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Review Article

A Review on Fast Dissolving Tablet

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ABSTRACT
Oral route is presently the gold standard in the pharmaceutical industry where it is regarded as the safest, most economical and most convenient method of drug delivery resulting in highest patient compliance. Over the past three decades, orally disintegrating tablets (FDTs) have gained considerable attention due to patient compliance. Usually, elderly people experience difficulty in swallowing the conventional dosage forms like tablets, capsules, solutions and suspensions because of tremors of extremities and dysphagia. In some cases such as motion sickness, sudden episodes of allergic attack or coughing, and an unavailability of water, swallowing conventional tablets may be difficult. One such problem can be solved in the novel drug delivery system by formulating "Fast dissolving tablets" (FDTs) which disintegrates or dissolves rapidly without water within few seconds in the mouth due to the action of superdisintegrant or maximizing pore structure in the formulation. The review describes the various formulation aspects, superdisintegrants employed and technologies developed for FDTs, along with various excipients, evaluation tests, marketed formulation and drugs used in this research area.

Keywords: Mouth dissolving tablet, Disintegration, Patented technologies, Enhanced Bioavailability, Superdisentegrantes, Patient Compliance.

INTRODUCTION

The tablet is the most widely used dosage form existing today because of its convenience in terms of self-administration, compactness and ease in manufacturing. However, geriatric, pediatric and mentally ill patients experiences difficulty in swallowing conventional tablets, which leads to poor patient compliance. To overcome these problems, scientists have developed innovative drug delivery system known as mouth dissolving/disintegrating tablets(MDTs)[1]. fast-dissolving tablets are also called as orally disintegrating tablets, Orodispersible tablets, mouth-dissolving tablets, rapid dissolving tablets, fast disintegrating tablets. Recently, European Pharmacopoeia has used the term Orodispersible tablets. This may be defined as uncoated tablets intended to be placed in the mouth where they disperse readily within 3 min before swallowing. The United States Pharmacopoeia has also approved these dosage forms as Orodispersible tablets. Thus, Orodispersible tablets are solid unit dosage forms like conventional tablets, but are composed of super disintegrants, which help them to dissolve the tablets within a minute in the mouth in the presence of saliva without any difficulty of swallowing. Recent market studies indicate that more than half of the patient population prefers ODTs to other dosage forms and most consumers would ask their doctors for ODTs (70%), purchase ODTs (70%), or prefer ODTs to regular tablets or liquids (>80%)[1,2].

Fast dissolving tablets are novel drug delivery system that dissolves, disintegrate or disperse the API in saliva within few seconds with or without intake of water. The faster the dissolution of drug into the solution, quicker is the absorption and onset of clinical effect. The bioavailability of some drugs may increase due to absorption of drugs in oral cavity or also due to pregastric absorption of drug from saliva that pass down into the stomach. Natural and synthetic Superdisintegrants like mucilage, cross linked carboxymethyl cellulose (crosscarmellose) and sodium starch glycolate (primogel), poly vinyl pyrollidone etc. provide immediate disintegration of tablets and facilitate the design of delivery system with desirable characteristics. These types of formulations are widely recommended for the drugs used in emergency. e.g., Cardiac agents, Asthma, Brain stroke, Anti-hyper-lipidemic etc[3].

Criteria for Fast dissolving Drug Delivery System

The tablets should[1]

- Not require water to swallow, but it should dissolve or disintegrate in the mouth in matter of seconds.
- Have a pleasant mouth feel.
- Leave minimum or no residue in the mouth after oral administration.
- Be compatible with taste masking.
- Be portable without fragility concern.

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- Exhibit low sensitive to environmental condition as temperature and humidity.

