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REVIEW ARTICLE Open Access

INNOVATIONS IN FORMULATION AND EVALUATION OF ORAL FAST DISSOLVING FILM

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Abstract:
The most popular and convenient route for the drug administration is oral route with some merits, demerits, and limitations with some paediatric and geriatrics patients as they face difficulty to take solid dosage forms like capsules or compressed tablets that results in improper dosing due to vomit or removal of drug from buccal cavity. Oral fast dissolving films are a good alternate to overcome these difficulties and to deliver the drugs with any these age groups. Fast dissolving oral films are capable of delivering the drug locally and systemically by absorption through buccal mucosa, sublingual route, and oesophagus and finally form the stomach. Oral fast dissolving films offers a convenient way of dosing medication, not only for special groups of the population like paediatric, geriatric, confined to bed patients, patients with mental problems, but also to the general population. The present article review is focused on composition, preparation methods, evaluation and advancements of orally fast dissolving oral films.

Keywords: *Oral Fast Dissolving Films; Disintegrating; Hydrophilic, Polymers; Oral; Buccal; Solvent Casting*

1. Introduction

The oral route is most convenient and effective route for drug administration and as a result it's most popular among patient and patients. Some of the limitation of the oral route are basically found with pediatric and geriatrics due to difficulty in swallowing and they have fear of chocking from swallowing or chewing solid dosage forms, bitterness of drug, size of tablets. Even with fast dissolving tablets there is a fear of choking due to its tablet type appearance. One study showed that 26% of 1576 patients experienced difficulty in swallowing tablets. [1] Fast dissolving/ disintegrating formulations are one of the most convenient and accurate dosages forms that can be swallowed without need of water with some limitations especially with geriatric and pediatric patients. Oral fast dissolving films (Oral fast/ rapid dissolving films/ strips) are good alternate drug delivery system for the administration of drug via oral strips that disintegrates rapidly in seconds. Oral rapidly dissolving strips as soon comes into contact with the saliva of the patient, it disintegrated rapidly and release the medication for both local and systemic purpose without need of water. [2; 3]. These formulations were first introduced in 1970s to overcome the problem of ingestion/ swelling of tablets and capsules by young children and elderly

patients and became a very major route in recent years and increased patient acceptability and resulted in improving safer and newer drug delivery system and these are originated due to histology of oral mucosa [4].

1.1 Structure of Buccal Cavity

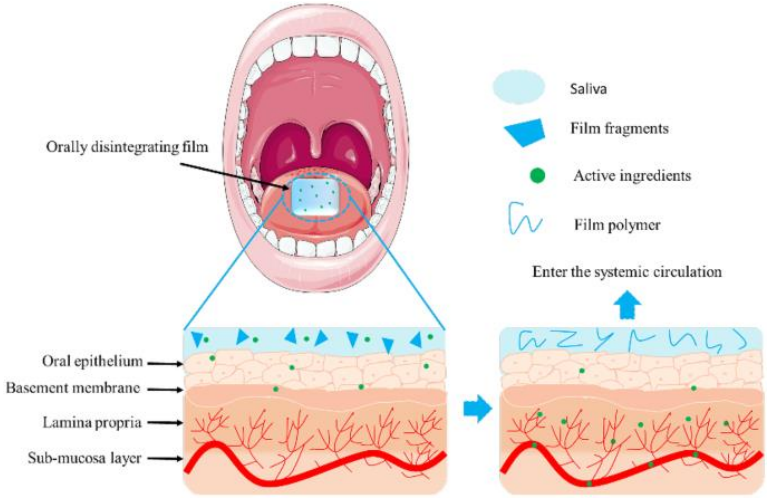

Figure 1: Structure of buccal cavity and Absorption sites for drug absorption

The outer most layer of oral cavity is composed of epithelial cells of stratified type and below this layer there is basement membrane that separates the outermost layer from lamina propria and sub-mucosa which is the innermost layer. The tissue arrangement of buccal mucosa enhance the permeability through oral mucosa, since the permeability of drug through oral mucosa is better than that of skin so it becomes an excellent route of administration for the drugs that have poor dermal absorption [5; 6].

