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A OVERVIEW ON FAST DISSOLVING FILMS

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ABSTRACT
Fast dissolving oral films is a novel drug delivery system. Fast dissolving oral films offer a convenient way of drug administration. The main advantage of this technology is the administration to pediatric and geriatric patient where the difficulty of swallowing larger oral dosage forms is eliminated. Now a day fast dissolving films are preferred over conventional tablets and capsules for masking the taste of bitter drugs to increase the patient compliance. Fast dissolving oral film is the type of drug delivery system which when placed in the oral cavity, disintegrate or dissolve within few seconds without the intake of water. Fast dissolving oral films are very similar to postage stamp. The present review provides an account of various formulation considerations, method of preparation and quality control of fast dissolving oral films.

KEYWORDS: *Fast dissolving oral Films, Geriatric Patients, Patient Compliance, Pediatric Patients etc.*

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INTRODUCTION

Dysphagia (difficulty in swallowing) is commonly found among all age groups. Due to this problem mainly pediatric and geriatric patients, tend to avoid taking oral solid dosage preparations due to fear of choking. To overcome various problems related to swallowing, fast dissolving Tablets (FDTs) were designed in early 19th century, and further advancement in this is Fast Dissolving Films (FDFs) [1]. Fast dissolving films has become increasingly important because of their unique properties. They quickly disintegrate and dissolve, and can be administered without water, making them particularly suitable for pediatrics and geriatric patients. Fast dissolving films (FDFs) , have gained popularity not only in breath strips but also in personal care, food and drug delivery markets [2, 3]. FDFs offer fast, accurate dosing in a safe, efficacious format that is convenient and portable, without requiring the use of water or a spoon. Mouth dissolving films should have the property to dissolve within seconds when placed on tongue or any oral mucosal tissue of mouth and deliver the drug to the oral cavity instantaneously. The various synonyms used for FDFs include mouth dissolving films (MDFs), orally disintegrating films (ODFs), melt in-mouth films, oro-dispersible, quick dissolving and rapid disintegrating films [4, 5].

Special features of Fast Dissolving films[6-7]

- It is thin elegant film
- It is free from obstructions
- It gives good mucoadhesion
- It gives rapid disintegration (within 5-30 sec)
- It release the drug quickly

Advantages[8-9]

- Quick onset of action as compare to tablet.
- Does not require water during administration
- Taste masking is possible by using different sweetening agent
- There is no risk of chocking
- It offer good stability
- offer patient compliance
- Rapid disintegrating and dissolution in the oral cavity
- Flexible and portable nature provides ease in transportation, handling, storage
- Avoids first past metabolism

Disadvantages[10]

- Only low dose drug can be incorporated (less than 30mg)
- Dose uniformity is a technical challenge
- They takes moisture from atmosphere
- Require special packaging for products stability and safety

The ideal characteristics of a drug to be selected [11]

- The drug to be incorporated should have low dose less than 30mg.
- The drugs with smaller and moderate molecular weight are preferable.
- The drug should have good stability and solubility in water as well as in saliva.
- It should be partially unionized at the pH of oral cavity.

Classification of Oral Films:[12]

i. Flash release,
ii. Mucoadhesive melt-away wafer,
iii. Mucoadhesive sustained-release wafers.

Formulation of fast dissolving oral films:

Active Pharmaceutical agents[14]

Active pharmaceutical substance can be from any class of pharmaceutically active substances that can be administered orally or through the buccal mucosa. Like antiulcers, antiasthma tics, antitussive, antihistaminic, antiepileptic, expectorants, antianginal etc. For the effective formulation, dose of drug should be in mgs (less than 20 mg/day).

Film forming Polymers[15, 16]

The polymers can be used alone or in combination to improve hydrophilicity, flexibility, mouth feel and solubility of fast dissolving films. The stiffness of the strip depends on the type of polymer and the amount of polymer. The film should not damage while handling or during transportation. The various polymers which can be used for making fast dissolving films must be water soluble with low molecular weight and excellent film forming capacity. The ideal qualities of polymer

- Should be non-irritant
- Should have good wetting and spreadability

Examples of water soluble polymer – gum such as guar, acacia, tragacanth and
other polymers are cellulose or cellulose derivatives, HPMC E15, HPMC E5.