Salient Feature of Fast Dissolving Drug Delivery System

- Ease of Administration to the patient who cannot swallow, such as the elderly, Stroke victims, bedridden patients, patient affected by renal failure and patient who refuse to swallow such as pediatric, geriatric & psychiatric patients.
- Rapid dissolution and absorption of the drug, which will produce quick onset of action.
- Some drugs are absorbed from the mouth, pharynx and esophagus as the saliva passes down into the stomach. In such cases bioavailability of drug is increased.
- No need of water to swallow the dosage form, which is highly convenient feature for patients who are traveling and do not have immediate access to water.
- Beneficial in cases such as motion sickness, sudden episodes of allergic attack or coughing, where an ultra-rapid onset of action required.
- Pre-gastric absorption can result in improved bioavailability and as a result of reduced dosage; improve clinical performance through a reduction of unwanted effects.
- Good mouth feel property helps to change the perception of medication as bitter pill Particularly in pediatric patient.
- Stability for longer duration of time, since the drug remains in solid dosage form till it is consumed. So, it combines advantage of solid dosage form in terms of stability and liquid dosage form in terms of bioavailability.
- The risk of chocking or suffocation during oral administration of conventional formulation due to physical obstruction is avoided, thus providing improved safety.
- New business opportunity like product differentiation, product promotion, patent extensions and life cycle management.
- Increased bioavailability, particularly in cases of insoluble and hydrophobic drugs, due to rapid disintegration and dissolution of these tablets.

Advantages of Fast dissolving Tablets

FDTs has many advantages of solid dosage forms and liquid dosage forms along with special features which include: [4,5,6]

Accurate dosing

being a solid dosage forms, provide luxury of accurate dosing, easy portability and manufacturing, good physical and chemical stability and an ideal alternative for pediatric and geriatric patients.

Enhanced Bioavailability

Bioavailability of drugs can be enhanced due to absorption from mouth, pharynx and esophagus.

Rapid action

Fast onset of therapeutic action as tablet gets disintegrated rapidly along with quick dissolution and absorption in oral cavity.

Patient compliance

No need of water to swallow the dosage form. Hence, it is convenient for patients who are traveling and do not have immediate access to water.

Ease of administration

Convenient to administer specially for geriatric, pediatric, mentally disable and bed ridden patients who have difficulty in swallowing.

Obstruction free

No risk of suffocation in airways due to physical obstruction when swallowed. Thus, providing improved safety and compliance.

Enhanced Palatability

Good mouth feel, especially for pediatric patient as taste masking technique is used to avoid the bitter taste of drug.

Simple packaging

No specific packaging required. It can be packaged in push through blisters.

Business Avenue

Provide new business opportunities in the form of product differentiation. Line extension, uniqueness and life cycle management.

Cost effective

Conventional processing and packaging equipment's allow the manufacturing of tablets at low cost.

Limitations of Mouth Dissolving Tablets

The tablets usually have insufficient mechanical strength. Hence, careful handling is required.

The tablets may leave unpleasant taste and/or grittiness in mouth if not formulated properly.

Challenges in Formulating ODTS

Palatability

As most drugs are unpalatable, orally disintegrating drug delivery systems usually contain the medicament in a taste-masked form. Delivery systems disintegrate or dissolve in patient's oral cavity, thus releasing the active ingredients which come in contact with the taste buds; hence, taste-masking of the drugs becomes critical to patient compliance[7].

Mechanical strength

In order to allow ODTs to disintegrate in the oral cavity, they are made of either very porous and soft-molded matrices or compressed into tablets with very low compression force, which makes the tablets friable and/or brittle, difficult to handle, and often requiring specialized peel-off blister packing that may add to the cost. Only few technologies can produce tablets that are sufficiently hard and durable to allow them to be packaged in multidose bottles, such as Wow tab® by Yamanouchi-Shaklee, and Durasolv® by CIMA labs[9].

Hygroscopicity

Several orally disintegrating dosage forms are hygroscopic and cannot maintain physical integrity under normal conditions of temperature and humidity. Hence, they need protection from humidity which calls for specialized product packaging[8].

Amount of drug

The application of technologies used for ODTs is limited by the amount of drug that can be

Incorporated into each unit dose. For lyophilized dosage forms, the drug dose must be lower than 400 mg for

insoluble drugs and less than 60 mg for soluble drugs. This parameter is particularly challenging when formulating a fast-dissolving oral films or wafers[8].

Aqueous solubility

Water-soluble drugs posses various formulation challenges because they form eutectic mixtures, which result in freezing-point depression and the formation of a glassy solid that may collapse upon drying because of loss of supporting structure during the sublimation process. Such collapse sometimes can be prevented by using various matrix-forming excipients such as mannitol than can induce crystallinity and hence, impart rigidity to the amorphous composite[9].