Table 1: Comparison of three different fast dissolving technologies

Properties	Lyophilized system	Compressed Tablet based system	Oral thin films
Content	Mixture of medication + excipients	API with superdisintegrants	Water soluble film forming polymers and other excipients
Method in use	Lyophilization	Direct Composition	Casting methods, hot melt extrusion
Characteristics	High porosity which allows rapid water or saliva penetration and disintegration	Different levels of hardness and Friability these result in varying disintegration and packaging needs	The fast disintegration of these is resulted from their large surface area
Packaging	Blister coverings	High density PE bottles	Blister cards with multiunits

1.2 Oral Rapidly Dissolving/ Disintegrating Films/ Strips/ Oral Wafers

Oral films or mouth strips are flat films that are placed in buccal cavity on tongue that dissolves/ disintegrate without need of water and without fear of swallowing the formulation. This property of ODF makes this formulation so popular and new area of interest in recent years. ODF's are accepted by consumers as breath strips and as a form of delivering vitamins and various categories of drug. [7] Today, FDFs are a proven and accepted technology for the systemic delivery of APIs for over-the-counter (OTC) medications and are in the early- to mid-development stages for prescription drugs. This has been attributed to the success of the breath freshener products by consumers such as Listerine Pocket Paks in the US consumer [8]

1.2.1 Advantages of Orally Fast Dissolving Film

- No needs of water for drug administration.
- Precise dosing as compared to liquid formulations.
- Flexible and easily consumable.
- Ideal formulation to deliver the drug for paediatric, geriatric, bedridden, mentally ill and uncooperative patients.
- Buccal cavity offers a large surface area for drug absorption.
- Film dissolves rapidly and releases the drug from formulation.
- Improved stability of drug formulation as compared to liquid dosage forms.
- Rapid absorption, improved bioavailability and rapid onset of action.
- Enhanced efficacy and safety use of drug.
- Bioavailability improvement with drugs that undergo first pass effect (fraction of drug directly enter systematic circulation from oral mucosa).
- Highly accepted among patients due to its ease of administration, handling and storage,
- Bitter taste of drug can be masked (pleasant taste) [2; 3]

1.2.2 Drawbacks of Orally Fast Dissolving Oral Films [8]

1. Dose limitation (1-30mg).
2. Dose uniformity can be challenging.
3. Hygroscopicity (keep away from moisture)
4. Only drugs that are absorbed by passive diffusion can be administered by this route
5. Special packaging required for product safety and stability [1]
6. Thermal process so drug/polymer stability problem
7. Flow properties of the polymer are essential to processing
8. Limited number of available polymers

1.2.3 Limitations of OFDF

1. Highly bitter drugs can't be incorporated.
2. Dose limitation

Table 2: Comparison between fast dissolving films and fast dissolving tablets

S. No.	Fast Dissolving Film	Fast Dissolving Tablet
1	Higher dissolution than FDT's	Lower dissolution than FDF
2	Higher surface area of formulation	Lower surface area of formulation
3	Low doses can be used to prepare films as compare to FDT	High doses can be used to prepare tablets as compare to FDF
4	Flexible and durable than FDT	Brittle and less durable than FDF
5	Thickness of 0.38-1.27 mm	Size varies form 3-5 mm
6	More compliance than FDT's	Less compliance than FDF's

1.2.4 Characteristics of Mouth Dissolving Films

1. Rapid disintegration (Seconds)
2. Rapid release of drug or active pharmaceutical ingredient (API).
3. Excellent mucoadhesion.
4. Not obstructive
5. Thin and elegant appearance
6. Available in variety of sizes and shapes
7. Non-irritant to mouth [3]
8. Best drug dissolution
9. Patient compliance
10. Ease of handling
11. High stability
12. Easily administered
13. Pleasant taste
14. Fast disintegrated
15. No need to be administered with water [7]

