Oral Dissolving Films: A Novel Drug Delivery System

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Abstract: Oral drug delivery through fast dissolving strips is gaining popularity due to the ease of administration and high patient compliance. These strips offer a convenient and safe alternative for patients who have difficulty swallowing traditional tablets and capsules. As the drug is directly absorbed into systemic circulation, degradation in gastrointestinal tract and first pass effect can be avoided. Different types of fast dissolve technologies and formulations have been developed to cater to various patient needs and preferences. They come in three subtypes - flash release, mucoadhesive melt-away wafer, and mucoadhesive sustained release wafers. These films have a thin area containing drug, with formulation considerations like plasticizers impacting their mechanical properties.

Keyword: First pass metabolism, Tensile strength, Fast Dissolving Oral Film etc.

INTRODUCTION

The oral route is one of the most preferred routes of drug administration as it is more convenient, cost effective, and ease of administration lead to high level of patient compliance. The oral route is problematic because of the swallowing difficulty for pediatric and geriatric patients who have fear of choking.[1] Patient convenience and compliance oriented research has resulted in bringing out safer and newer drug delivery systems. Recently, fast dissolving drug delivery systems have started gaining popularity and acceptance as one such example with increased consumer choice, for the reason of rapid disintegration or dissolution, self-administration even without water or chewing. Fast dissolving drug delivery systems were first invented in the late 1970s as to overcome swallowing difficulties associated with tablets and capsules for pediatric and geriatric patients.[2]

Mouth dissolving films, a new drug delivery system for the oral delivery of the drugs, was developed based on the technology of the transdermal patch. The delivery system consists of a very thin oral strip, which is simply placed on the patient's tongue or any oral mucosal tissue, instantly wet by saliva the film rapidly hydrates and adheres onto the site of application. It then rapidly disintegrates and dissolves to release the medication for oromucosal absorption or with for mula modifications, will maintain the quick-dissolving aspects allow for gastrointestinal absorption to be achieved when swallowed. In contrast to other existing, rapid dissolving dosage forms, which consist of liophylisates, the rapid films can be produced with a manufacturing process that is competitive with the manufacturing costs of conventional tablets Mouth dissolving films, a new drug delivery system for the oral delivery of the drugs, was developed based on the technology of the transdermal patch. The delivery system consists of a very thin oral strip, which is simply placed on the patient's tongue or any oral mucosal tissue, instantly wet by saliva the film rapidly hydrates and adheres onto the site of application. It then rapidly disintegrates and dissolves to release the medication for oromucosal absorption or with for mula modifications, will maintain the quick-dissolving aspects allow for gastrointestinal absorption to be achieved when swallowed. In contrast to other existing, rapid dissolving dosage forms, which consist of liophylisates, the rapid films can be produced with a manufacturing process that is competitive with the manufacturing costs of conventional tablets Mouth dissolving films are a new drug delivery system for the oral administration of medication. These thin oral strips rapidly dissolve on the tongue or oral mucosal tissue, providing quick absorption of the drug. This system addresses challenges faced by geriatric and pediatric patients with swallowing solid medication, leading to improved patient compliance and bioavailability.[3] The pharmaceutical geography is dominated by solid dosage form including tablets, granules, capsules and liquids. Never the less conventional dosage forms have their significant challenges, particularly geriatric and pediatric patients, who struggle with chewing and swallowing of solid medication. this results in poor patient compliance. In response to these challenges oral

dissolving film(ODF's) came into existence as a better alternative . oral dissolving strips are a type of oral drug delivery system where the drug is rapidly dissolved in mere seconds because they are composed of water soluble polymers .These are ultra thin, and dissolve quickly on tongue, rapidly reaches the drug to systemic circulation. ODF's have rapid dissolution and absorption with enhanced bio-availability and improved patient compliance with reduced risk of as phyxiation.[4]

The sublingual mucosa offers high bioavailability of drugs by bypassing first-pass metabolism and taking advantage of its high permeability. ODFs are defined by the FDA as a flexible strip containing one or more active pharmaceutical ingredients that dissolve quickly in saliva when placed on the tongue, thereby entering the bloodstream directly. according to US food drug administration(FDA), ODF's are defined as "including one or more active pharmaceutical ingredient, a flexible and non-brittle strip that is placed on the tongue before passing into gastro-intestinal tract ,aiming for quick dissolution in saliva.[3]