Size of tablet

The degree of ease when taking a tablet depends on its size. It has been reported that the easiest size of tablet to swallow is 7-8 mm while the easiest size to handle was one larger than 8 mm. Therefore, the tablet size that is both easy to take and easy to handle is difficult to achieve[10,11].

Techniques used in prepararion of FDTS

Freeze drying/ Lyophilization

Freeze drying is the removal of ice or other frozen solvents from a material through the process of sublimation and the removal of bound water molecules through the process of desorption. Lyophilization and freeze drying are terms that are used interchangeably depending on the industry and location where the drying is taking place. Controlled freeze drying keeps the product temperature low enough during the process to avoid changes in the dried product appearance and characteristics. It is an excellent method for preserving a wide variety of heat-sensitive materials such as proteins, microbes, pharmaceuticals, tissues & plasma. Drug in a water soluble matrix which is then freeze dried to give highly porous structure. The tablets prepared by lyophilization disintegrate rapidly in less than 5 seconds due to quick penetration of saliva in pores when placed in the oral cavity. Lyophilization is useful for heat sensitive drugs i.e. thermo-labile substances.Freeze drying process normally consists of three steps:[4,7]

Material is frozen to bring it below the eutectic point.

Primary drying to reduce the moisture around 4% w/w of dry product.

Secondary drying to reduce the bound moisture up to required final volume.

Freeze Drying Equipment

The main components of freeze drying equipment are:

- Refrigeration System
- Condenser
- Vacuum System
- Product Chamber or Manifold
- Control System

Advantages

More rapid dissolution than other available solid products.

Disadvantages

High cost of the equipment's & lack of physical resistance in blister packs.

Spray drying

Spray drying technique is based on a particulate support matrix, which is prepared by spray drying an aqueous composition containing support matrix and other components to form a highly porous and fine powder. This then mixed with active ingredients and compressed into tablets. The formulations are incorporated by hydrolyzed and non-hydrolyzed gelatins as supporting agents, mannitol used as bulking agent, crosscarmellose sodium or sodium starch glycolate as disintegrating and an acidic material (e.g. citric acid) and / or alkali material (e.g. sodium bicarbonate) to enhance disintegration and dissolution. Tablet compressed from the spray dried powder it will disintegrated within 20 seconds when immersed in an aqueous medium[12].

Advantages

Rapid disintegration of tablets.

Molding

The major components of molded tablets typically are water-soluble ingredients. Molding technique is of two type's i.e. Solvent method and heat method. In solvent method, Molded tablets offer improved taste due to water soluble sugars present in dispersion matrix. The powder mixture is moistened with a solvent (usually ethanol or water), and then the mixture is molded into tablets under pressures lower than those used in conventional tablet compression. (This process is known as compression molding.) Then the solvent can be removed by air-drying. Because molded tablets are usually compressed at a lower pressure than are conventional compressed tablets, a higher porous structure is created to enhance the dissolution. To improve the dissolution rate, the powder blend usually has to be passed through a very fine screen. The heat molding process involves preparation of a suspension that contains a drug, agar and sugar (e.g. mannitol or lactose) and pouring the suspension in the blister packaging wells, solidifying the agar at the room temperature to form a jelly and drying at 30○C under vacuum[13].

Advantages

Moulded tablets disintegrate more rapidly and offer improved taste because the dispersion matrix is, in general made from water soluble sugars.

Disadvantages

Moulded tablets do not possess great mechanical strength. Erosion & breakage occur during handling & opening of blister packages.

Sublimation

Sublimation is the phase transition of a substance directly from the solid to the gas phase without passing through the intermediate liquid phase. Sublimation is an endothermic process that occurs at temperatures and pressures below a substance's triple point in its phase diagram. The reverse process of sublimation is deposition or desublimation, in which a substance passes directly from a gas to a solid phase. Sublimation has also been used as a generic term to describe a solid-to-gas transition (sublimation) followed by a gas-to-solid transition. In this method a subliming material like Ammonium bicarbonate, Ammonium carbonate, Urea, Benzoic acid, Naphthalene, camphor is used. Then materials are removed by sublimation from compressed tablets. Due to the formation of many pores it gives high porosity.These compressed tablets which have

high porosity (approximately 30%) rapidly dissolved within 15 seconds in saliva[14].