1.2.5 Ideal Drug Candidates for Fast Dissolving Films

1. Pleasant taste of the drug
2. Low dose(<40mg)
3. Good solubility and stability in water or saliva.
4. Good permeation in mucosal membrane (good bioavailability).
5. The drug should have fast release and disintegration (hydrophilic is better) [7;9]

Basically three types of oral dissolving strips available are:

1. Flash release
2. Mucoadhesive melt away wafer
3. Mucoadhesive sustained release wafer [2]

1.2.6 Composition of Fast Dissolving Films

The fast-dissolving films contain inert and non-toxic excipients like film forming agent, plasticizer, sweetener, stabilizer, thickening agent, saliva promoting agents, permeation enhancers, colorants, flavors, emulsifiers, super disintegrants etc as mentioned in the table-3 [7] Formulation considerations

have been reported as important factors affecting mechanical properties of the films. From the regulatory perspectives, all excipients used in the formulation should be generally regarded as safe (i.e. GRAS listed) and should be approved for use in oral pharmaceutical dosage forms [10].

Table 3: Ingredients of fast dissolving oral films

Ingredients	Amount
Drug	5-30%w/w
Water soluble polymers	45%w/w
Plastisizers	0-20%w/w
Sweetening agent	3-6%w/w
Saliva stimulating agent	2-6%w/w
Fillers, colorants, flavors	q.s.
Surfactant	q.s.

1.2.6.1 Active Pharmaceutical Ingredients

Several types of API's are used to prepare ODF's like anti-allergic (diphenhydramine), anti-psychotics (tianeptine), anti-diarrhea, vasodilators, analgesics (paracetamol), anti-asthmatics. The best drug candidates to formulate the ODF are one with low dose, stable at buccal and gastric pH, have good aqueous solubility. The dissolution time of ODF's should be less than 60 seconds. Micronization/ nanonization of the drug molecules plays an important role in dissolution, absorption and bioavailability improvement. The particle size reduction of drug results in better appearance, uniform distribution in film and better drug dissolution. [11; 12; 13; 8] The unpalatable taste of the drug is a major challenge to formulate a fast dissolving film. The sweeteners and flavors are added in formulation to improve the taste of formulation. Sometimes co-processed are mixed with the active ingredient to enhance the palatability of the formulation [1; 14].

1.2.6.2 Film Forming Polymers

The successful formulation as ODF is based on a proper selection of proper excipients as the robustness of the film is hugely dependent on it. A proper combination of these excipients can alter the film properties. The 45% weight per weight concentration of the total mass of the film that is in dry form of polymer incorporated into a fast-dissolving film but sometimes can changed to be as high as 60 to 65% w/w to get the desired characteristics of the film. [15] Hydrophilic polymers or water-soluble polymers (water-soluble grades of pullulan, cellulose ethers, polyvinyl alcohol, polyvinylpyrrolidone, polysaccharides, polyethylene glycol, gelatin, HPMC) are basically used to prepare the ODF to attain required mechanical strength of film and the disintegration of film become proper/ desired with with good mouthfeel. [16; 17]. The concentration of the polymer determines the strength of film. The disintegration rate decreases on an increase in the molar mass of the polymer. [18] Some ideal properties of polymers that are incorporated in manufacturing of rapidly dissolving film/ strips are mentioned following:

1. Decrease the disintegration time of the film.
2. Nontoxic, Non-sensitizing
3. Should be cheap and accessible
4. It shouldn't cause irritation ot the oral mucosa

5. Should have sufficient shelf life.
6. Should possess sufficient peel, shear and tensile strength
7. Should devoid leachable impurities
8. The polymer should be tasteless [8; 19]