CLASSIFICATION OF FAST DISSOLVING TECHNOLOGY

1. LYOPHILIZED SYSTEM: The technology associated with these systems entails the preparation of a suspension or solution of a drug combined with various structural excipients. This mixture is then shaped into tablet-like units using a mould or blister pack. Following this, the units or tablets undergo freezing and lyophilization within the pack or mould. The final products exhibit significant porosity, facilitating swift penetration of water or saliva and leading to rapid disintegration. These units can accommodate a variety of taste-masked substances and demonstrate a faster disintegration rate compared to traditional tablet-based systems.[4-5]

2. COMPRESSED TABLET-BASED SYSTEMS: This system is developed utilizing conventional tablet technology through the direct compression of excipients. The manufacturing method influences the hardness and friability levels of the tablets, leading to variations in disintegration performance and packaging requirements. These can range from standard high-density polyethylene (HDPE) bottles or blisters to more specialized packaging designs aimed at product protection, such as those offered by CIMA Labs and Pack Solv. Fast dissolving tablets achieve quicker disintegration compared to standard tablets by incorporating water-soluble excipients, super disintegrants, or effervescent components, facilitating rapid water penetration into the tablet core. An exception to this method is the Biovail Fuisz Technology, which employs a proprietary Shear form system to create drug-loaded candy floss, subsequently used for tableting with additional excipients. This system can theoretically accommodate relatively high doses of drug material, including taste-masked coated particles.[5]

ADVANTAGES [6-7]

- Easy transportation
- No need of water for administration: Can be used safely even when access to water is not possible (such as travel)
- Oral strip technology provides an alternate route for drugs with first pass metabolism
- Ease of administration of film to the patients suffering from dysphagia, repeated emesis, motion sickness, and mental disorders
- Large surface area provides rapid disintegration and dissolution in the oral cavity.
- No risk of suffocation
- Improved stability
- Easy application to mental and incompatible patients
- Bypasses the gastrointestinal tract and thus increasing bioavailability
- Low dosage and low side effects
- It provides more accurate dosage when compared to liquid dosage forms
- Provides rapid onset of effects in conditions requiring urgent intervention, for example, allergic attacks such as asthma and intraoral diseases
- Improves the absorption rate and amount of drugs

DISADVANTAGES [6]

1. Drugs which are unstable at buccal pH cannot be administered.
2. Drugs with high dose cannot be incorporated into the film
3. Drugs which irritate the mucosa cannot be administered by this route
4. As it is fragile and must be protected from water, it requires special packaging.

STANDARD COMPOSITION OF MOUTH DISSOLVING FILM [8-11]

- Active pharmaceutical ingredient
- Film forming polymers
- Plasticizer
- Sweetening agent
- Saliva stimulating agent
- Flavoring agent
- Coloring agent

1. ACTIVE PHARMACEUTICAL COMPONENT : Any class of pharmaceutically active drugs that can be delivered orally or through the buccal mucosa considered as active pharmacological substance. such as expectorants, antianginals, antitussives, antihistaminic, antiepileptic, anti-analgesic and antiulcer drugs.[8]

2. POLYMERS: The Greek terms poly, which means "many," and meros, which means "pieces or units of large molecular mass," are combined to form the word "polymer." Each molecule is made up of an enormous number of individual structural components that are regularly connected to one another by covalent bonds.

Classification of Polymers Used In Mouth Dissolving Film[9]

1. Natural Polymer
2. Synthetic Polymer

1. Natural Polymers:

- Guar gum:

Guar gum is a naturally occurring polysaccharide gum that is soluble in water, derived from the seeds of Cyamopsis tetragonoloba, which belongs to the leguminosae family. From a chemical perspective, it consists of (1/6) linkages that connect linear polymer chains of (1/4)-β-D-mannopyranosyl units and α-D-galactopyranosyl units. The microorganisms present in the gastrointestinal tract effectively ferment the galactomannan residues, producing short-chain fatty acids that are not metabolizable by humans or animals. Due to its beneficial properties, such as biocompatibility and biodegradability, guar gum plays a crucial role in biomedical applications and drug delivery systems. It possesses various attributes, including enhanced bioavailability, mechanical strength, and physicochemical stability.[7]

- Xantham gum:

Xanthomonas campestris, a bacterium typically associated with cabbage plants, synthesizes xanthan gum, a naturally occurring high molecular weight polymer. This xantham gum appears as a free-flowing powder that ranges in color from white to cream and is soluble in both hot and cold water, while remaining insoluble in most organic solvents. Even at minimal concentrations, solutions of xantham gum demonstrate a viscosity that is significantly greater than that of other polysaccharide solutions, enhancing its effectiveness as a thickening and stabilizing agent. Although xanthan gum is not thixotropic, its solutions exhibit pseudoplastic behavior, which aids in processing and ensures excellent pourability. Furthermore, xantham gum possesses superior thermal stability compared to many other water-soluble polysaccharides. Its lack of flavor means it does not alter the taste of other culinary components, while also enhancing the sensory qualities of final products. Additionally, xantham gum solutions are resistant to pH variations, maintaining stability in both acidic and alkaline conditions.[7]

- Agar:

Agar is dehydrated gelatinous product made from the red algae gelidiumamansii (gelidanceae) and several of other species, including gracilaria. Pterocadia and (gracilariaceae) (gelidaceae). Agar comes in the form of strips, sheet flakes, or coarse powder and is available in shades of yellowish grey, white, or practically colourless. It has a mucilaginous flavour and has no odour. Agarose and agaropectin are the two polysaccharides that make up agar. The viscosity of agar is result of agaropectin, while agarose is responsible for the stability of the gel solutions. As its high gel strength, it as viable candidate to function as a disintegrant.[8]

- Fenugreek seed:

The mucilage made of polysaccharides and derived from fenugreek seeds is an amorphous powder with a cream colour. In warm water, this rapidly dissolves to create a thick colloidal solution. Angle of repose, bulk density, and compressibility index are determined to be 22.25degree C, 0.64 g/cc, and 15.20 % of its physicochemical properties, respectively. Fenugreek mucilage creates a thick, gelatinous substance when it comes into contact with liquids; water does not cause it disintegration.[9]

2. Synthetic polymers:

Synthetic polymer is created artificially in lab by human being. A variety of chemical reactions since they do not exist in nature. It is further classified in two major categories i.e., • biodegradable synthetic polymers. • non-biodegradable synthetic polymer.

- Hydroxy propyl cellulose:

Hydroxypropyl cellulose (HPC) is a thermoplastic non-ionic polymer that is water soluble. Poly (hydroxypropyl)ether of cellulose that has been partly replaced with hydroxypropyl cellulose. It could include another appropriate anti-caking agent 0.6% silica. Commercially, HPC is offered in a many of grades with varied solution viscosities. It is well known that films made of polymers with extremely high glass transition temperatures have a rigid consistency. Hpc has a strong ability to create films. As the sole water-soluble thermoplastic cellulose derivative, it was selected as the main matrix-forming polymer. Depending on its molecular weight, hpc can soften at temperatures between 100 and 1500°c.it may be employed alone or in cooperation with hypromellose to make flexible films since it gives its solution low surface and interfacial tension.[10]

- Poly vinyl pyrrolidone:

Polyvinyl pyrrolidone (PVP) is a water-soluble polymer created by N-vinyl pyrrolidone. It forms films easily, has excellent wetting characteristics, and is non-toxic, chemically inert, and temperature resistant. Povidone is combined to make flexible, rapidly dissolving strips.[11]

- Hydroxy propyl methyl cellulose:

Hydroxypropyl methylcellulose (HPMC) polymers are commonly used excipients in hydrophilic tablet production. Different grades are selected based on molecular size, chemical substitution, and particle size. For consistent drug release profiles, controlling these variables is crucial. Release and dissolution depend on the polymeric film matrix properties, with higher hydroxypropyl/methoxy ratios resulting in delayed drug release due to thick gel formation.[11]

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- Croscarmellose sodium:

croscarmellose sodium cross-linked polymer of cellulose carboxymethyl is the term used to describe croscarmellose sodium. In addition to differences in the starch and cellulose polymer backbones, there are changes in the synthetic techniques used to modify the polymer. Most significantly, croscarmellose sodium use as a distinct cross-linking mechanism.[10]

- Polyvinyl alcohol:

A polymer that dissolves in water is polyvinyl alcohol. Its water-soluble properties are caused by the hydroxyl group (- OH) that is present in its structure. It is produced by polymerizing vinyl acetate to create polyvinyl acetate, which is subsequently hydrolysed to produce PVA. Polyvinyl alcohol's ability to crystallise and dissolve depend on number of acetate groups present and to the rate of hydrolysis. [11]

