

REVIEW: FAST DISSOLVING TABLET

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ABSTRACT

Fast dissolving tablets is one of the most widely accepted dosage forms and also most popular dosage form, especially for pediatric patients because of incomplete development of the muscular and nervous system and a case of geriatric patients suffering from Parkinson's disorder or hand tremors. Some solid dosage forms like tablets and capsules are present days facing the problems like difficulty in swallowing (dysphagia), resulting in many incidences of non-compliance and making the therapy ineffective. Oral dosage form and oral route are the most preferred route of administration for various drugs have limitations like the first-pass metabolism. Fast dissolving tablets are one of them. FDT have benefits such as accurate dosing, easy portability and manufacturing, good physical and chemical stability and an ideal alternative for pediatric and geriatric patients. Some tablets are designed to dissolve fastly in saliva, within a few seconds, and are true fast-dissolving tablets. Others contain agents to enhance the rate of tablet disintegration in the oral cavity and are more appropriately termed fast-disintegrating tablets, as they may take up to a minute to completely disintegrate.

Keywords: Fast Dissolving Drug Delivery System, Superdisintegrants, Advantages of FDT, Patented Technology

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INTRODUCTION

Oral drug delivery is regarded as the safest, most suitable and most economical method of drug delivery. Oral route of drug administration converted popular route for systemic effects due to ease of ingestion, accurate dosage, self-medication, pain avoidance. Fast dissolving drug delivery system is concluded as novel drug delivery system for designing dosage forms, convenient to be manufacture and administer without water, free of side effects, offering immediate release and enhanced bioavailability, so as to achieve better patient compliance [1]. United States Food and Drug Administration (FDA) defined fast dissolving tablet (FDT) as "a solid dosage form containing medicinal element or active ingredient which disintegrate or dissolve rapidly within seconds when placed upon the tongue." Fast dissolving tablets are also known as mouth-dissolving tablets, rapid dissolving, melt-in mouth tablets, or dispersible tablets, melts, porous tablets, quick dissolving, quick melt, quick disintegrating tablets [2]. Approximately one-third of the population (mainly paediatric and geriatric) has swallowing difficulties, resulting in poor compliance with oral tablet drug therapy. For these reason, tablets that can rapidly dissolve or disintegrate in the oral cavity have attracted a great deal of attention [3]. United States Food and Drug Administration (USFDA) defined fast dissolving tablet (FDT) as "a solid dosage form containing a medicinal substance or active ingredient which disintegrate rapidly usually within a matter of seconds when placed upon the tongue" [3]. These tablets are designed to dissolve or disintegrate rapidly in the saliva generally less than 60 seconds [4]. Mouth dissolving tablets are formulated mainly by two techniques first use of super disintegrants like Croscarmellose sodium, sodium starch glycolate and crospovidone. Another method is maximizing pore structure of the tablets by freeze drying and vacuum drying [4]. In all methods, direct compression is preferred because of its effortlessness, quick procedure and cost-effectiveness [5]. Bioavailability of some drugs may be increased due to absorption of drugs in oral cavity and also due to pregastric absorption of saliva containing dispersed drugs that pass down into the stomach. The amount of drug that is subjected to first pass metabolism is reduced as compared to standard tablets [4].

Requirements of fast dissolving tablets

Patient factors [3]

Fast dissolving dosage forms are suitable for those patients are not able to swallow tablets and capsules like pediatric and geriatric patients.

- Patients who have difficulty in swallowing or chewing solid dosage forms.
- Patients in compliance due to fear of choking.
- Very old patients of depression who may not be able to swallow the solid dosage forms.
- An eight-year-old patient with allergies desires a more convenient dosage form than antihistamine syrup.
- A middle-aged patient undergoing radiation therapy for breast cancer may be too nauseous to swallow her H2-blocker.
- A schizophrenic patient who may try to hide a conventional tablet under his or her tongue to avoid their daily dose of an atypical antipsychotic.
- A patient with persistent nausea, who may be a journey, or has little or no access to water.