Plasticizer

It also helps to improve the flexibility of the strip and reduces the brittleness of the film[17, 18]. The commonly used plasticizers are glycerol, sorbitol, propylene glycol, low molecular weight polyethylene glycols, citrate derivatives, castor oil etc.[19]

Sweetening agents

The classical source of sweetener is sucrose, dextrose, fructose, glucose, liquid glucose and

isomaltose. Polyhydric alcohols are less carcinogenic and do not have bitter after taste. Saccharin, cyclamate and aspartame are the first generation of the artificial sweeteners followed by acesulfame-K, sucralose, alitame and neotame which fall under the second generation artificial sweeteners[20].

Saliva stimulating agents

Commonly used saliva stimulating agents are citric acid, lactic acid, ascorbic acid, malic acid, tartaric acid[21].

Flavoring agents

Flavoring agents can be selected from synthetic flavor oils, oleo resins, extract derived from various parts of the plants like leaves, fruits and flowers. Peppermint oil, oil of nutmeg are examples of flavor oils while vanilla, cocoa, coffee, chocolate and citrus are fruity flavors[22].

Coloring agents

A full range of colors is available including FD& C colors, EU colors, natural coloring agents, and natural juice concentrates, pigments such as titanium oxide, silicon dioxide and zinc dioxide and custom pantone-matched colors[11].

Methods of Manufacturing Fast Dissolving Films [8, 11]

One or combination of the following process can be used to manufacture the fast dissolving films –

1. Solvent casting method- Fast dissolving films are preferably formulated using the solvent casting method, whereby the water soluble ingredients are dissolved to form a clear viscous solution and the drug along with other excipients is dissolved in suitable solvent then both the solutions are mixed and stirred and finally casted in to the Petri plate and dried.

2. Hot melt extrusion- It's benefits are minimum product wastage, better content uniformity, an anhydrous process, absence of organic solvents.

3. Semisolid casting method

This method is preferably adopted when acid insoluble polymers are to be used in the preparation of the films. Acid-insoluble polymers used to prepare films include: cellulose acetate phthalate, cellulose acetate butyrate. Acid insoluble polymer and film forming

4. Solid dispersion extrusion method

The term solid dispersions refer to the dispersion of one or more active ingredients in an inert carrier in a solid state in the presence of amorphous hydrophilic polymers.

5. Rolling method

In this method the film is prepared by preparation of a pre-mix, addition of an active and subsequent formation of a film.

Packaging [23]:

Single packaging is mandatory for films. Applied Pharma Research (Switzerland)-Labtec GmbH of Germany has developed the Rapid Card for films. The Rapid Card is exactly the same size as a credit card and holds three mouth dissolving films on each side. Every dose can be taken out individually, allowing the patient to carry six single, packaged doses of his medication in his purse or wallet and have it readily available**.**

Evaluation : [8, 11,24]

1. Mechanical properties

- **Thickness**

The thickness of film is determined by screw gauge or micrometer at different points of the films. This is essential to ascertain uniformity in the thickness.

- **Dryness/Tack test**

Tack is the tenacity with which the strip adheres to an accessory (a piece of paper) that has been pressed into contact with the strip.

- **Tensile strength**

Tensile strength is the maximum stress applied to a point at which the strip specimen breaks.

Tensile strength = Load at breakage/ Strip thickness × Strip Width

- **Percent elongation**

When stress is applied, a strip sample stretches and this is referred to as strain. Strain is basically the deformation of strip divided by original dimension of the sample. Generally elongation of strip increases as the plasticizer.

% Elongation = Increase in length ×100 / Original length

- **Young's Modulus**

Young.s modulus or elastic modulus is the measure of stiffness of strip. It is represented as the ratio of

applied stress over strain in the region of elastic deformation.