Table 4: Natural and synthetic polymers uses in OFDF's

S. No.	Natural polymer	Synthetic polymer
1.	Pectin	Polyvinyl alcohol
2.	Xanthan	Hydroxyl ethyl cellulose
3.	Pullulan	Hydroxypropylmethyl cellulose
4.	Starch gelatin	Polyvinyl pyrrolidone
5.	Sodium alginate	Carboxy methyl cellulose
6.	Maltodextrin	Kollicoat
7.	Polymerized rosin	Hydroxypropyl cellulose
8.	Lycoat NG 73	Poly ethylene oxide

1.2.6.3 Plasticizers

The plasticizer is responsible for the flexibility and to decrease the brittleness/ fragility of the ODF. The concentration and the chemical structure of plasticizer play a crucial role in decreasing the glass transiting temperature of the polymers. Plasticizer is selected on the basis of polymer and plasticizer compatibility in context to solubility. Plasticizers improve the mechanical strength and folding endurance of ODF's. The mechanical properties such as tensile strength and elongation to the films have also been improved by the addition of plasticizers. The inappropriate concentration of plasticizers causes film cracking, splitting and peeling. Some plasticizers may affect rate of dissolution/ drug absorption. [20] Glycerol, low molecular weight polyethylene glycols, propylene glycol, phthalate derivatives such as dibutyl, diethyl, and dimethyl phthalate, citrate derivatives such as triethyl, tributyl, acetyl citrate are common plasticizers. These are typically employed at a concentration of 1–20 %w/w of dry polymer weight. [21]

1.2.6.4 Sweetening Agent

Sweeteners are used to overcome the problem of un-agreeable/ unpalatable/ bitter taste of drug. Bothe natural and synthetic sweeteners are used to preparing ODF's. [22; 23]

Table 5: Types of sweetening agents

Generation	Synthetic	Natural
I	Cyclamate Aspartam Saccharin	Dextrose Mannitol Sucrose Fructose
II	Sucralose Acesulfame-K Alitame and Neotame	Glucose Sorbitol Isomaltose Liquid Glucose

1.2.6.5 Flavoring Agents

The US-FDA approved flavoring agents are used to synergies the taste masking of bitter or nauseating drug, sometimes alone or in combination with sweeteners. Both naturally derived (leaves, flowers, fruit) and synthetic derived (oleo resins) flavors are used I ODF's. The amount of flavor incorporated in ODF's depends on the nature and strength of the flavoring agent used like flavors are essential oils (menthol, sweet mint, peppermint, wintergreen, spearmint, cinnamon, clove, eucalyptol, thymol, vanilla, lemon, orange. These can be used alone or in combination [12; 24] like orange or sweet confectionary flavors such as vanillin, chocolate, or fruit essence like apple, raspberry, cherry, pineapple. The amount of flavor needed to mask the taste depends on the flavor type and its strength [10].

1.2.6.6 Saliva Stimulating Agent

These are used to increase the saliva production by stimulating the salivary glands in the buccal cavity. Increased salivation results in the increased rate of disintegration of the ODF's. Some acids like lactic acid, citric acid, ascorbic acid, tartaric acid are used to improve salivation. These agents can be used alone or in combination at a percentage of 2-6% w/w of the dry thin strip [9; 25].

1.2.6.7 Coloring Agents

Natural pigments, lake color, synthetic colors are sued as coloring agents. The TiO2 is the most commonly and commercially used coloring material. These are used in in concentration (≤1%w/w) [26; 27; 28]

1.2.7 Methods Used in the Production of Oral Rapidly Dissolving Strips

The conventional approaches used to prepare FODF's are solvent casting method, hot melt extrusion, semisolid casting, solid dispersion extrusion and rolling method.