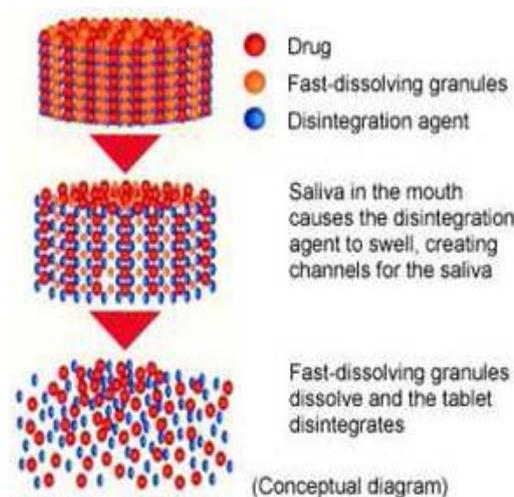


Fig. 1: Conceptual diagram of FDTs. [6]

Effectiveness factor [5]

Increased bioavailability and faster onset of action are a major claim of these formulations. Dispersion in saliva in oral cavity causes pregastric absorption from some formulate ions in those cases where drug dissolves quickly. Buccal, pharyngeal and gastric regions are all areas of absorption for many drugs. Any pre-gastric absorption avoids first-pass metabolism and can be a big advantage in drugs that undergo hepatic metabolism. Furthermore, safety profiles may be improved for drugs that produce significant amounts of toxic metabolites mediated by first-pass liver metabolism and gastric metabolism, and for drugs that have a substantial fraction of absorption in the oral cavity and pre-gastric segments of GIT.

Manufacturing and marketing factors [7]

As a drug nears the end of its patent life, it is common for pharmaceutical manufacturers to develop a given drug entity in a new and improved dosage form. A new dosage form allows a manufacturer to extend market exclusivity, extend patent protection and unique product differentiation. For examples, Eisai Inc. launched Aricept FDT, a line extension of donepezil for Alzheimers disease, in Japan in 2004 and in the U. S. in 2005 in response to a generic challenge filed in the U. S. by Ranbaxy.

Advantages of FDTs [8, 9]

- The FDTs do not need water for swallowing, unlike conventional dosage forms. This is very convenient for patients who are travelling or do not have immediate access to water, and thus, provide improved patient compliance.
- FDT provides easy portability and accurate dosing manufacturing, good physical and chemical stability as an ideal alternative for pediatric and geriatric patients. Bioavailability of drugs is enhanced due to absorption from mouth, pharynx, and esophagus.
- Tablet is disintegrated rapidly along with quick dissolution and absorption in the oral cavity.
- Minimum risk of suffocation in airways due to physical obstruction, when ODTs are swallowed, thus they provide improved safety and compliance with their administrations.
- Rapid drug therapy intervention is possible.
- Conventional processing and packaging equipments allow the manufacturing of tablets at low cost.
- No specific packaging is required. It can be packaged input through blisters.

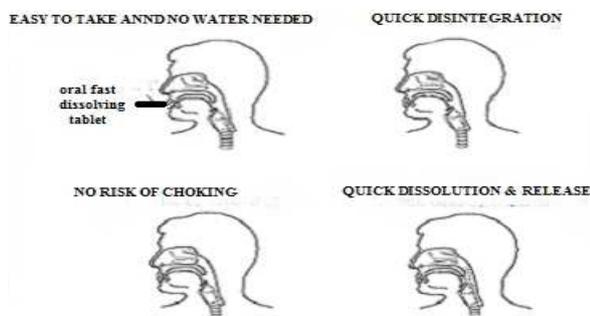


Fig. 2: Advantages of FDTs

Limitations of FDTs [10, 11]

- The major disadvantages of FDTs is related to the mechanical strength of tablets.
- FDT are very porous and soft molded metrics or compressed in a tablet with low compression, which makes tablet friable and brittle which difficult to handle.

- Bad tastes drugs are difficult to formulate as FDT; special precaution should have to be taken before formulate such kind of drug.

- Several FDT are hygroscopic cannot maintain physical integrity under normal condition from humidity which requires a specialized package.

- Dryness of the mouth due to decreased saliva production may not be good candidates for these tablet formulations.

- Rate of absorption from the saliva solution and overall bioavailability.

- Drug and dosage form stability.

Excipients used for the preparation of FDT

FDT contain one superdisintegrant, a diluent, a lubricant. Contain optionally a swelling agent, a permeabilizing agent, sweeteners and flavouring agents.

Super disintegrants [12-14]

As day's passes, demand for the faster disintegrating formulation is increased. For, that pharmacist needs to formulate disintegrants i.e. Super disintegrants which are effective at less concentration and have greater disintegrating efficiency. The superdisintegrant must quickly wick saliva into that tablet to generate the hydrostatic pressure and volume expansion necessary to provide rapid disintegration in the mouth.