- Propylene glycol:

In controlled-release devices, it has been tested in biodegradable polymeric matrices. Almost completely non-irritating to the skin, polyethylene glycols are stable, hydrophilic compounds. The polyethylene glycols do not easily permeate glycol, polyethylene glycols can also be utilized to improve the water solubility or dissolution characteristics of poorly soluble substances.[11]

3. PLASTICIZER: Plasticizers contribute to the improvement of skin texture; however, they are readily washed away by water due to their water-soluble nature. After cleansing, they can serve as effective bases for ointments by forming solid dispersions with appropriate polyethylene glycol. These plasticizers enhance the mechanical properties of the film, including its tensile strength and elongation, while also reducing brittleness. Furthermore, they may improve the strength and flow characteristics of the polymer. It is essential to select plasticizers with care, ensuring compatibility with the polymers, active ingredients, and other excipients. An inappropriate choice may lead to issues such as peeling, splitting, or cracking of the film.

Commonly used plasticizers include dimethyl, dibutyl, diethyl phthalate, tributyl, triethyl, acetyl citrate, triacetin, propylene glycol, polyethylene glycol, and glycerol.[8]

4. SALIVA STIMULATING AGENT : Saliva stimulating drugs are used to boost saliva production in to accelerate the breakdown and dissolution of the oral film insight the mouth. It has a range of 2-6% that can be used alone or in mixture. Citric acid, malic acid, lactic acid, ascorbic acid, and tartaric acid are often used saliva-stimulating substances. Citric acid is the most popular of them.[9]

5. SWEETENING AGENT:Sweeteners are typically used to cover up the bitter taste of some drugs. One can use natural and artificial sweeteners alone or together. Types of sweetener includes natural sweeteners, such as corn syrup solids, xylose, ribose, glucose, mannose, galactose, fructose, dextrose, and sucrose and artificial sweeteners aspartame, cyclamate, and saccharin. Acesulfame K, sucralose, alitame, and neotame. [9]

6. FLAVOURING AGENT: Both natural and artificial flavours, including methyl salicylate, eucalyptol, thymol, artificial vanilla, cinnamon, various fruit flavours, mints like peppermint and menthol, and essential oils, may be used singly or in combination. [9]

7. SURFACTANT:It is a solubilizing, wetting, or dispersion agent, surfactants are employed. Surfactant is used to breakdown the film quickly and release the active ingredient. Surfactant can increase the solubility of poorly soluble drugs in rapidly dissolving oral films. Polaxamer 407, sodium lauryl sulphate, benzalkonium chloride, benzthonium chloride, tweens, and spans are a few examples.[9]

8. COLOURING AGENT: When some of the ingredients or drugs in the formulation are present in insoluble or suspension form, titanium dioxide or FD&C approved colouring additives are added (not exceeding concentration levels of 1%w/w).[11]

- STANDARD COMPOSITION OF ORAL DISSOLVING FILMS[9]:

S.no	Composition	Percentage	Examples
1	Drug	1-30%	Anti-hypertensive, anti-epileptics, anti-emetics etc
2	Polymer	10- 50%	HPMC, Methyl cellulose, pectin, gelatin, polyvinylpyrrolidine, hydroxy propyl cellulose etc.
3	Plasticizer	Up to 20%	Glycerin, PEG, triethyl citrate etc.
4	Saliva stimulating agents	2-6%	Citric acid, malic acid, lactic acid, ascorbic acid, and tartaric acid
5	Sweetening agents	2-6%	Acesulfame K, sucralose, alitame, and neotame
6	Flavouring agents	1-10%	Eucalyptus oil, thymol, artificial vanilla, cinnamon
7	Surfactants	q. s	Sodium lauryl sulphate, benzalkonium chloride, benzthonium chloride, tweens,
8	Colorants	q. s	Titanium, zinc oxide etc.