1.2.7.1 Solvent Casting Method

It is the most common method to prepare the ODF's with hydrophilic excipients. The polymers and drug(s)are dissolved in purified water to make a homogenous mass using high levels of shearing produced by mechanical stirrer. The solution is father placed on a petri-plate, percolated with lubricant and dry out at very high temperatures to remove the solvent. The high quality ODF's are produced by this method. [29; 30] A mouth disintegrating film of tianeptine sodium was created using varying grades of Lycoat and HPMC by solvent casting method. [31] The strip forming agent mixed with drugs and other excipients are poured in a suitable mold and dried. The physicochemical properties of APT and affects the selection of appropriate vehicle to form a film. The drug's suitability with the vehicle and other agents of the formulation is well considered before finalizing a formulation. Entrapment of air bubbles during formulation can affect the homogeneity of drug/ excipients and performance of films. [32] The mosaprideorodispersible film is produced by solvent casting method. [33] The viscosity of the mixture is a critical factor in the solvent casting process. The pullulan is used in 2-8 % concentration. The viscosity is a critical parameter the affects the performance of ODF's. [34]. Anastrozole fast dissolving films have been successfully developed using the vehicle casting approach with PVA & HPMC [35]

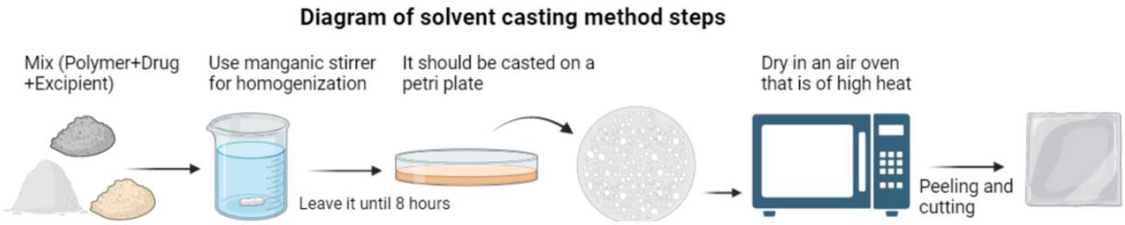

Figure 1: Solvent casting method steps

1.2.7.2 Hot Melt Extrusion

Transdermic, extended release tablets and transmucosal drug formulations are prepared using hot-melt extrusion (HME) process. Films are also processed/ manufactured with this process. It includes a polymer in a molded that turned into a thin strip by the heating method rather than using solvent casting method. Extrusion (solid dispersion) is employed as a production technique in the pharmaceutical sector in the early 1970s to produce the extended-release pellets. The drug and excipient mix is put in the hopper and transported, combined, and reach toits melting point by the extruder. The molten mass is then poured into molds of desired film shape/ size. Lower temperatures of hotmelt and shorter dwell times are the main features of extrusion. Some features of hot melt extrusion are short mixing time, absence of a preservative organic solvents and ability to operate continuously. The hydroxypropylcellulose(HPC) films containing chlorpheniramine maleate (CPM) has been developed by extrusion method. [36]

1.2.7.3 Semi-Solid Casting

An aqueous solution of film forming polymer with drug and other excipients is formed and poured into another solution having acid insoluble polymer (Cellulose acetate butyrate, Cellulose acetate phthalate formed in ammonium or sodium hydroxide). At the final stage the gel is poured into the films or ribbons by using drums that are controlled by heat. Film thickness obtained is around 0.38-1.27 mm at ratio 1:4 of acid insoluble polymer to film forming polymer is 1:4 [37; 38]

1.2.7.4 Solid Dispersion Extrusion

The dispersion of crystalline or amorphous particles is termed as solid dispersion. In solid dispersion extrusion technique, the API is distributed/ mixed/ scattered with inert carrier/ polymer. A medication is first dissolved in a desired liquid vehicle and then mixed into a melt of polyethylene glycol and maintained at 70°C. The selection of right solvent is prime as the alter the structure of polymorphism (results in precipitation in aqueous solution) in the solid dispersion. [39] The immiscible components are extrude with drug and then converted in solid dispersions-. Finally, the solid dispersions are shaped in to films by means of dies [1]

