: the low mechanical strength of FDFs, the reduced swallowability of regular tablets and capsules in paediatric and/or dysphagic patients or the lack of dose uniformity that might be seen in liquid formulations, especially suspensions. Furthermore, this dosage form benefits from increased dose flexibility, the patient or caregiver being able to adjust the dose by cutting the FDFs to the size corresponding to the desired dose. [20]

A. Classification of Fast-Dissolving wafers

Oral films/wafers can be divided into three categories which differ in their physical structure, appearance, composition, mode of application, characteristics, and site of action are summarized in Table 3.

1) *Flash release films*
2) *Mucoadhesive melt-away films*
3) *Mucoadhesive sustained-release films.* **[21]**

Table 3: Properties of different Fast dissolving films [21]

Property/Sub Type	Flash release films.	Mucoadhesive melt-away films.	Mucoadhesive sustained release films.
Area (cm2)	2-8	2-7	2-4
Thickness (µm)	20-7	50-500	50-250
Structure (Film)	Single layer	Single or multilayer system	Multilayer system
Excipients	Soluble & highly hydrophilic polymer	Soluble & hydrophilic polymer	Low/nonsoluble polymer
Drug phase	Solid solution	A solid solution or a suspension of drug particles	Suspension and/or solid solution
Application	Tongue	Gingival or buccal region	Gingival (other regions in oral cavity)
Dissolution	Minimum 60 sec Maximum 8-10 hrs.	Minimum 60 sec Maximum 8-10 hrs.	Minimum 60 sec Maximum 8-10 hrs.
Site of Action	Systemic/local	Systemic/local	Systemic/local

II. Formulation of Fast-Dissolving Film

A. Drugs

Both water-soluble and poorly water-soluble chemical drugs can be inserted into FDFs. Water-soluble drugs can be easily dissolved with saliva in the mouth cavity, however, the excessive first-pass metabolism and short half-life of drugs may lead to poor bioavailability after oral administration, for example, propranolol. Therefore, frequent administration might be needed for drugs with short biological half-life. In addition, poorly water-soluble drugs can be embedded in FDFs as well, despite their characteristics of limited aqueous solubility and slow dissolution rate limit the oral bioavailability. One of the major barriers that prevents patient from adhering to a prescribed medication regimen has

been identified as the unacceptable taste of active pharmaceutical ingredients (APIs) in these dosage forms. Different strategies have been made to improve solubility of poorly water-soluble drugs in FDFs formulation. For instance, micronization, nanoparticle technology, solid dispersion, solubility enhancers. [22] One approach to formulate the poorly water-soluble APIs in FDFs is their embedding in a particulate form. Therefore, both micro as well as nanoparticles were closer investigated. While the embedding of microparticles resulted in rough film surfaces, especially at high API contents [23]. another interesting approach for enhancing bioavailability was proposed by Islam et al. Ebastine, which is a second BCS class drug which was incorporated into transfersomes (a specific drug carrier) to increase its transmucosal delivery through the gastrointestinal track [24]. Various studies indicated that the oral bioavailability of APIs can be increased when they are formulated in lipid nanoparticles. [23].