Examples

- Croscarmellose Sodium
- Crospovidone
- Cross-linked alginic acid
- Gellan gum
- Sodium starch glycolate
- Soy polysaccharide meant for diabetics.
- Xanthan gum

Bulking materials [16, 17]

Bulking materials are very important in the development of fast dissolving tablets. They contribute the functions of a diluent, filler and cost reducer. Bulking agents improve the texture of the tablets that consequently enhances the disintegration in the mouth, besides adding volume and reducing the concentration of the active in the formulation. The bulking agents for this formulation should be sugar-based such as mannitol, polydextrose, lactose derivatives such as directly compressible lactose (DCL) and starch hydrolysate for higher aqueous solubility and good sensory perception. Mannitol especially has high aqueous solubility and good sensory perception, as it provides a cooling effect due to its negative heat of solution. Bulking agents are added in the range of 10% to about 90% by weight of the final composition. Sugar based excipients are two types they classify on the basis of moulding and dissolution rate:

Type 1 saccharides: (lactose and mannitol) which exhibit low moldability but high dissolution rate.

Type 2 saccharides: (maltose and maltitol) which exhibit high moldability but low dissolution rate.

Emulsifying agents [5, 17]

Emulsifying agents are more significant for formulation of fast dissolving tablets they help in quick disintegration and drug release without the need for chewing, swallowing or drinking water. Also, emulsifying agents stabilize the immiscible blends and increase bioavailability. A variety of emulsifying agents for fast dissolving tablet formulations include alkyl sulfates, propylene glycol esters, lecithin, sucrose esters and others. These can be added in the range of 0.05% to about 15% by weight of the final formulation.

Lubricants [5, 15]

Though not essential excipients, these can aid in making the tablets more palatable after they disintegrate in the mouth. Lubricants reduce grittiness and help in the drug transit process from the oral to the stomach.

Flavours (taste masking agents) and sweeteners [5, 17]

Flavours and taste masking agents are useful for the formulation they make the products more palatable and pleasing for patients. The incorporation of these ingredients assists in overcoming bitterness and undesirable tastes of some actives. Natural as well as synthetic flavours can be used to enhance the organoleptic characteristic of fast dissolving tablets. A wide range of sweeteners including sugar, dextrose and fructose, as well as non-nutritive sweeteners such as aspartame, sodium saccharin, sugar alcohols and sucralose are available. The addition of sweeteners imparts a pleasant taste as well as bulk to the formulation.

Mechanism of action of superdisintegrants

- Capillary action/Water wicking
- Swelling
- Heat of wetting
- Disintegration particle/particle repulsive forces
- Release of gases
- Enzymatic action

Capillary action

This mechanism suggests that primarily all the particles of the tablet are surface wetted in the given aqueous media. Water then penetrates into the core of the tablet, reducing the inter-particle bond thus aiding in breaking of the tablet. Thus it is termed as capillary action or wicking as slowly, the wetting rises in the tablet with the ultimate result of breakage of the tablet. Here the porosity of the tablet is of the most importance as it is the fundamental requirement for easy and quick wetting/water uptake. The more porous the material the greater the rate of wetting and disintegration time is less.

Swelling

Superdisintegrants which act by this mechanism work on the fundamental of "swell" and "burst" When the Superdisintegrant comes in contact with the water/saliva, the aqueous phase exerts more adhesive force upon the superdisintegrant as compared to other excipients and drug resulting in swelling and trust or breaking apart of the tablet.

Heat of wetting

Disintegrants having exothermic property due to that exothermic property they gets wetted, localized stress is generated due to capillary air expansion, which helps in the disintegration of the

tablet. However, is limited to only a few types of disintegrates and cannot describe the action of most modern disintegrating agents.

Disintegration particle/particle repulsive forces

Guyot-Hermann has proposed a particle repulsion theory. This theory states the swelling via tablet made of "non-swellable" disintegrates. The electric repulsive forces between particles are the mechanism of disintegration and water is required for it. Researchers found that repulsion is secondary to wicking.

Release of gases

Carbon dioxide released within tablets on wetting due to contact between bicarbonate and carbonate with citric acid or tartaric acid. The tablet disintegrants create pressure in the tablet. The effervescent mixture is used to formulate very rapidly dissolving tablets or fast disintegrating tablet. The effervescent blend is either added immediately prior to compression or can be added into two separate fractions of the formulation.

By enzymatic reaction

Enzymes presents in the body act as disintegrants. Presence of enzymes destroy the binding property of binder and helps in disintegration. Actually, due to swelling, pressure exerted in the outer direction or radial direction, it causes the tablet to burst or the accelerated absorption of water leading to an enormous increase in the volume of granules to promote disintegration.