1.2.7.5 Rolling Method

A solution or suspension containing API and excipient is rolled on a carrier in the rolling machine. Water alone or in combination with alcohol is used as solvent. The film on the rollers, is curved and cut into the necessary shapes and sizes. [40; 1]

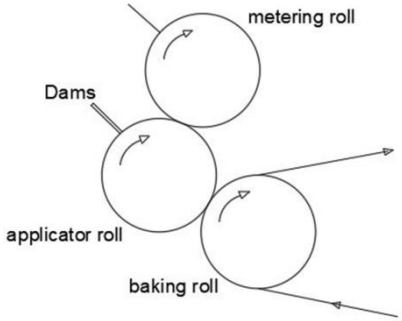

Figure 2: Three roll coating unit

1.2.8 Patent Approaches to prepare DFD's

1.2.8.1 XGel

BioProgress developed the XGel film technology that creates the colored or printed non animal derived films during production (product identification) It is suitable for vegetarians, colored, taste masked, and capable of being enteric properties and having ability to incorporate active ingredient. The XGel film is comprised of a range of different water soluble polymers. [14]

1.2.8.2 Soluleaves

The film releases its API as it comes in contacts with saliva when placed on the tongue. During this phase, the film adheres to the mucous membrane and allows the medicine to be released slowly over 15 minutes. [41] This strategy is beneficial for patients who have trouble to swallow the traditional tablets. Flavors are also used in this technique. [42]

1.2.8.3 Foam Burst

It's a patented technology in September 2004. Films can be used to prepare the capsules by using an inert gas during manufacturing. When honeycomb structure is blown into the film, the outcome is a film with a honeycomb structure as a consequence. The capsules dissolve quickly and melt in saliva on tongue. The film's emptiness might be gas-filled, vacant, or filled to develop particular flavor burst qualities with additional elements or administer active pharmaceuticals. [43]

1.2.8.4 Wafertab

The API is incorporated within the ingestible film. When the film comes into contact with saliva, it dissolves quickly and releases the active ingredient. Flavors help to cover unpleasant tastes of API. WafertabTM technology allows numerous strips with various actives to be bind to each other and so it opens up a lot of options for unique product design. [14]

1.2.9 Evaluation Parameters of Fast Dissolving Oral Films

The organoleptic properties, dissolution test, thickness, dryness test, tensile strength, percent elongation young's modulus, tear resistance, folding endurance, swelling test, surface ph test, contact angle, transparency, content uniformity, disintegration test, in-vitro dissolution test, stability studies are used to evaluate the DFDF's.

1.2.9.1 Organoleptic Evaluation

The smell, taste and color are three basic organoleptic properties. As the ODF's disintegrates first when come in contact with saliva in buccal cavity. ODF's must be palatable as administered in pediatric and geriatric patients. ODF's should have attractive and acceptable color and taste. Flavors are also used

sometimes to overcome the problem of taste. Special human panels are required to evaluate the taste of film for the confirmation of flavor. Some experiments utilize potentiometric titration method based electronic tongue measurements to distinguish the level of sweetness in the formulations where a formulation is dissolved in a suitable solvent, and analyzed. The reference anode, cathode heads and triggered sensors are immersed in a beaker holding a test solution for 120 seconds, and the E-tongue software measures and records the potentiometric differences between each triggered sensor and a reference of anode, cathode head. [44]

1.2.9.2 Dissolution Test

Dissolution is defined as the amount of drug substance that goes into the solution per unit time under standardized conditions of liquid/solid interface, temperature and solvent concentration. In vitro release studies are carried out in modified USP XXIII apparatus (paddle over disk). [1]

1.2.9.3 Thickness

The thickness of the film is measured at different areas of the film (four corners and at the center) using digital Vernier Caliper. Ideally the thickness of film should be in range 5-200 micrometer. The uniform thickness indicates the uniform distribution of drug and other excipient's in the film uniformly. [11; 15]