Table1: standard composition of oral dissolving films. [9]

METHOD OF PREPARATION:[12-15]

1. SOLVENT CASTING METHOD:
The preparation of thin films involves a two- stage process. Initially aqueous-soluble excipients are dissolved in deionized water to clear solution. Simultaneously the active pharmaceutical ingredient is accurately weighed and dissolved in a suitable organic solvent. The resultant solutions are combined and stirred thoroughly to ensure homogeneity.The composite mixtures is subsequently cast into a petridish and allowed to dry under controlled conditions. Finally, the dried film is cut to the desired dimension for future analysis. [12]

2. HOT MELT EXTRUSION:
   It is a continues processing method utilized in the manufacturing of thin films. This method integrates powder blending, thermal extrusion, and film formation in a single step, ensuring optimal product uniformity and minimal material loss. Key benefits include improved content uniformity, reduced waste, and enhanced manufacturing efficiency. [13]

3. SEMISOLID CASTING METHOD:
   Applicable to formulations containing acid-insoluble polymer containing formulations (example: cellulose acetate butyrate, cellulose acetate phthalate) utilizing 4:1 ratios. [12]

4. ROLLING METHOD:
   Applies API containing suspensions or solutions onto carrier, followed by controlled drying and precision cutting. [12]

5. SOLID DISPERSION EXTRUSION:
   Suitable for immiscible substances, this process entails formation of solid mixtures and subsequent thin film fabrication using specialized molds. Multiple drugs are combined with hydrophilic polymers to create homogenous solutions, which are then incorporated into polyethylene glycol at temperature below 70 degrees centigrade, without solvent removal. The resulting solid mixtures are then transformed into films. [12]

- DIFFERENT DRUGS AND THEIR PREPARATIVE METHODS[13]:

S.no	Drug	Disease	Preparation method
1	Pregabalin	Pain originating in the central nervous system	Solvent pouring method
2	Captopril	Hypertension	Solvent casting method
3	Usnea barbata	Oral squamous cell sarcoma	Solid dispersion method
4	Diclofenac	NSAID, pain and inflammation	Solvent casting method
5	lansoprazole	Gastric acid disorders	Solvent casting method
6	Nifedipine	Hypertension	Solvent casting method

Table 2: Different drugs and their preparative methods. [13]

ADVANCED TECHNOLOGIES USED IN ORAL DISSOLVING FILMS[14]

1. X-Gel: This groundbreaking film technology represents a significant advancement, enabling pharmaceutical companies to create innovative formulations and optimize their production processes.

2. Soluleaves: By leveraging the capabilities of soluleaves, manufacturers can produce effective flavor-release products, including mouth fresheners, candies, and vitamin supplements, which deliver medication directly to the oral cavity with exceptional efficiency.

3. Wafertab: This patented, state-of-the-art delivery system employs a distinctive thin film technology to integrate the drug after casting, allowing for precise topical and oral application.

4. Foamburst: Bio-progress's pioneering foam burst technology, patented in 2004, consists of capsules crafted from a foamed film with a honeycomb structure, facilitating rapid dissolution and customized taste burst features that enhance sensory enjoyment.

5. Micap: In 2004, Bio-progress unveiled advanced film technologies that significantly improve the development and manufacturing of pharmaceutical products.

EVALUATION PARAMETERS:[15-16]

Thickness:
The thickness of the different films was measured using a baker precision measuring instrument, China. It was measured by placing each film between the anvil and the presser foot of the dial guage is 5 different location and the average thickness was calculated.

Tensile strength:
Tensile strength is maximum stress applied to at which film specimen brakes. It is calculated by the load at rupture divided by the cross-section area of the film.
Tensile strength = F max/A film

Young's modulus:
It is use to estimate stiffness. It is found as balance applied stress to the strain in the region.it is determined by Youngs modulus = force of corresponding strain/cross sectional area.

Tail flick test:
The ventral surface of the tail of the animal was placed on the heating coil of digital analgesiometer and the basal reaction times were noted. About 3-5 basal coxib was fixed of 10 mg/kg body weight.

Thermodynamic stability test:
Optimize formulations then subjected to different thermodynamic stability study test namely centrifugation and freeze the cycles by thermodynamic stability test.

Viscosity:
Evaluate the viscosity of the optimized formulation by Brookfield viscometer.

Drug content:[16]
Determine the percentage of drug content of formulation from the calibration curve by using uv spectrometer.