Advantage

Tablets dissolve in 10-20 sec. and exhibit sufficient mechanical strength.

Mass Extrusion

This technology involves using of the solvent mixture of water soluble polyethylene glycol and methanol for softening of the active blend.Then expulsion of softened mass through the extruder or syringe to get a cylindrical shaped extrude which are finally cut into even segments using heated blade to form tablets. This process are also used for masking of bitter taste of drugs[15].

Advantage

Mask bitter taste by coating the granules.

Direct Compression

Direct compression represents the simplest and most cost effective tablet manufacturing technique.

Superdisintegrants

In many orally disintegrating tablet technologies based on direct compression, the addition of superdisintegrants principally affects the rate of disintegration and hence the dissolution. The presence of other formulation ingredients such as water-soluble excipients and effervescent agents further hastens the process of disintegration. For the success of fast dissolving tablet, the tablet having quick dissolving property which is achieved by using the super disintegrants[15-18].

Mechanisms of superdisintegrants

There are four major mechanisms for tablet disintegration as follows:[22-24]

Swelling

Although not all effective disintegrants swell in contact with water, swelling is believed to be a mechanism in which certain disintegrating agents (such as starch) impart the disintegrating effect. By swelling in contact with water, the adhesiveness of other ingredients in a tablet is overcome causing the tablet to fall apart.

Porosity and capillary action (wicking)

Tablet in the aq. Media leads to penetration of the medium into tablet and thus replacement of air adsorbed resulting in weakening of intermolecular bond and breaking of tablet into fine particles.

Due to deformation

During tab. compression, disintegrated particles gets deformed and in contact with aq. media returns to normal structure .e.g: starch.

Sugar Based Excipients

This is another approach to manufacture FDT by direct compression. In which sugar based excipients especially bulking agents like lactilol, maltilol, dextrose, fructose, Isomalt, maltose, mannitol, sorbitol, starch hydrolysate, polydextrose and xylitol which display high aqueous solubility and sweetness, and hence impart taste masking property and gives a pleasing mouth feel.

Advantages

It is cost effective due to low manufacturing cost, conventional equipment's and limited number of processing steps.

Disadvantages

Differences in particle size and bulk density b/w the drug and diluents may lead to stratification within the granulation.

Large dose may present problem if it is not easily compressible by itself.

Cotton candy process

This process is so named as it utilizes a unique spinning mechanism to produce floss-like crystalline structure, which mimic cotton candy. In which the formation of matrix of polysaccharides by simultaneous action of flash melting and spinning. This candy floss matrix is then milled and blended with active ingredients and excipients after re crystallization and subsequently compressed to FDT.

Advantages

It can accommodate high doses of drug and offers improved mechanical strength

Nanonization

A recently developed Nanomelt technology involves reduction in the particle size of drug to nanosize by milling the drug using a proprietary wet-milling technique. The nano crystals of the drug are stabilized against agglomeration by surface adsorption on selected stabilizers, which are then incorporated into MDTs. This technique is especially advantageous for poorly water soluble drugs. Other advantages of this technology include fast disintegration/dissolution of nanoparticles leading to increased absorption and hence higher bioavailability and reduction in dose, cost effective manufacturing process, conventional packaging due to exceptional durability and wide range of doses (up to 200 mg of drug per unit).

Important patented technologies in ODTS

Zydis

This drug delivery system consists of freeze-dried tablets having active drug designed to rapidly disintegrate in the mouth. The freeze-dried tablet is made by lyophilizing a suspension or solution of drug containing various excipients such as polymer, polysaccharides, preservatives, pH adjusters, flavors, sweeteners, and colors, which is then filled in blisters. Freeze drying occurs in the blisters, which are then sealed and further packaged[25].

Advantages

It enhances fast disintegration time of tablet.

Disadvantages

low throughput, high cost of goods, and limited taste masking.

OraSolv, DuraSolv

In this technique the ingredients such as polyols as fillers, disintegrants, which may include an

Effervescence couple, flavor, sweetener, and lubricant are used. The drug may be taste masked if required typically utilizing a fluid bed coating process. The tableting process includes direct compression, and can accommodate a wide range of potency from less than 1 mg to as high as 500 mg. DuraSolv tablets are compressed at higher hardness compared to OraSolv that allows for packaging in bottles or push through blisters[26].