1.2.9.4 Dryness Test/Tack Test

There are eight tests reported to determine the dryness of ODF's. Generally these evaluation like Set to touch, dust free, tack free (surface dehydrated), dehydrated to touch, dehydrated rough, dehydrated through (dehydrated to handle), dehydrated to recoat, and dehydrated print free tests are used for paint films but can also be used to determine the properties of medicinal ODF's. The persistence and strength with which a strip binds to an accessory (a piece of paper) put into contact with the strips referred to as tack. [11]

1.2.9.5 Tensile Strength

The maximum strength sustained by film until it break into two pieces, on applying the force created by a load, is termed as tensile strength [45]. The result is calculated by following equation below:

$$tensilestrength = \frac{100 \times loadatfailure}{filmwidth \times filmthickness}$$

1.2.9.6 Percent Elongation

The file stretched on application of applied stress applied to film, termed as strain that results in an elongation of file and calculated in percentage by using the following equation. [18]

$$\%\ elongation = \frac{100 \times stretchoffilmstrip}{baselengthofstrip}$$

1.2.9.7 Young's Modulus or Elastic Modulus

It measures the stiffness of the strip. When a strip is hard and brittle it indicates that it has high tensile strength and Young's modulus with small elongation. The Young's modulus can be calculated by:

$$Youngsmodulus = \frac{100 \times slope}{crosshead \times stripthickness}$$

1.2.9.8 Tear Resistance

It is the ultimate resistance to tear a plastic film or sheet. A very low rate of force i.e., 51 mm (2 in)/min is used to initiate the tearing. The maximum level of force needed to rip up the studied sample is determined as the tear resistance in unit Newton (or pounds-force) [46]

1.2.9.9 Folding Endurance or Bending Tolerance

It is measured by folding the film strip until there is a crack or break into two pieces at the folding edge. The film is repeatedly folded at the same place until it breaks. [47; 10; 48]

1.2.9.10 Surface pH of the Film

The surface pH of the ODF's should be 7 or close to it for the prevention of buccal mucosa irritation. This average pH of 6 films or more in the formulation is used for determination by two ways. Firstly by placing the film on the surface of 1.5% w/v agar gel followed by placing pH paper (pH range1-11) on the films and the change in the color of pH paper is observed and reported. The second method involves electronic measurement of pH by pH meter. The film is turned slightly wet using water and the pH was measured by bringing electrode in contact with surface of oral film. [49]

1.2.9.11 Palatability Test

Palatability study is conducted on the basis of taste, after bitterness and physical appearance. All the batches are rated A, B and C grades as per the criteria. When the formulation scores at least one A grade, formulation is considered as average. When the formulation scores two A grade then it would be considered as good and the one with all three A grade it would be the very good formulation. (Grades: A=Very good, B=Good, C=Poor) [1]

1.2.9.12 Transparency

The ultra-visible photo-spectrophotometer is used to determine the transparency of the film. The sample films are cut into rectangles shape and placed in spectrophotometer cell to measure the transmittance of the film at 600nm (suitable wavelength). The transparency can be calculated by:

Transparency= (logT600)/b =− € C

T600= Transmittanceat600nm

b= Film thickness (mm)

C= Concentration [9]

1.2.9.13 Content Uniformity

The drug/ API content in individual strip is determined by ultra-visible photo-spectrophotometer/ HPLC or by any assay of drug by standard technique. [14].

1.2.9.14 Disintegration Test

The time required for the oral film to break into small particles on contact with water or saliva is called disintegration time. Physicochemical properties of drug and excipients affects the disintegration time of ODF's. Ideal disintegration time for ODF's is 5-30 seconds. The USP disintegration test apparatus is used for measurement. [49; 1]

1.2.9.15 In-vitro Dissolution Test

A USP-I (Basket type) and USP-II (Paddle Apparatus) apparatus are used for in-vitro dissolution of ODF's to determine the extent of active material dissolves in dissolution media under specified conditions. The sink conditions are maintained for dissolution. The temperature is maintained at 37 ±0.5°Candrpmare set at50.TheUSP-II (Paddle Apparatus) apparatus is used when film hve floating tendency or have less density then dissolution media. [9].