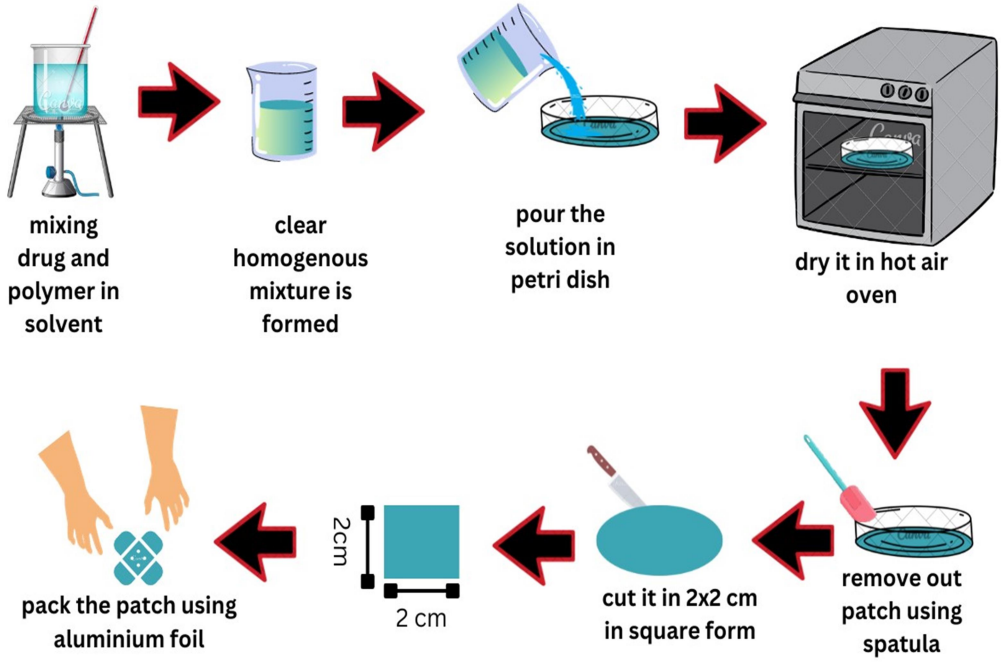

Figure 2: Preparation of FDFs

B. Excipients

A typical FDF consists of several technological elements: (i) drug or active substance; (ii) a film-forming polymer; (iii) a plasticizer agent to improve mechanical properties; (iv) a filler to improve toughness and structure; (v) saliva-stimulating agents to provoke salivation and facilitate disintegration; (vi) taste-masking agents such as flavours and sweeteners to cover the bitter and unpleasant taste of many APIs; (vii) colouring agents to make the film more attractive to consumers, and (viii) others such as surfactants, enzyme inhibitors, antioxidants, preservatives and thickening agents. Table 4 presents a summary of the most widely used excipients in FDF preparation. [25]

The polymers used in the oral film formulation cannot be toxic and irritant, free of leachable impurities, tasteless, have good wetting and spread ability characteristics, capability to utilize peel, shear, and tensile strength, be easily accessible, inexpensive, have an adequate shelf life, and secondary infections in the oral mucosa or dental regions are not produced. Orodispersible dosage formulations can employ both synthetic and natural polymers. To achieve the required finished product qualities, the composition of the polymeric matrix that compose oral films may be altered. The kind, quantity, or grade of the polymers can be changed to fine-tune a number of parameters, including muco-adhesiveness, disintegration time, percentage of drug load, mechanical/handling capabilities, among others. The polymers produced by natural inchoation are more reliable and effective. They are selected instead of synthetic polymers as they are easily accessible in natural areas all over the world. Naturally occurring polymers are used in most preparations and are preferable to synthetic ones since they are more affordable, easy to get in large enough quantities, and economical. Natural polymers are harmless and do not harm the body in any way. Natural polymers are pollution-free since they are biodegradable in nature and do not harm the environment. As they come from a natural source, natural polymers are free of adverse effects. Consumers often like natural polymers over synthetic ones since they are more effective and safer and have higher patient compliance. Natural polymers are renewable since they are used again in various processes and serve as a nutritional supplement [26].

Table 4: Excipient and its role in FDFs formulation [26]