Advantage

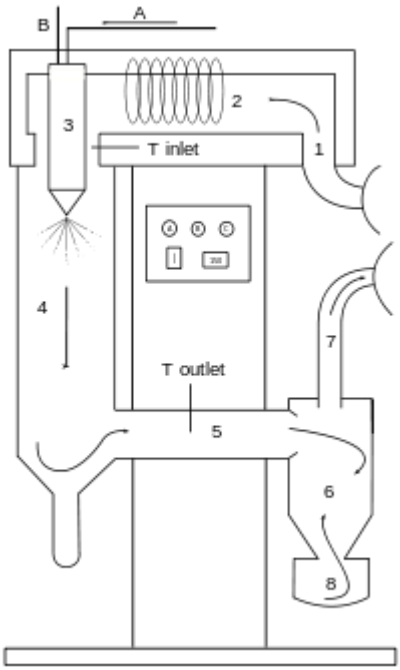

Figure 1: Schematic diagram of Spray Drying Tech.

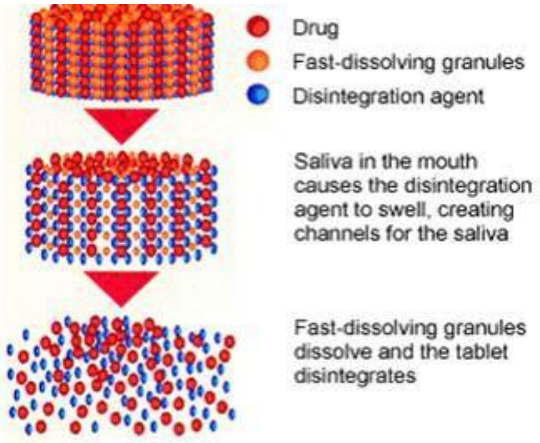

Figure 2: Basic mechanism of Super disintegrants .

low cost of goods, standard manufacturing technology, standard packaging format and materials, and low development costs and risks.

Disadvantage

slightly longer disintegration time.

Lyoc

This was the first freeze drying- based technology introduced for FDTs. In this process preparation of a liquid solution or suspension of the drug containing fillers, thickening agents, surfactants, non-volatile flavoring agents, and sweeteners. This homogenous liquid is then deposited in blister cavities and subjected to freeze drying[27].

Advantage

compared with other freeze dried dosage forms include absence of preservatives.

Flashtab

It includes a swellable agent (e.g.modified starch or microcrystalline cellulose) and a super disintegrant (e.g.crospovidone or croscarmellose). The tech. may also contain, depending on the need, a highly water-soluble polyol with binding properties such as mannitol, sorbitol, maltitol, or xylitol, instead of the swellable agent as mentioned before. The taste is masked by direct coating to the active ingredient. By using this process durable tablets are prepared. In which the excipients are first granulated using wet or dry granulation process, then the coated drug is mixed with the excipient granules and compressed into tablets that can be handled and packaged using conventional processing equipment. Tablets for blister packaging can withstand the pressure used to push the tablet out of the lidding foil of the blister card. By using high-quality polyvinyl chloride or aluminum foils the hygroscopic material can be blister packaged, which provide a higher degree of moisture protection than ordinary polyvinyl chloride or polypropylene foils[28].

Flash Dose

Fuisz who was the inventor of the Flash Dose technology. It is now owned by Biovail. Flash Dose tablets containing a matrix of polysaccharides sugar fibers disintegrates very rapidly upon contact with saliva, with disintegration times of a few seconds. The tablets produced by Flash Dose are hydrophilic and highly porous, owing to relatively low compression during the Pressing of the tablets. For taste masking, Fuisz uses its own patented, single-step, solvent-free process, termed ‘‘CEFORMTM technology,’’ which produces uniform microspheres with a very narrow particle size distribution. By using this process the tablet are soft, friable, and highly moisture sensitive. It require specialized packaging materials and processes to protect them from external humidity and mechanical abrasion[29].