1.2.9.16 Measurement of Dissolution Rate by Conductivity Method

In the past few years many self-care products have been formulated as fast dissolving films like mouth fresheners, antiracial, antifungal, anti-inflammatory etc. The film should dissolve within seconds (<1 minute) by conductivity method that can be seen in high resolution. [50] The equipment contains an impeller has 2 inch diameter size with 1 blade (monel metal or steel) stirred by a motor at 250 rpm. The conductivity is measurement in to µ-Siemens.

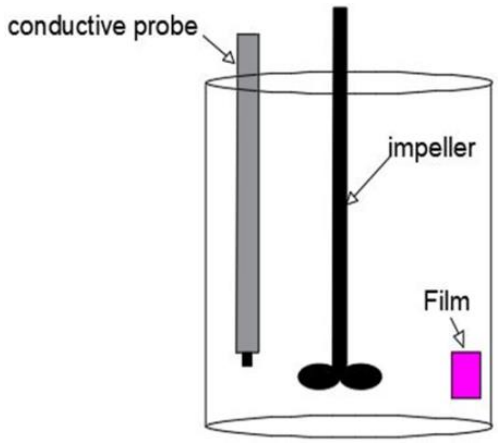

Figure 3: Equipment for dissolution test by conductivity method

1.2.9.17 Stability Study

Stability study of fast dissolving films is carried out for all the batches according to ICH guidelines at predetermined time intervals by determining the drug content, disintegration time. [1] The ODF's or ready-to-use composition is covered in a unique fashion in a package that is first covered with papers of butter and then with aluminum covering is folded above it. The package is then put in an aluminum pouch, heated and sealed. Storage temperatures for products should be 30°C/60% relative humidity (RH) and 40°C/75% RH, respectively. [51]

1.2.10 Packaging of Fast Dissolving Film

The packaging system should adequately preserve the integrity of the product. Expensive packaging, specific processing, and special care are required during manufacturing and storage to protect the dosage of other fast dissolving dosage forms. A variety of packaging options are available for fast dissolving films. Single packaging is mandatory for films, which are most commonly used packaging format. APR- Labtec has developed the Rapid card, a proprietary and patented packaging system, which is specially designed for the Rapid films. The rapid card has same size as a credit card and holds three raid films on each side. Every dose can be taken out individually. The material selected must have the following characteristics

- They must protect the preparation from environmental conditions.
- They must be FDA approved.

- They must meet applicable tamper-resistant requirement
- They must be non-toxic.
- They must not be reactive with the product.
- They must not impart to the product tastes or odors

1.2.10.1 Foil, Paper or Plastic Pouches

The flexible pouch is a packaging concept capable of providing not only a package that is temper-resistance, but also by the proper selection of material, a package with a high degree of environmental protection. A flexible pouch is usually formed during the product filling operation by either vertical or horizontal forming, filling, or sealing equipment. The pouches can be single pouches or aluminum pouches.

1.2.10.2 Single Pouch and Aluminum Pouch

Soluble film drug delivery pouch is a peelable pouch for "quick dissolve" soluble films with high barrier properties. The pouch is transparent for product display. Using a 2 structure combination allows for one side to be clear and the other to use a cost-effective foil lamination. The foil lamination has essentially zero transmission of both gas and moisture. The package provides a flexible thin film alternative for nutriceutical and pharmaceutical applications. The single dose pouch provides both product and dosage protection. Aluminum pouch is the most commonly used pouch. [1]

2. Conclusion

The purpose of this review was to know about brief abut different fast dissolving technologies, Fast oral dissolving films in context to merit, demerits, limitations, types and characteristics. It also focus on ideal drug candidates for fast dissolving films, formulation consideration, methods of fabrication, patented technologies, evaluation and packaging regarding formulation considerations of fast dissolving oral films.

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