S. No	Excipients	Role	Concentration	Examples
1.	Film-forming	They provide shape, elasticity, fast disintegration, and mechanical strength in films	40–50%	Sodium carboxy methyl cellulose, hydroxyl ethyl cellulose, hydroxyl propyl methyl cellulose, pectin, pullulan, gelatin, sodium alginate, starch, maltodextrin, methacrylic acid, xanthan gum, guar gum, locust bean gum, carrageenan, chitosan, polyvinyl pyrrolidone, polyvinyl alcohol, polyethylene oxide, polyvinyl acetate, polyvinyl pyrrolidone
2.	Plasticizers	They provide elongation, tensile strength, and plasticity; improve absorption and solubility; prevent crushing; and reduce brittleness and glass transition temperature	0–20%	Mannitol, glycerol, sorbitol, citric acid macrogol, propylene glycol, polyethylene glycols, phthalate derivatives (dibutyl, diethyl, dimethyl), citrate derivatives (triacetin, acetyl citrate, triethyl, tributyl)
3.	Sweetening agents	They are used to improve the taste of films for patient compliance	0–10%	Glucose, fructose, sucrose, sucralose, maltose, sorbitol, mannitol, stevioside sodium, ribose, cyclamate salts, aspartame, thaumatin, xylose, ribose, flavored essences, cyclamate, oleoresins
4.	Saliva stimulants	They increase saliva production	0–10%	Ascorbic acid, tartaric acid, malic acid, lactic acid, citric acid
5.	Taste maskers	They are used to mask nauseating and bitter tastes for patient compliance	0–10%	Hydroxypropyl-β-cyclodextrin, maltodextrin, sulfobutylether-β-cyclodextrin
6.	Surfactants	They help to disintegrate films in seconds and allow dispersion and solubilization	0–10%	Poloxamer, sodium lauryl sulfate, polysorbate, laureth-a, sucrose esters, dodecyl maltoside, cetyl trimethylammonium bromide, Sodium Starch Glycolate

C. *Methods for Manufacturing of Mouth Dissolving Film*

FDFs could be formulated using techniques such as Casting and drying (A. Solvent casting B. Semisolid casting), Freeze dried wafer, and Extrusion which are divided into Hot melt extrusion, Solid Dispersion Extrusion, Rolling method. [27]

1) Solvent casting method

This method is preferred for fast-dissolving buccal films, in which a clear viscous solution is formed by dissolving the water-soluble ingredient, the drug along with another excipient, is dissolved in a suitable solvent, then both solutions are mixed with continuous stirring before being cast in a Petri plate and dried [28],[29],[30] as shown in [2].

2) Semi-Solid Casting Method

The process begins with creating a polymer film-forming solution that is water soluble. Then, this solution is transferred to an acid-insoluble polymer solution, which can be created by combining either cellulose acetate butyrate or cellulose acetate phthalate with either a sodium hydroxide solution or an ammonium hydroxide solution in a ratio of roughly 1:4. In order to create a gel mass that can be moulded into thin films, plasticizer is carefully added after that [31].

3) Freeze dried wafer

It's also known as Lyophilisation or Cryodesiccation because it involves dehydrating water and lowering surrounding pressure to allow water in a substance to sublime straight from the solid to the gaseous phase. Lyophilization produces extremely porous preparation with a high specific surface area that dissolve quickly and have increased absorption and bioavailability [28]

4) Hot Melt Extrusion

In present method the mass is prepared first under the control of steering speed and temperature. Afterward, the film is coated and dried in a drying tunnel, once again the air circulation, temperature and line speed are controlled. Then follows a slitting and in the last step the films are punched, pouched after that sealed. formulated Piroxicam film with Maltodextrin plasticized by glycerine by using Hotmelt extrusion method [32].

5) Solid Dispersion Extrusion

Solid dispersion is prepared by immiscible components and drug. Finally, the solid dispersion is shaped in to film using dies.

6) Rolling method

In this approach, a drug solution or suspension is made with rheological considerations in mind. As a solvent, water or a combination of water and alcohol is employed. The carrier is rolled with a drug-containing suspension or solution. The films are cured on rollers before being cut into the desired shapes and sizes [28, 33].