Wow tab

This technology is patented by Yamanouchi Pharmaceutical Co. WOW means “Without Water”. In this process, combination of low mouldability saccharides with hardness 0-2 kg and high mouldability saccharides with hardness more than 2 kg is used to obtain a rapidly melting strong tablet. The active ingredient is mixed with a low mouldability saccharide e.g. lactose, glucose, and mannitol and granulated with a high mouldability saccharide e.g. Maltose, Oligosaccharides and compressed into tablet[29].

Advantages

Tablet having Good mechanical strength.

Preformulation Studies

Angle of Repose, Bulk Density, Tapped Density, Void Volume, Porosity, Compressibility characteristics (Carr’s index and Hausner ratio)

Angle of Repose

The angle of repose was determined by the funnel method suggested by Newman.

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 just touches the apex of the heap of blend. The drug blend was allowed to flow through the funnel freely on to the surface. The diameter of the powder cone was measured and angle of repose was calculated using the following equation:[30]

$\tan \theta = h/r$

Therefore **$\theta = \tan^{-1} h/r$**

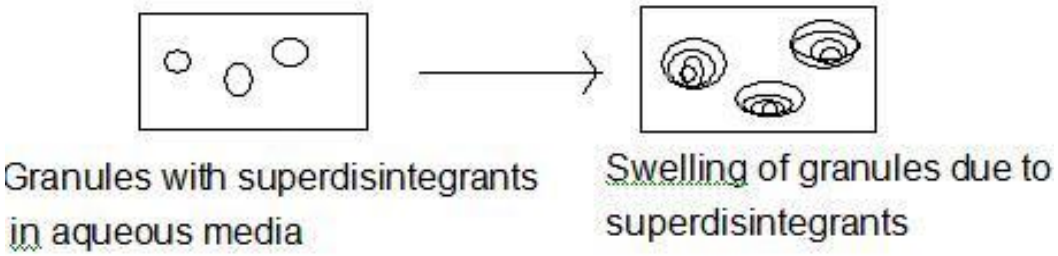

Figure 3: Mechanism of superdisintegrants by swelling.

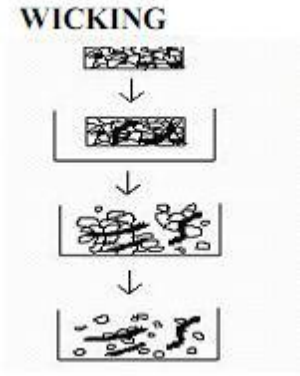

Figure 4: Mechanism of superdisintegrants by Porosity and capillary action (wicking).

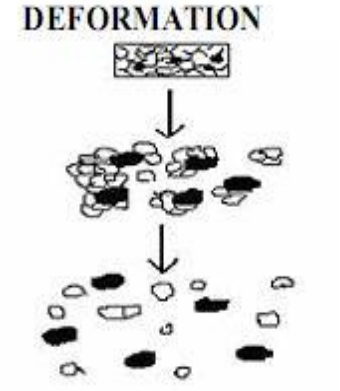

Figure 5: Mechanism of superdisintegrant due to deformation.

Where: **θ** = Angle of repose, **h** = height of the cone, **r** = Radius of the cone base

Angle of Repose less than 30 ° shows the free flowing of the material.

Bulk Density

Specific bulk volume or reciprocal of bulk density is called bulkiness or bulk. Bulkiness increases with a decrease in particle. The bulkiness can be calculated by the following formula,

Bulkiness= 1/ Db

Where, **Db** = Bulk Density.

Bulk density is defined as the mass of the powder divided by the bulk volume and is expressed as gm/cm3. The bulk density of a powder primarily depends on particle size distribution, particle shape and the tendency of particles to adhere together. The particles are pack in such a way so as to leave large gaps between their surfaces resulting up in light powder of low bulk density. Bulk density is very important in the size of containers needed for handling, shipping, and storage of raw material and blend. It is also important in size blending equipment[31].

Db=M/Vb

Where,

Db-Bulk Density

M-Weight of sample in gm

Vb-Bulk volume (untapped volume)

Tapped Density

It is the ratio of total mass of the powder to the tapped volume of the powder. Volume was measured by tapping the powder for 750 times and the tapped volume was noted if the difference between these two volumes is less than 2%. If it is more than 2%, tapping is continued for 1250 times and tapped volume was noted. Tapping was continued until the difference between successive volumes is less than 2 % (in a bulk density apparatus). It is expressed in g/ml and is given by;[32]

Dt = M / Vt

Where**, M** is the mass of powder

Vt is the tapped volume of the powder.