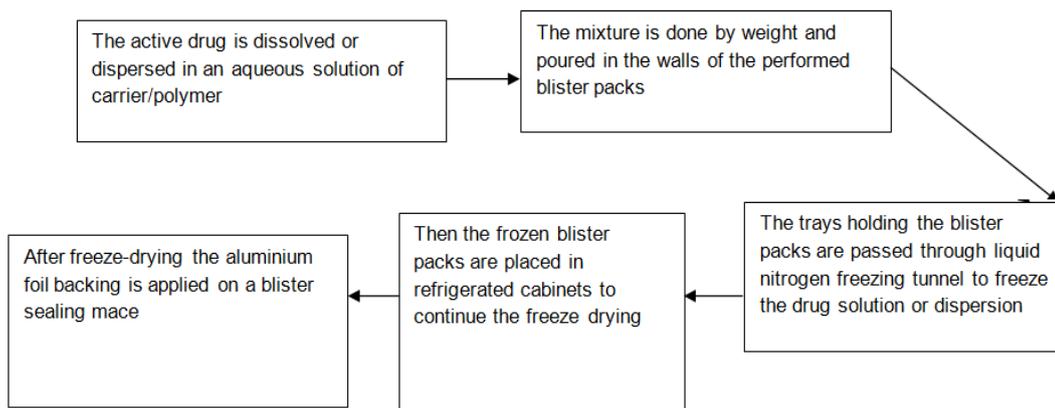
Techniques for preparing fast dissolving tablets

Many techniques used for the formulation of Fast dissolving tablets. Here we have discussed the six major techniques which are widely used for the formulation of these tablets [18, 19].

- Freeze drying/lyophilisation
- Tablet moulding
- Spray drying
- Direct Compression
- Sublimation
- Mass Extrusion

Freeze-drying or lyophilisation

Lyophilisation is the process in which water is sublimed from the product after it is frozen. This technique creates an amorphous porous structure that can dissolve rapidly. A typical procedure involved in the manufacturing of FDT using this technique is mentioned here [16]. The freeze-drying technique has demonstrated improved absorption and increase in bioavailability. The major disadvantages of lyophilisation technique are that it is expensive and time-consuming; fragility makes conventional packaging unsuitable for these products and poor stability under stressed conditions [17, 18].



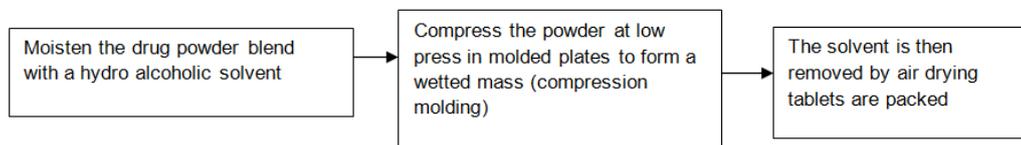
Steps by step procedure of lyophilisation of FDT

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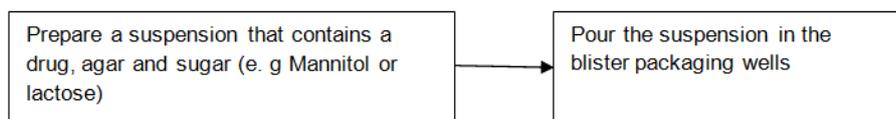
Tablet molding

The molding process is of two types i.e. solvent method and heat method. FDT manufactured by the solvent method are less compact

Solvent method



Heat method



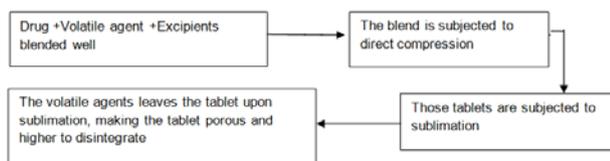
Spray drying

In this technique, gelatin is used as a matrix and a supporting agent, mannitol as a bulking agent, and superdisintegrants like croscarmellose or sodium starch glycolate or crospovidone. The Tablets manufactured from the spray-dried powder containing bulking agent, super disintegrant and an acidic ingredient (citric acid) and/or alkaline ingredients.

(e. g. sodium bicarbonate) have been reported to disintegrate in within 20 seconds in aqueous medium. This spray-dried powder, compressed into tablets showed quick disintegration and improved dissolution [24].

Sublimation

Incorporation of volatile ingredients to generate a porous mixture is subjected to a process of sublimation. Highly volatile ingredients like benzoic acid, ammonium bicarbonate, ammonium carbonate, camphor, naphthalene, urea, phthalic anhydride and urethane may be compressed along with other excipients into a tablet. With help of process of sublimation, this volatile material is then removed, leaving behind a highly porous matrix. Tablets manufactured by this technique have reported to usually disintegrate within 10-20 sec. Solvents like benzene; cyclohexane can be used as pore-forming agents [25].



