Original Article

A Novel Approach For Drug Delivery System In Orodispersible Tablet

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Abstract

The simplest and preferred route of drug administration is the oral route. Orodispersible tablets represent a revolution among all routes of drug administration as well as the oral mode of drug administration. Orodispersible drugs are unit dosage forms but have unique properties. It disintegrates in the mouth within a minute for the presence of saliva, where the presence of excellent disintegration in the preparation. New ODT technologies address many pharmaceutical and patient needs ranging from better lifecycle management to convenient dosing for pediatric, geriatric, and psychiatric patients with dysphagia. Orodispersible drug delivery systems are used extensively to improve bioavailability and patient compliance. ODT is an appropriate drug delivery preference in pediatric and geriatric patients as it resolves the problems of dysphagia. The modern article focuses on perfect traits, pros and cons, a range of technologies developed for ODT, evaluation techniques, and current research and future potential.

KEYWORD: Orodispersible tablets, Bioavailability, Mechanism of disintegration

INTRODUCTION:

Oral route still represents the desired way of administration owing to its numerous benefits and excessive patient compliance in contrast to many different routes [1]. Orodispersible tablets are additionally referred to as as orally disintegrating tablets, mouth-dissolving tablets, rapid dissolving tablets, fast-disintegrating tablets, fast-dissolving tablets. Recently, European Pharmacopoeia has used the time period orodispersible tablets. This may also be described as uncoated tablets supposed to be placed in the mouth the place they disperse conveniently inside 3 min earlier than swallowing. The orodispersible tablets are solid unit dosage varieties like conventional tablets, however are composed of excellent disintegrants, which assist them to dissolve the tablets inside a minute in the mouth in the presence of saliva except any problem of swallowing. These patients essentially incorporate, older (who experience issues taking regular oral dose structures as a result of hand quakes and dysphagia), pediatric patients (who are frequently unfortunate of taking strong oral dose structures, inferable from their immature solid and sensory systems) and others which incorporate the deranged, formatively crippled [2], patients who are uncooperative, on diminished fluid ingestion designs or sickened, and explorers who might not approach water[3,4]. Furthermore, the moderately unfortunate retention, presence of bountiful stomach related compounds in the GI lumen and epithelium, post absorption efflux (i.e., by P-glycoprotein, and so on), and first-pass digestion by the hepatic catalysts and resulting end, limit the capacity of many medications to arrive at restorative levels by oral course. In addition, a tablet (most

normal measurement structure for this course) needs to crumble in the gastrointestinal parcel followed by disintegration of the medication. These cycles stretch out the time until adequacy somewhat, which is unwanted in conditions, for example, torment [5].

In Ayurveda, it is used to treat high blood sugar (diabetes), as it has the property to lower blood sugar. Animal studies have proven this property of the plant. Further studies need for its application for the same in people. Gulvel is a medicinal plant with various properties of importance for our health. It belongs to the family Menispermaceae and scientifically it is called Tinospora cordifolia. It is a deciduous shrub commonly called "Guduchi" in Sanskrit. Gulvel has blood sugar lowering properties. Therefore, caution is to be exercised before taking gulvel if a person is already on antidiabetic drugs.

The orally dissolving tablet (OMDT) is one such novel strategy to increase consumer acceptance through the benefit of rapid dissolution, self-administration other than water, or chewing. The tablet is a great intra-oral, fast-dissolving drug delivery system that satisfies the unmet needs of the market, being convenient to use and administer, retaining a simple and convenient packaging, mitigating unpleasant taste, and convenient to manufacture. The tablet is placed on the top or bottom of the tongue. It is retained at the point of use and rapidly releases the active ingredient for nearby and/or systemic absorption. In addition, the development of a fast-dissolving tablet offers an opportunity for an assortment expansion in the market, which can include a wide range of drugs (e.g. neuroleptics, cardiovascular drugs, analgesics, allergy drugs, anti-asthmatics and pills for erectile dysfunction) than contenders for this measurement structure.[6,7,8]

IDEAL PROPERTIES OF ORODISPERSIBLE TABLETS

- The essential property of such tablets is the capability to disintegrate fastly and disperse or dissolve in saliva, thereby obviating the need for water.
- Various technologies have been developed that allow ODT to perform this unique function.
- Be compatible with taste protecting and different excipients
- Have a desirable mouth feel
- Leave minimal or no residue in the mouth after oral administration
- Exhibit low sensitivity in the direction of environmental prerequisites such as humidity and temperature
- Be adaptable and amenable to current processing and packaging machinery.

Advantages of ODTS [10,11]

- Administration to the patients who can't swallow, such as the elderly, stroke victims, bedridden patients, patients affected through renal failure and sufferers who refuse to swallow such as pediatric, geriatric and psychiatric patients.
- Improved stability.
- Suitable for controlled/sustained launch actives.
- Allows excessive drug loading.
- Ability to provide benefits of liquid medicinal drug in the form of solid preparation.
- Rapid drug therapy intervention. Achieve improved bioavailability/rapid absorption via pre-gastric absorption of drugs from mouth, pharynx and esophagus as saliva passes down.
- Convenient for administration and patient compliant for disabled, bedridden patients and for travelers and busy people, who do now not usually have access to water.
- Good mouth feel property helps to alternate the understanding of medication as bitter tablet especially in pediatric patients.