Void Volume

The volume of the spaces is known as the void volume "**v**" and is given by the Formula,[33]

V=Vb-Vt

Where, **Vb** = Bulk volume (volume before tapping)

Vt = True volume (volume after tapping)

Porosity

The porosity € of powder is defined as the ratio of void volume to the bulk volume of the packaging. The porosity of the powder is given by [34]

€= Vb - Vt/ Vb =1- Vt/Vb

Porosity is frequently expressed in percentage and is given as

%€ = (1 - Vt/ Vb) X 100.

Carr's index (or) % compressibility

It indicates powder flow properties. It is expressed in percentage and is give[35]

$$I = \frac{Dt - Db}{Dt} \times 100$$

Where, **Dt** is the tapped density of the powder and **Db** is the bulk density of the powder.

If the bed of particles is more compressible the blend will be less flowable.

Hausner's ratio

A similar index to indicate the flow properties can be defined by Hausner's ratio. Hausner's ratio can be calculated by using following formula:[36]

Table 1: List of common superdisintegrants.

Superdisintegrants	Example	Mechanism of action	Special comment
Crosscarmellose® Ac-Di-Sol®	Cross-linked cellulose	Swells 4-8 folds in < 10 seconds. -Swelling and wicking both.	-Swells in two dimensions. -Direct compression or granulation
Crosspovidone Crosspovidon M® Kollidon® Polyplasdone®	Cross-linked PVP	-Swells very little and returns to original size after compression but act by capillary action	-Water insoluble and spongy in nature so get porous tablet
Sodium starch glycolate Explotab® Primogel®	Crosslinked starch	-Swells 7-12 folds in <30 seconds	-Swells in three dimensions and high level serve as sustain release matrix.
Soy polysaccharides Emcosoy	Natural super disintegrants	----------	-Does not contain any starch or sugar. Used in nutritional products

Table 2: Angle of Repose as an Indication of Powder Flow Properties.

Sr. no.	Angle of Repose	Type of Flow
1.	<20	Excellent
2.	20-30	Good
3.	30-34	Passable
4.	>34	Very poor

$$\text{Hausner ratio} = \frac{Dt}{Db}$$

Where, **Dt** is the tapped density, **Db** is the bulk density. Hausner's ratio <1.25 – Good flow = 20% compressibility index 1.25 – Poor flow =33% compressibility index.

Identification of drug sample

It was confirmed by melting point determination and also by FT-IR spectral analysis[36].

Drug excipient Compatibility study

Compatibility of the drug with excipients was determined by FT-IR spectral analysis, this study was carried out to detect any changes on chemical constitution of the drug after combined it with the excipients. The samples were taken for FT-IR study[35-36].

Evaluation of orodispersible tablets

Tablet thickness

Tablet thickness is an important characteristic in reproducing appearance and also in counting by using filling equipment. Some filling equipment utilizes the uniform thickness of the tablets as a counting mechanism. Thickness was recorded using vernier calliper[34,35].

Weight variation

20 tablets were selected randomly from the lot and weighted individually to check for weight variation. Weight variation specification as per I.P. is shown in Table 3[35].

Friability

Friability Attempts for decreasing the disintegration time increase the friability of ODTs than the conventional tablets. Dosage forms like Zydis are very fragile. Friability is a measure of mechanical strength of the tablet. If a tablet has more friability it may not remain intact during packaging, Transport or handling. Roche friabilator is used to determine the friability by following procedure. Pre weighed tablets are placed in the friabilator. Friabilator consist of a plastic chamber that revolves at 25rpm, dropping those tablets at a distance of 6 inches with each revolution. The tablets are rotated in the friabilator for at least 4 minutes. At the end of test tablets are dusted and reweighed; the loss in the weight of tablet is the measure of friability and is expressed in percentage as:[36]

% Friability = 1- (loss in weight / Initial weight) X 100

Limit- less than 1%

Hardness (Crushing strength)

Tablet hardness is measured with hardness testers like Monsanto. A tablet is placed in the hardness tester and load required to crush the tablet is measured. The hardness of ODTs is generally kept lower than conventional tablets as increased hardness delays the disintegration of the tablet. The force is measured in kg and the hardness of about 3-5 kg/cm2 is considered to be satisfactory for uncoated tablets[37].