D. Various Technologies Used in Oral FDFs Formulation

1) **XGel:** it is developed by Bio Progress is causing a revolution in the product offerings and manufacturing methods now available to the pharmaceutical industry.
2) **Soluleaves:** This is applied to flavour-release products such as mouth fresheners, confectionery and vitamin products. SOLULEAVES technology can be used to deliver active ingredients to the oral cavity efficiently and in a pleasant and easily portable form.
3) **Wafertab:** it is a patented delivery system that uses a unique process to prepare drug-loaded thin films which can be used in topical or oral application. Active Pharnaceutical Ingredient is incorporated into the film after casting.
4) **Foamburst:** it is a new patent granted in September 2004 which is for capsules made of foamed film. Gas is blown into the film during production, resulting in a film with a honeycombed structure. The voids in the film may be gas-filled, empty or filled with other materials to produce specific taste-burst characteristics or to deliver active drugs. The light honeycombed structure results in capsules that dissolve rapidly, causing a melt-in-the mouth sensation.
5) **Micap:** Micap plc signed an option agreement in 2004 to combine its expertise in micro encapsulation technology with the Bio Progress water-soluble films. The developments will be aimed at providing new delivery mechanisms for the $1.4bn global market for smoking cessation products (SCPs).[32]

III. Evaluation Parameters

A. Weight Uniformity

Films can be weighed on analytical balance and average weight can be determined for each film. It is useful to ensure that a film contains proper amount of excipients and drug [34],[35],[36].

B. Thickness

Micrometre screw gauge is utilized to measure the thickness at different strategic locations (at least 5 locations). This is essential to determine evenness in the thickness of the film as this is directly related to the accuracy of dose in the film [34].

C. DrynessTest/Tack Tests

About eight stages of film drying process have been identified and they are set-to-touch, dust-free, tack-free (surface dry), Dry-to-touch, dry-hard, dry-through (dry-to-handle), dry-to-recoat dry print free. Tackiness can be determined by the tenacity with which the strip adheres to an accessory object (a piece of paper) that has been pressed into contact with the strip. [37]

***D.* Surface pH**

Either highly acidic or highly basic pH of MDF would cause discomfort on administration. To know the surface pH of the film, the film was placed in a Petri dish and was moistened with 0.5 mL of distilled water and kept for 30 sec. The surface pH was measured using pH paper placed on the surface of the swollen films. The average of 3 determinations for each formulation was found out. [34],[38]

E. Visual inspection

The Colour, homogeneity, and transparency of a prepared orally disintegrated film can be evaluated visually.

F. Folding Endurance

Folding endurance is measured by manually folding the same place of film repeatedly until it breaks. It is the number of times the film can be folded without breaking. [29],[34],[36]

G. Wetting time

A circular paper is placed in the petridish to evaluate wetting time, and 6 ml of 0.1 % w/v amaranth dye solution is prepared and added to the petridish. The film strip (2x2 cm2) is placed on the surface of tissue paper. The wetting time is the time required for the dye to appear on the surface of the film [39]

H. Tensile strength

It is the maximum stress applied to a point at which the film specimen breaks. This test is performed to measure the mechanical strength of the same. It can be calculated from the applied load at cleavage divided by the film cross-sectional area as mentioned below: [34]

a. Tensile strength = (load at failure / strip thickness ×strip width) × 100

I. Percent elongation

A film sample stretches after applying stress, this is referred to as a strain. Strain is the deformation of film divided by the original dimension of the sample.

Percentage elongation=increase in length×100/original length [40]

J. Moister Contain

The prepared films were weighed and stored at room temperature in a vacuum desiccator containing anhydrous silica. The film was measured several times until it indicated a stable weight. The formula was used to calculate the percentage of moisture content.

K. $\%\ moisture\ content = \frac{(Initial\ weight\ of\ the\ film - final\ weight\ of\ the\ film)}{final\ weigh\ \ of\ the\ film} \times 100$

L. Swelling Test

By using a simulated saliva solution, this test is carried out. Each film sample is weighted and put in a stainless-steel wire mesh that has been pre-weighed. In a plastic container, the mesh holding the film sample is immersed in a 15ml medium. The film weight is measured at fixed intervals before it reached a steady weight.

$$\alpha = \frac{wt - w}{wo}$$

where,

α = Swelling Index

wt = weight of film at time t

wo = weight of film at time zero [41].