Weight of films:
Oral fast dissolving films can be weighed on analytical balance and average weight can be determined. It is desirable that film should have constant amount of API and excipients.

pH value:
PH is measured by the dissolving one oral film in 10ml distilled water and measuring the pH of the obtained solution should have nearly uniform pH value

Elongation:
When stress is applied, a film sample stretches and this is referred to as strain. Strain is basically the deformation of film divided by original dimension of the sample.Generally elongation of film increases as the plasticizer content increases. Stretches and this is referred to as strain.
Percent elongation= L*100/L
L = Increase in length of film L = Initial length of film
Swelling property:
Each film sample is weighed and placed in a pre-weighed stainless steel wire mesh. Then the mesh containing film sample is submerged into 15ml medium (simulated saliva solution) in a plastic container. Increase in the weight of the film was determined at preset time interval until constant weight was observed.
Degree of swelling = Wt– Wo/ Wo
Where, Wt is weight of film at time t, and Wo is weight of film at time zero.

Stability Studies:
Stability studies on the optimized oral fast dissolving film is carried out for determination of effect of temperatures and humidity on the stability of the drug. The film are stored in an aluminium foil and subjected to stability at room temperature. The sample can withdraw at 3 months and 6 months and subjected for cumulative % drug release and in vitro dissolution studies to determine disintegration time and disintegration test.

Transparency:
The transparency of the films can be decide using a simple UV spectrophotometer. Cut the film samples into rectangles and placed on the inner side of the spectrophotometer cell. The direct transmittance of films at 600 nm. The transparency of the films was calculated as follows:
Transparency = (logT600)/b = -€c Where T600 is the transmittance at 600 nm and b is the film thickness (mm) and c is concentration.

Contact angle:
It allows the information about wetting behaviour, disintegration time and dissolution of oral film. This can be executing with the help of goniometer at room temperature. For this cause, double distilled water should be used. A dry film is taken and a drop of double distilled water is situating on surface of the dry film. Images of water droplet are taken by a convey of digital camera within 10 s of deposition. Digital pictures should be analysed by image J 1.28v software for angle determination.

Scanning electron microscopy:[16]
Scanning electron microscopy is a prime method to study the surface morphology of the film between different excipients and drug. A film sample is taken and placed in sample holder and at ×1000 magnification and various photomicrographs were taken using the tungsten filament as source of electron.

In vitro disintegration:[16]
It is the time at which the film disintegrates when conduct in contact with water. This test is carried

out by position the film in the phosphate buffer. United State Pharmacopoeia disintegration apparatus can be also used to study the disintegration time. The disintegration time should be in the range of 5-30 sec.

- DIFFERENCE BETWEEN ORAL DISSOLVING STRIPS AND FAST DISSOLVING ORAL TABLETS[18]

Sl No	FAST DISSOLVING ORAL FILMS.	FAST DISSOLVING ORAL TABLETS.
1	It is a film	It is a solid dosage form
2	High dissolution due to larger surface area	Low dissolution due to less surface area
3	Low doses can be incorporated	High doses can be incorporated
4	No risk of chocking	It has risk of chocking
5	Bypasses first pass metabolism	Tablet undergoes first pass metabolism

Table 3: Comparisons between fast oral dissolving films and oral dissolving tablets. [18]

- MARKETED ORAL DISSOLVING STRIPS[19]

Year	Trade name	Drug
2001	Listerine oral care strips	Menthol
2004	Theraflu day time strips	Dextromethorphan, diphenhydramine, phenylephrine.
2005	Suppress cough strips	Menthol.
2006	Gas-x thin strips	Simethicone.
2007	Orajel sore throat relief strips	Benzocaine.
2008	Pedia-lax	Sennoside.
2016	Sildenafil oral dispersible film	Sildenafil.

Table 4: Marketed oral dissolving strips.

PACKAGING: The packaging for oral dissolving films encompasses various materials, including plastic pouches, individual pouches, foil paper, aluminum pouches, blister packaging, and barrier films. Barrier films are particularly utilized for drugs that are highly sensitive to moisture. Labtec GmbH's rapid film technology outlines that the primary packaging, which consists of sealing pouches, provides ample space for logos, codes, and instructions. The films are produced through a laminating process, and the associated packaging costs are comparable to those of tablets.[20]

CONCLUSION

Fast dissolving oral films offer improved patient compliance, biopharmaceutical properties, efficacy, and safety compared to conventional oral dosage forms. These new products, called Fast Dissolving Oral film, are promising for elderly patients and offer an opportunity for line extension in the marketplace for various drugs. With quick action within a minute, these dosage forms are expected to be more acceptable and prescribed due to increasing patient demand.

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