Direct compression

Direct compression represents the most cost-effective and simplest tablet manufacturing technique. Because of the accessibility of improved excipients superdisintegrants and sugar based excipients, this technique can now be utilized for preparation of Fast Dissolving Tablets [26].

Superdisintegrants

Superdisintegrants are the principally affecting disintegration and ultimate dissolution of the fast dissolving tablets, mainly for direct compression techniques. The presence of other ingredients such as water-soluble excipients and effervescent agents further hastens the disintegration process.

than compressed tablets and posses a porous structure that hastens dissolution. The mechanical strength of moulded tablets is a matter of great concern. Binding agents, which improve the mechanical strength of the tablets, need to be incorporated [23]. Masking of taste is an added problem to this technology and the masked drug particles are prepared by spray congealing a molten mixture of hydrogenated polyethylene glycol, cottonseed oil, lecithin, and sodium carbonate an active ingredient into a lactose-based tablet triturate form. Tablets produced by the moulding technique are easy to scale up for the industrial manufacturer, compared to the lyophilisation technique.

Sugar based excipients

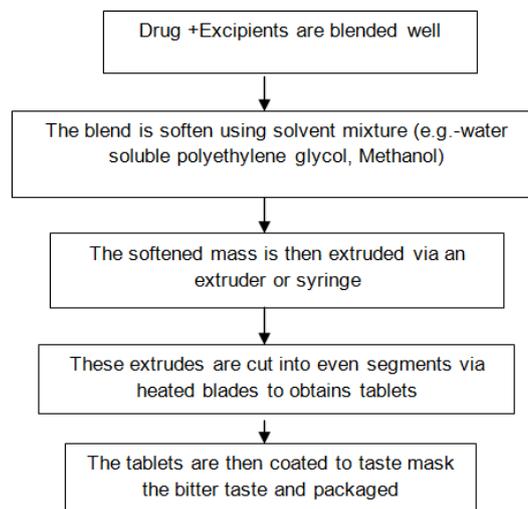
This is another route to approach the direct compression technique. starch hydrolysate which display high aqueous solubility and sweetness, and hence impart taste masking property and a pleasant mouthfeel. Sugar based excipients specially bulking agents like lactitol, dextrose, isomalt, fructose, maltitol, maltose, mannitol, sorbitol, polydextrose, xylitol. Mizumito *et al.* have categorized sugar-based excipients into two types on the basis of molding and dissolution rate.

Type 1 saccharides (mannitol and lactose) exhibit low mould-ability but high dissolution rate.

Type 2 saccharides (maltitol and maltose) exhibit high mould-ability and low dissolution rate [27].

Mass-extrusion

In this technology, the active blend is soften using the solvent mixture of water-soluble methanol and polyethylene glycol and subsequent expulsion of softened mass through the extruder or syringe to get a cylinder product and is divided into even segments using the heated blade to form a tablet. The dried cylinder can be used to coat granules for bitter drugs and thereby achieve taste masking [28].



Patented technologies for fast dissolving tablets

Several technologies have been developed on the basis of formulation aspects and different processes and patented by several pharmaceutical companies. The patented technology is described below: [29]

Zydis technology [30]

Zydis is a unique freeze-dried oral solid dosage form that can be swallowed without water as it dissolves instantly on the tongue in less than 5 seconds. The drug is physically trapped in a water-soluble matrix and then freeze-dried to produce a product that rapidly dissolves. The matrix consists of water-soluble saccharides and polymer to provide rapid dissolution and to allow sufficient physical strength to withstand handling. Water is used during the process to produce porous units for rapid disintegration.

Limitations

- The amount of drug added should generally be less than 400 mg for insoluble drugs and less than 60 mg for soluble drugs.
- The particle size of the insoluble drugs should not be less than 50µm and not more than 200 µm to prevent sedimentation during processing.

Advantages

- Buccal pharyngeal and gastric regions are all areas of absorption from this formulation. Pre-gastric absorption avoids first-pass metabolism and can be an advantage in drugs that undergo a great deal of hepatic metabolism.
- Patients who have difficulty swallowing oral medication due to dysphagia, stroke or medical conditions such as gastroesophageal reflux disease, multiple sclerosis or Parkinson's disease.

Disadvantages

- The process of freeze-drying is a relatively expensive manufacturing process.
- The formulation is very lightweight and fragile, and there of re should not be stored in backpacks or the bottom of purses.
- It has poor stability at higher temperatures and humidities.
- A water-insoluble drug can be incorporated only up to 400 mg per tablet or less. On the other hand water, the soluble drug can be incorporated only up to 60 mg.