M. Disintegration test

FDFs are developed to dissolve rapidly in the mouth. Therefore, disintegration and dissolution tests have to be performed. FDFs should disintegrate rapidly in vivo as well. As a disintegration tester does not mimic the physiological conditions in the oral cavity, it is inappropriate for orally disintegrating dosage forms in general and particularly for FDFs. Nevertheless, it is often used. Typical disintegration times range from 5 to 30s. Simple tests such as the slide frame method and the Petri dish method have been described in the literature. These tests deal with a small volume of disintegration medium adapting the small volume of saliva in the mouth. A slide frame holding an FDF is laid on a Petri dish and a drop of distilled water is added. Time until the drop forms a hole in the film is measured. For the Petri dish method, the FDFs are placed on the surface of 2 ml distilled water Using a Petri dish and time for complete dissolution is recorded. Then placed the FDFs on a stainless-steel wire mesh containing 10 ml of distilled water. The disintegration time refers to the time it takes for the film to break. In another test disintegration is determined in a glass dish with 25 ml distilled water. The dish is swirled every 10 seconds and the time recorded when the film starts to break. Peh and Wong described the measurement of swelling behavior. [29],[36],[38],[41]

N. **In-vitro dissolution studies** The in-vitro dissolution studies are conducted using simulated saliva (300 mL). The dissolution studies are carried out using USP dissolution apparatus at 37 ± 0.5 °C and at 50 rpm using specified dissolution media. Each film with dimension (3 x 2 cm2) is placed on a stainless-steel wire mesh with a sieve opening 700µm. The film sample placed on the sieve was submerged into dissolution media. Samples are withdrawn at 0, 15, 30 and 60 sec. time intervals and filtered through 0.45µm Whatman filter paper and are analyzed spectrophotometrically at the wavelength of the drug. To maintain the volume, an equal volume of fresh dissolution medium maintained at the same temperature is added after withdrawing samples. The absorbance values are converted to concentration using standard calibration curve previously obtained by experiment. The dissolution testing studies are performed in triplicate for all the batches [36],[38],[42],[43]

Table 4: Recent research on API-loaded FDFs

DT- Disintegration time, WV-Weight Variation, FE- Folding endurance, %DR- % Drug Release

Drug	Excipients used	Evaluation Parameters of FDFs	Category of API
Aceclofenac[1]	Cross Carmellose Sodium, Sodium Saccharin, β-Cyclodextrin, Propylene Glycol, Hydroxy Propyl Methyl Cellulose.	F E 102 W V 0.195 D T 43 % DR 98.95	Non-steroidal anti-inflammatory drugs (NSAIDs)
Agomelatine[4]	HPMC E-15, PVP K-30, Mannitol, PVA	FE 182 WV 0.80 D T 170 % DR 94.01	Melatonergic Antidepressant
Domperidone[12]	HPMC E-15, Propylene glycol, Citric acid, Sucralose	FE 291 WV 71.84±0.21 D T 25.4 % DR 95.10	Antiemetic Drug
Escitalopram; quetiapine[27]	Polyvinylpyrrolidone, ethyl alcohol, ethyl alcohol	D T 2 s % DR 100%	Antidepressant Drug
Etoricoxib[34]	Hypromellose (hydroxypropyl methyl cellulose 15 cPs), Sucralose, Glycerin	FE 2 ± 1 WV 93.4 ± 1.66 D T 8.5 ± 0.70 % DR 34.6 ± 3.70	Pain Management
Carvedilol[44]	Maltodextrin, Polyvinyl alcohol (PVA), propylene glycol (PG), Cross povidone, Citric acid, Mannitol	FE above 250 D T 30 sec % DR 98.01	Antihypertensive Drug
Granisetron[45]	Hydroxypropyl methyl cellulose 15 cps, Saccharin sodium and polyvinyl pyrrolidone K-30, Oil of peppermint and glycerine.	FE 202 WV 68.67	Antiemetic Drug
Losartan[35]	Sodium carboxymethylcellulose, HPMC 5cps, Na–alginate, Gelatin, Glycerol, SSG, Saccharin sodium, Menthol.	FE 120-150 WV 58.40±2.449 D T 38.0±2.00 % DR 96.8	Antihypertensive Drug
Meloxicam, Tizanidine[5]	HPMC E5, HPMC E50, HEC, PVA, Xanthan gum, Croscarmellose sodium, Aspartame, PVP K30.	FE More than 100 times WV 105.8±2.9 D T 27±1.7 % DR within 5 min	Osteoarthritis and Rheumatoid Arthritis
Mosapride[13]	MDX, HPMC E15 and K4M, Poloxamer 188 (P188) and 407, Glycerol (GLY) and propylene glycol (PG)	Weight 200.23 D T 6s % DR 75.6	Gastroprokinetic agent
Naratriptan hydrochloride[29]	Hydroxypropyl methylcellulose (HPMC) E5, propylene glycol, and polyethylene glycol 400 (PEG 400)	FE >150 folds D T <1 min % DR 100. 0.82±1.050	Migraine
Olanzapine[14]	Hydroxy propyl methyl cellulose (HPMC-E5) and sodium carboxy methyl cellulose (NaCMC), Glycerol, menthol, propylene glycol, anhydrous carboxylic acids (CAPs); ascorbic acid, tartaric acid, and citric acid.	FE 132.00 D T 4.00s % DR 100.23	Typical antipsychotic drugs
Propranolol Hcl[42]	HPMC, HPMC E 15, Propylene Glycol,	FE 120±4.92	Migraine Prophylaxis