Water absorption ratio

A small piece of tissue paper folded twice is placed in a small petridish containing 6 ml of water. Put a tablet on the paper and the time required for complete wetting is measured. The wetted tablet is then reweighed. Water absorption ratio, **R** is determine by using following formula;[38]

R= 100 x Wa-Wb / Wb

Where, **Wb** is the weight of tablet before water absorption **Wa** is the weight of tablet after water absorption

Uniformity of dispersion

Keep the Two tablets in 100ml water and stir gently for 2 minutes. The dispersion is passed through 22 meshes. The tablets will consider passing the test if no residue remained on the screen[39].

Wetting time

Five circular tissue papers of 10 cm diameter are placed in a petridish with a 10 cm diameter. Ten millimeters of water

Table 3: Weight Variation Specification as per IP.

Average Weight of Tablet	% Deviation
80 mg or less	±10
More than 80 mg but less than 250 mg	±7.5
250 mg or more	±5

containing Eosin, a water-soluble dye, is added to petridish. A tablet is carefully placed on the surface of the tissue paper. The time required for water to reach upper surface of the tablet is noted as a wetting time[36].

Disintegration time

According to the European pharmacopoeia the fast disintegrating or Orodispersible tablets should disintegrate within 3 minutes without leaving any residue on the screen. However, it is difficult to assess the disintegration rate even in small amounts of water. Further the conventional test employs a volume of 900 ml of distilled water compared to the volume of saliva in humans, which is limited to a few ml. Thus, the disintegration rate obtained from conventional test does not appear to reflect the actual disintegration rate in human mouth. To overcome these problems, several new methods have been proposed. One of these methods uses a Charge Couple Device (CCD) camera or texture analyzer to evaluate the disintegration time of tablets. In another method, a modified DT apparatus is used. Here a wire basket of 3cm height and 2 cm diameter and mesh size of #10 is placed above a beaker containing 900 ml of simulated saliva. The basket is so positioned in the liquid that it contains only 6 ml of the liquid. The assembly is supported with a heater to maintain temperature at 37°C and a magnetic stirrer. DT is noted at 25 rpm. One of the simplest methods is to take 6ml of simulated saliva in a measuring cylinder and place the tablet in it. The liquid is neither shaken nor stirred and DT is noted[38].

In vivo disintegration time

In vivo disintegration time is determined using a panel of healthy human volunteers. The DT noted by the volunteers by placing the tablet in mouth[39].

Taste/ Mouth sensation

Mouth-feel is critical, and patients should receive a product that feels pleasant. One tablet from each batch is tested for the sensation by placing the tablet on the tongue. The healthy human volunteers are used for evaluation of mouth feel. Taste evaluation is done by a panel of 5 members using time intensity method. Sample equivalent to 40 mg i.e. dose of drug is put in mouth for 10 seconds and record taste

instantly and then after 10 secs, 1, 2, 4 and 6 minutes. Volunteer's opinion for the taste is rated by giving different score values i.e. 0 = good, 1 = tasteless, 2 = slightly bitter, 3 = bitter, 4 = awful[38].

issolution test

The dissolution method for oral disintegrating tablets is the same as that of conventional tablets. USP 2 paddle apparatus is most suitable and common choice for dissolution test of oral disintegrating tablets, where the paddle speed is 50 rpm is used. The USP 1 (basket) apparatus may have certain application for such tablets but is used less frequently due to specific physical properties of tablets[38,39].

CONCLUSION

The FDTs have potential advantages over conventional dosage forms, with their improved patient compliance, convenience, bioavailability and rapid onset of action had drawn the attention of many manufactures over a decade. ODTs are to maximize the porous structure of the tablet matrix and incorporate super disintegrating agents in optimum concentration so as to achieve rapid disintegration and instantaneous dissolution of the tablet along with good taste masking properties and excellent mechanical strength. They remain solid during storage, which aid in stability of dosage forms and transform into liquid form within few seconds after its administration.

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