Orasolv technology [31, 32]

Orasolv technology has been developed by CIMA labs. In this system, the active medicament is taste masked. It also contains the effervescent disintegrating agent. Fast dissolving tablets are made up by direct compression technique at low compression force in order to minimise oral dissolution time. Tablet machine and Conventional blenders is used to produce the tablets. The tablets produced are soft and friable and packaged in specially designed pick and place system.

Advantages [30]

Taste-masking is two-fold, quick dissolution. This technology has been used for drug strengths in the range of 1 mg to 750 mg. Depending on Tablet size, the disintegration time of the tablet can be designed in the range of 10 to 40 seconds.

Disadvantages [30]

They are sensitive to moisture due to the presence of the effervescent system and must be packaged appropriately. Low mechanical strength.

Durasolv technology [33, 31]

Durasolv is the patented technology of CIMA labs. The tablets made by this technology consist of a drug, fillers and lubricant. Tablets are prepared by using conventional tableting equipment and have good rigidity. These are packed into usual packaging system like blisters.

Durasolv is an appropriate technology for products requiring low amounts of active ingredients.

Advantages [30]

Dura Solv technology is good for tablets having a low amount (125mcg to 500 mg) of active ingredients and tablets are compressed to a greater hardness of 15-100 N, resulting in a more durable ODT. As a result, this technology gives packaging flexibility; tablets can be bottled and blistered.

Disadvantages [30]

The drug powder coating in Durasolv may become fractured during compaction, exposing the bitter tasting drugs to the patient taste buds.

Wow tab technology [30-34]

Wow, tab technology is patented by Yamanouchi Pharmaceutical Co. WOW means "Without Water". In this process, a combination of low moldability saccharides and high moldability saccharides is used to obtain a rapidly melting strong tablet. The combination of high and low mold ability is used to prepare tablets of adequate hardness.

Advantages

Adequate dissolution rate and hardness. Wow, tab product can be packed in both into the conventional bottle and blister packs.

Disadvantages

No significant change in bioavailability.

Flash dose technology [33, 35, 30]

Flash dose technology has been patented by Fuisz Nurofen, let a new form of Ibuprofen as melt in mouth tablets, prepared using flash dose technology is the first commercial product launched by Biovail Corporation. Flash dose tablets consist of self-binding shear form a matrix termed as floss. Shear form matrices are prepared by flash heat processing.

Advantages

High surface area for dissolution.

Disadvantage

- High temperature required to melt the matrix can limit is the use of heat-sensitive drugs, sensitive to moisture and humidity.
- The dosage form can lodging only up to 600 mg of the drug.
- Tablets produced are highly friable, soft and moisture sensitive. Therefore specialised packing is required.

Flash tab technology [36, 37]

This technology involves the preparation of rapidly disintegrating tablet which consists of an active ingredient in the form of microcrystals. Prographarm laboratories have patented the flash tab technology. It utilizes most of the same excipients as in conventional compressed tablets. Disintegrating agent and a swelling agent are used in combination with coated drug particles in this formulation to form a tablet that disintegrates in the mouth in less than one minute.

Oraquick technology [30-38]

K. V. S. Pharmaceuticals have a patent over this technology. It utilizes taste masking microsphere technology called as micro mask, which provides superior mouthfeel over taste masking alternatives, significant mechanical strength, and quick disintegration/dissolution of the product. Any kind of solvents are not utilized by taste masking process. Therefore it leads to superior and fast efficient production.

Advantages

Faster and efficient production, appropriate for heat-sensitive drugs.

Dispersible tablet technology [31]

Lek in Yugoslavia has issued patents for dispersible tablets of dihydro ergotoxine and cimetidine, which were claimed to

disintegrate in less than 1 minute when in contact with water at room temperature. Dihydroergotamine is poorly soluble in water in the free base form. An improved dissolution rate of dihydroergotamine methanesulphonate was observed with dispersible tablets containing 0.8-10%, preferably about 4% by weight, of organic acids. One of the essential excipients in the cimetidine formulation is a disintegrating agent. It provides rapid swelling and/or good wetting capability to the tablets and thereby a quick disintegration. The disintegrating agents include starch or modified starches, cyclodextrin polymers, alginic acid, cross-linked sodium carboxymethylcellulose, and microcrystalline cellulose. A combination of two or more than two disintegrating agents produced better disintegration results.

Advatab technology [39]

Advatab is distinct from other FDT technologies as it can be combined with Eurand's complimentary particle technologies like its world-leading MicrocapsR taste-masking technology and its DiffucapsR, controlled release technology.

Tablets produced from advatab technology disintegrate rapidly in the mouth, less than 30 seconds, to allow for convenient oral drug administration without water. These tablets are especially suited to those patients that experience difficulty in swallowing capsules and tablets.