- **Tear resistance**

Tear resistance of plastic film or sheeting is a complex function of its ultimate resistance to rupture. Basically very low rate of loading 51mm (2 in)/min is employed and is designed to measure the force (that is generally found near the onset of tearing) required to tear the specimen is recorded as the tear resistance value in Newton.s (or pounds-force).

- **Folding endurance**

Folding endurance is determined by repeated folding of the strip at the same place till the strip breaks. The number of times the film is folded without breaking is computed as the folding endurance value.

2. Organoleptic evaluation

For evaluation of psychophysical evaluation of the product, special controlled human taste panels are used. In-vitro methods of utilizing taste sensors, specially designed apparatus and drug release by modified pharmacopoeial methods are being used for this purpose.

3. Morphology Studies

Scanning electron microscopy (SEM) study refers the differences between upper and lower side of the films. It also helps in determination of the distribution of API. Near-infrared chemical imaging (NIR-CI) study helps in determining the difference between drug distributions in drug loaded films and recrystallization.

4. Surface pH of film

Surface pH of films is determined by placing the film on the surface of 1.5% w/v agar gel followed by placing pH paper (pH range 1-11) on films. The change in the color of pH paper was observed and reported.

5. Swelling property

Film swelling studies is conducted using simulated saliva solution. Each film sample is weighed and placed in a pre-weighed stainless steel wire mesh. The mesh containing film sample is submerged into 15ml medium in a plastic container. Increase in the weight of the film was determined at preset time interval until a constant weight was observed.

The degree of swelling was calculated using parameters

S.I = Wt – Wo/Wo , Where S.I is the swelling index, Wt is the weight of the film at time.t., and Wo is the weight of film at t = 0.

6. Transparency

The transparency of the films can be determined using a simple UV spectrophotometer. Cut the film samples into rectangles and placed on the internal side of the spectrophotometer cell. The determine transmittance of films at 600 nm. The transparency of the films was calculated as follows:

Transparency = (logT600)/b = - €c

Where T600 is transmittance at 600 nm and b the film thickness (mm) and c is concentration.

7. Assay/ Content uniformity

This is determined by any standard assay method described for the particular API in any of the standard pharmacopoeia. Content uniformity is determined by estimating the API content in individual strip. Limit of content uniformity is 85–115 percent.

8. Disintegration time

Typical disintegration time for strips is 5–30 s.

9. In-vitro dissolution test

Dissolution testing can be performed using the standard basket or paddle apparatus. The dissolution medium will essentially be selected as per the sink conditions and highest dose of the API.

In Technology Catalysts' recently-released report on 'orally disintegrating tablet and film technologies' (3rd Edition), the company identified over fifteen companies actively developing Fast dissolving films delivery technologies that enable the shift from a tablet form to a fast-dissolving and highly water-soluble wafer or film. In addition, the report identifies nine launched OTF(oral thin films) pharmaceutical products as well as 47 OTF products in the pipeline being developed by 12 companies. Technology Catalysts forecasted the market for drug products in oral thin film formulations to be valued at $500 million in 2007 and could reach at $2 billion by 2010.

In contrast to other existing rapid dissolving dosage forms, which consist of lyophilisates, the rapid films can be produced with a manufacturing

process that is competitive with the manufacturing costs of conventional tablets. Handling, transportation, and storage problems are also associated with orally disintegrating tablets (ODTs) due to their high porosity, low mechanical strength and low density. Special packaging requirement are necessary for ODTs because of high friability. There is also a major concern regarding the ease of swallowing and even the possibility of choking when using ODTs. But from brighter perspective, films can be produced by easily industrially feasible and scalable solvent cast methods or hot-melt extrusion technologies. Thus, from commercial point of view fast dissolving films can be utilized further in the life cycle management of existing products[25].

CONCLUSION

Fast dissolving oral films are drug delivery system which bypasses hepatic circulation. It can be especially useful for geriatric, bedridden, non cooperative patients, general patient due to its ease of administration. One can administer this dosage form without aid of water. They offer the good stability. It can be administer to psychological patient also due to ease of administration. It can be given in emergency cases such as allergic reactions and asthamatic attacks.

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