	Cross Povidone, Citric Acid, Aspartame.	WV 21±1.41 D T 15±0.81 % DR 106.84	
Ropinirole[15]	Aspartame, Pullulan, Sucralose, Polyethylene glycol 400 and sodium chloride.	FE 88.00 ± 1.00 WV 65.33 ± 0.68 D T 20.33 ± 0.57 % DR 99.48 ± 0.18	Parkinson disease
Tetrabenazine[46]	Hydroxy propyl methyl cellulose (HPMC) E15, hydroxy ethyl cellulose (HEC) and Povidone K90 (PVP K90) and pullulan, Glycerol and Sorbitol.	WV >100 D T 40	Hyperkinetic Movement Disorders
Eclipta prostrate[30]	HPMC E15, HPMC, PVA, Sodium alginate, propylene glycol, sodium starch glycolate, Sugar.	FE >270, WV 3.55±0.042 D T 27.3±.0140.	Hepatoprotective, Anti-Inflammatory, Hypoglycemic, Immunomodulator, Wound Healing
Eletriptan[36]	Pullulan, Maltodextrin (MDX), Acacia, Sodium alginate (SA), Locust bean gum (LBG), Guar gum (GG), Xanthan gum (XG), Polyvinyl alcohol (PVA), Polyvinyl pyrrolidine (PVP), Hydroxyl propyl methyl cellulose (HPMC) E5, and HPMC E15. Mannitol propylene glycol	FE 160 WV 78.33±0.577 D T 15.66±0.577 % DR 100.66	Moderate migraine
Enalapril Maleate[10]	HCT, 15% HPC and a mixture of acetone/distilled water (50:50 m/m), polyethylene glycole (PEG) 400	----	Cardiac Failure
Loratadine[47]	HPMC 60SH-50, Xanthan gum, Poly ethylene oxide N10,	FE >100 WV D T 40 % DR	Antihistamine (Tricyclic H1 Receptor Antagonist)
Metoprolol Tartrate[43]	HPMC, MC, PEG40, Saccharine, Menthol, MCC	FE 229±18 WV 25.53±2.18 D T 38.33±7.78 % DR 99.88%±0.89%	Anti-Hypertensive

IV. Conclusion

In the area of oral drug delivery, Fast-dissolving film (FDFs) is a novel approach that fulfills need in a wide range of populations, including children, nauseated, paralyzed, and non-compliant patients. There is no need for water, measurement and after disintegration; the drug gets absorbed in oral mucosa providing quick onset of action. Active pharmaceutical ingredients incorporated films can be formulated and used in the management of CNS-related diseases or disorders. The drug loading is restricted to roughly 25-100 mg, so the drug to be integrated into the film formulation should be highly potent. Recently, a number of research studies have been published that can be useful in the industrialization of this novel and unique dosage form that is currently being developed.

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