Nanocrystal technology [31, 39, 30]

Nanocrystal technology can give formulation and improve compound activity and final product characteristics. Decreasing particle size increases the surface area, which leads to an increase in dissolution rate. This can be accomplished predictably and efficiently using nanocrystal technology. Nanocrystal particles are small particles of drug substance, typically less than 1000 nanometers (nm) in diameter, which are produced by milling the drug substance using a proprietary wet milling technique.

Nanocrystal fast dissolving technology provides for

- Pharmacokinetic benefits of orally administered nanoparticles (<2 microns) in the form of a rapidly disintegrating tablet matrix.
- Product differentiation based upon a combination of proprietary and patent-protected technology elements.
- Cost-effective manufacturing processes that utilize conventional, scalable unit operations.

Pharmaburst technology [31, 39]

Pharmaburst technology is being patented by SPI Pharma. The tablet manufactured by this process involves a dry blend of a drug, flavours, and lubricant then followed by compression into tablets which then dissolve within 30-40 seconds. Tablets manufactured by this methodology have sufficient strength to be packed in blister packs and bottles.

Frosta technology (Akina) [31, 39, 40]

This technology is patented by Akina. Frosta technology utilizes the core concept of formulating plastic granules and compressing at low pressure to produce strong tablets with high porosity. The process involves mixing the porous plastic material with water penetration enhancer and followed by granulating with a binder.

Evaluation of blend

The prepared blend was evaluated by following tests.

The angle of repose.

Bulk density.

Tapped density.

Carr's index.

Hauser's ratio.

Angle of repose

Funnel method used for determine angle of repose. The accurately weighed blend was taken in a funnel. The height of the funnel was

adjusted in such a way that the tip of the funnel touches the apex of the heap of the blend. The drug (as solid dispersion) excipients blend was allowed to flow through the funnel freely on to the surface. The diameter of the powder cone was measured. The angle of repose was calculated using the following equation:

$$\tan \theta = h/r$$

Where h and r are the height and radius of the powder cone.

Bulk density

Bulk density was determined by pouring a weighed quantity of blend into a graduated cylinder and measuring the volume and weight.

BD = Weight of the powder/Volume of the packing.

Tapped density

It was determined by placing a graduated cylinder, containing a known mass of drug-excipients blend. The cylinder was allowed to fall under its own weight onto a hard surface from the height of 10 cm at 2-second intervals. The tapping was continued until no further change in volume was noted.

TBD = Weight of the powder/volume of the tapped packing.

Compressibility index

The Compressibility Index of the blends was determined by Carr's compressibility index.

Evaluation of fast dissolving tablets

Weight variation

The weight variation test is carried out in order to ensure uniformity in the weight of the tablets in each batch. First, the total weight of 20 tablets from each formulation is determined and the average is calculated. The individual weight of each tablet is also determined to find out the weight variation. Weight variation is given by the formula.

% Weight variation = Individual weight - Average weight / Average weight × 100

Hardness

Hardness is also called as crushing strength (fc) of the tablet, the force required to break a tablet in a diametric compression was measured using Monsanto tablet hardness tester. It is expressed by in kg/cm².

Friability (F)

Friability of the tablet determined using Roche friabilator. Friability is the loss of weight of the tablet in the container due to the removal of the fine particles from the surface. Friability test is carried out to assess the ability of the tablet to withstand abrasion in packaging, handling and transport. Weigh the 20 tablets from each batch and place in Roche friabilator that will rotate at 25 rpm for 4 min. Dedust the all tablets and weigh again. The friability (F) is given by the formula.

$$F = \frac{W(\text{initial}) - W(\text{final})}{W(\text{final})}$$

Wetting time

Wetting time is closely related to the hydrophilicity of the excipient and inner structure of the tablets. According to the following equation proposed by Washburn E. W(1921), the water penetration rate into the powder bed is proportional to the pore radius and is affected by the hydrophilicity of the powders.

$$dl/dt = rY\cos\theta/(4\eta l)$$

Where l is the length of penetration, r is the capillary radius, γ is the surface tension, η is the liquid viscosity, t is the time, and θ is the contact angle. It is obvious that pore size becomes smaller and wetting time increases with an increase in compression force or decrease in porosity. A linear relationship exists between disintegration and wetting time. Thus wetting is the important step for disintegration process to take place. A piece of tissue paper folded double was placed in a Petri plate (internal diameter is 6.5 cm) containing 6 ml of water. The tablet was placed on the paper

and then time for complete wetting of the tablet was measured in seconds. The method was slightly modified by maintaining water at 37 ± 0.5 °C. Wetting time related to the time taken for the tablet to disintegrate when kept motionless on the tongue.

In vitro drug release

The release of the drug *in vitro* was determined by estimating the dissolution profile, USP 2 Paddle apparatus was used and the paddle was allowed to rotate at 50 rpm, phosphate buffer (PH 6.8) (900 ml) was used as a dissolution medium.

Mechanical Strength

Tablets should possess adequate strength to withstand mechanical shocks of handling in Manufacturing, packaging and shipping. Friability and crushing strength are two important parameters to evaluate a tablet for its mechanical strength.

Crushing strength

Crushing strength is in simple form that the force required to break a tablet by compression in the radial direction, it is an important parameter in the formulation of mouth dissolve tablets because excessive crushing strength significantly reduces the disintegration time. In the present study, the crushing strength of the tablet was measured using Pfizer hardness testers. An average of three observations is reported.

Friability testing

The crushing test may not be the best measure of potential behaviour during handling and packaging. The resistance to the surface abrasion may be a more relevant parameter. Friability of each batch was measured in "Electro lab-friabilator". 10 preweighed tablets were rotated at 25 rpm for 4 min, the tablets were then reweighed and the percentage of weight loss was calculated.

Rapidly disintegrating property

To evaluate a tablet for their rapid disintegration properties, following tests were carried out.

Fast dissolving tablets products available in Indian market [2-8]

Brand (Trade) name	Active drug	Manufacturer/Company
Acepod-O	Cefpodoxime	ABL Lifecare, India
Acufix DT-TAB	Cefixime	Macleods, India
Alepam	Amoxicillin trihydrate and Potassium clavulanate	Scoshia Remedy, India
Bigcef DT-TAB	Cefuroxime	Bestochem, India
Clonazepam ODT	Clonazepam	Par Pharmaceutical
Dompan	Pantoprazole and Domperidone	Medley pharmaceuticals, India
Mosid-MT	Mosapride citrate	Torrent Pharmaceuticals, Ahmedabad, India
Minoclav DT-TAB	Amoxicillin trihydrate and Potassium clavulanate	Minova life Sciences, India
Nulev	Hyoscyamine sulfate	Schwarz Pharma, India
Nimulid MDT	Nimesulide	Panacea Biotech, New delhi, India
Numoxylin CV DT	Amoxicillin trihydrate and Potassium clavulanate	Gepach international, India
ZyrofMeltab	Rofecoxib	Zydus, Cadila, India
Romilast	Montelukast	Ranbaxy Labs Ltd., New Delhi, India
Torrox MT	Rofecoxib	Torrent Pharmaceuticals, Ahmedabad, India
OlanexInstab	Olanzapine	Ranbaxy Labs Ltd., New Delhi, India
Kemstro	Baclofen	Schwarz Pharma, India
Romilast	Montelukast	Ranbaxy Lab. Ltd. Delhi, India
Rofaday MT	Rofecoxib	Lupin,, India
Valus	Valdecocix	Glenmark, India

AUTHORS CONTRIBUTIONS

All the author have contributed equally

CONFLICT OF INTERESTS

Declared none

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Modified disintegration test

Accurate procedure for performing disintegration test for dosage forms has several limitations and they do not sufficient to the measurement of very short disintegration times. The disintegration time for fast dissolving tablet needs to be modified as disintegration is required without water, thus the test should mimic disintegration in salivary contents. For this parameter, a Petri dish having 10 cm diameter was filled with 10 ml of water. The tablet was carefully put into the centre of Petri dish and then the time required for the tablet to completely disintegrate into fine particles was noted.

Disintegration in oral cavity

The time required for complete disintegration of tablets in the oral cavity was obtained from the 6 healthy volunteers, who were given tablets from the optimum formulation Water absorption Ratio a piece of tissue paper folded twice was placed in a small Petri dish containing 6 ml of water. Tablet was put on the paper and the time required for complete wetting was measured. The wetted tablet was then weighed. Water absorption ratio denoted by R, was determined using following equation,

$$R = 10(wa/wb)$$

Where wb= weight of tablet before water absorption and

wa =weight of the tablet after water absorption

CONCLUSION

The advancement of a quick dissolving tablet give a decent chance to a line expansion in the commercial center, drugs (e. g. neuroleptics, analgesics, cardiovascular medication, antihistamines and medications for erectile brokenness) can be considered a contender for this dose structure. Pharmaceutical promoting is another explanation behind the increment inaccessible quick dissolving items.

Marketed products of fast dissolving tablets

The commercialized products of FDT which are available in the market are given in table

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