Disadvantage of ODTs[10,12]

- Orodispersible is hygroscopic in nature so must be keep in dry place Sometime it possesses mouth feeling

- ODT requires special packaging for properly stabilization and safety of stable product
- Dose uniformity is a technical challenge.

LIMITATIONS OF ORO-DISPERSIBLE TABLETS

- These tablets usually have insufficient mechanical strength i.e. hence, careful handling required.
- These tablets may leave unpleasant taste and/or grittiness in mouth if not formulated.[13]

Table 1: List of common superdisintegrants[14]

Superdisintegrants	Example	Mechanism of action	Special comment
Crosscarmellose® Ac-Di-Sol®	Crosslinked 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®	Crosslinked 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
Alginic acid NF Satialgine®	Crosslinked alginic acid	-Rapid swelling in aqueous medium or wicking action	-Promote disintegration in both dry or wet granulation
Soy polysaccharides Emcosoy®	Natural super disintegrant	----------	-Does not contain any starch or sugar. Used in nutritional products.
Calcium silicate	-Wicking action	-Highly porous, -light weight -optimum concentration is between 20-40%	

MECHANISM OF DISINTEGRATION FOR ORODISPERSIBLE TABLE:

Orodispersible mainly follows four types of basic mechanisms.

They are a) Swelling, b) Wicking, c) Repulsion, d) Deformation.

Swelling:

The mechanism for this is mainly based on the waves. Not all, but most excellent explosives work through this mechanism. Super disintegrating on contact with saliva in the mouth, the adhesiveness of the aqueous phase overcomes the various excipients to impose additional forces on excellent disintegrants, causing the tablet to swell and part of it to fall off. The swelling depends on the porosity of the tablet. Low porosity helps achieve sufficient swelling pressure and indicates higher disintegration compared to a tablet with greater porosity. It's also worth noting that if the porosity gets too low, water can't get in and the decay will go bad again.[15]

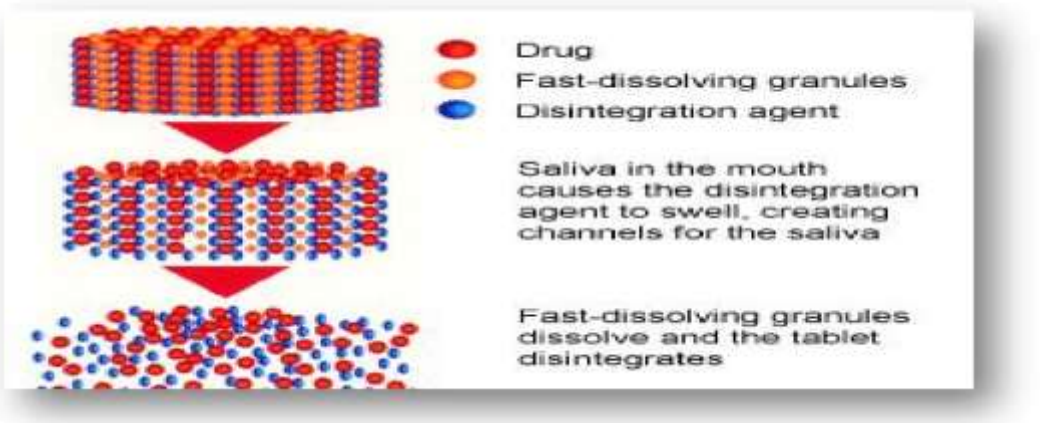

Figure 1: Swelling mechanism [15]

Deformation

The strain recovery theory implies that the shape of disintegrant particles is distorted during compression and upon wetting the particles return to their pre-compression shape, causing the tablet to break apart. Such a phenomenon can be an important aspect of the mechanism of action of disintegrants such as crospovidone and starch, which show little or no swelling. The disintegration of the tablet through deformation and repulsion is shown in Figure 3.[16]

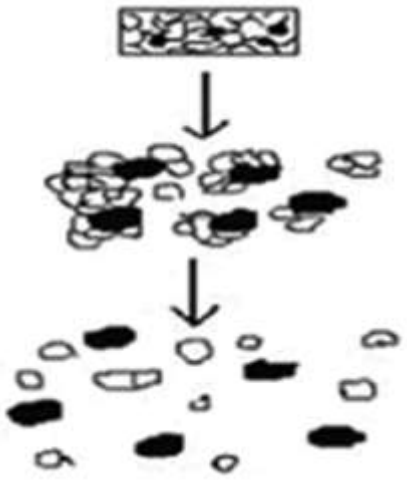

Figure 2: Steps involved in deformation

Repulsion:

This disintegration mechanism is mainly based on a repulsion concept proposed by Guyot-Hermann. This concept found that non-swellable disintegrants can also cause tablets to disintegrate. The disintegration technique is triggered by the modern forces of repulsion between two particles, and water is essential to generate these forces. In particular, the pores allow water to pass through the beverages and lead to the breakdown of hydrogen bonding as well as the various forces that hold the tablet together.[17]

Enzymatic Reaction

Enzymes also act as disintegrants in the body. These enzymes break the binding effect of the binder and help break it down. In fact, due to swelling, pressure exerted in the external course or in the radial direction, it causes the tablet to burst or the accelerated absorption of water, resulting in a significant increase in the amount of granules to promote disintegration.[18]

Due to Release of Gases:

The interaction of bicarbonate and carbonate with citric acid or tartaric acid releases carbon dioxide in tablets when they are wetted. The tablet disintegrates due to the technology of the pressure inside the tablet. This effervescent mix is used when the pharmacist needs to formulate very fast dissolving tablets or fast dissolving tablets. Because these disintegrants are incredibly sensitive to small changes in humidity and temperature, close environmental monitoring is required throughout the tablet manufacturing process. The effervescent mix is either introduced just prior to compression or can be introduced into two separate fractions of the formulation. [18]

METHOD USED IN PREPARARTION OF ODTs

Different methods used in the manufacture of orodispersible tablets include:

- Freeze-drying or lyophilization
- Tablet Molding
- Spray drying
- Sublimation
- Melt granulation
- Cotton candy process
- Mass extrusion
- Phase transition
- Nanonization
- Direct compression.

Freeze drying or lyophilization

Freeze drying or lyophilization is a process that removes solvent from a frozen drug solution or suspension that contains excipients that form the structure. Tablets formulated by this technique are usually very light and porous, allowing for their rapid dissolution. The glassy amorphous porous structure of the excipients as well as the drug substance produced by freeze drying leads to improved dissolution. The freeze drying process usually consists of three steps:

- 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.

Entire freeze drying technique is carried out at non-elevated temperature; therefore, nullifying destructive thermal results that may additionally have an effect on drug stability in the course of processing.[19]

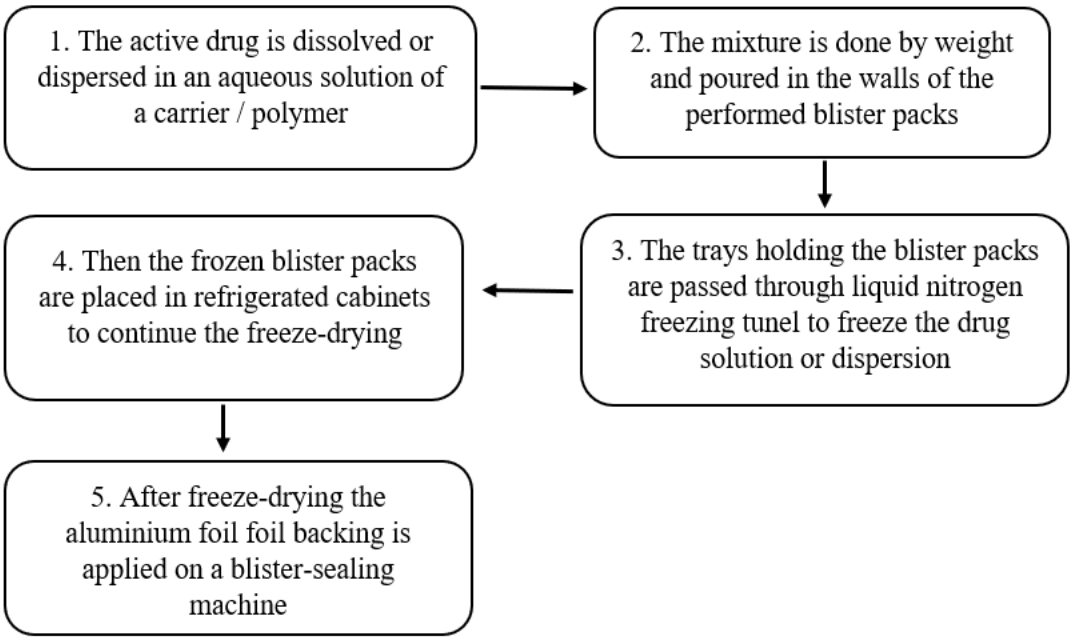

Figure 3: Steps by step Procedure of Lyophillization of ODTs [20]

Advantages:

More fast dissolution than different accessible solid products. The major advantage of using this technique is that the tablets produced by this technology have very low disintegration time and have great mouthfeel due to fast melting effect.

Disadvantages:

High price of the equipments & lack of physical resistance in blister packs. Shoukri. et al[21]

Tablet Molding methods

Tablets formed by molding processes have a highly porous structure, resulting in a high rate of disintegration and dissolution. This process involves wetting, dissolving or dispersing the drugs with a solvent and then forming the wet mixture into tablets by applying a lower compression molding pressure, but always lower than traditional tablet compression. The powder mixture can be sieved prior to manufacture to increase resolution.[16] Molded tablets have low mechanical strength, which results in erosion and breakage during handling.[22]

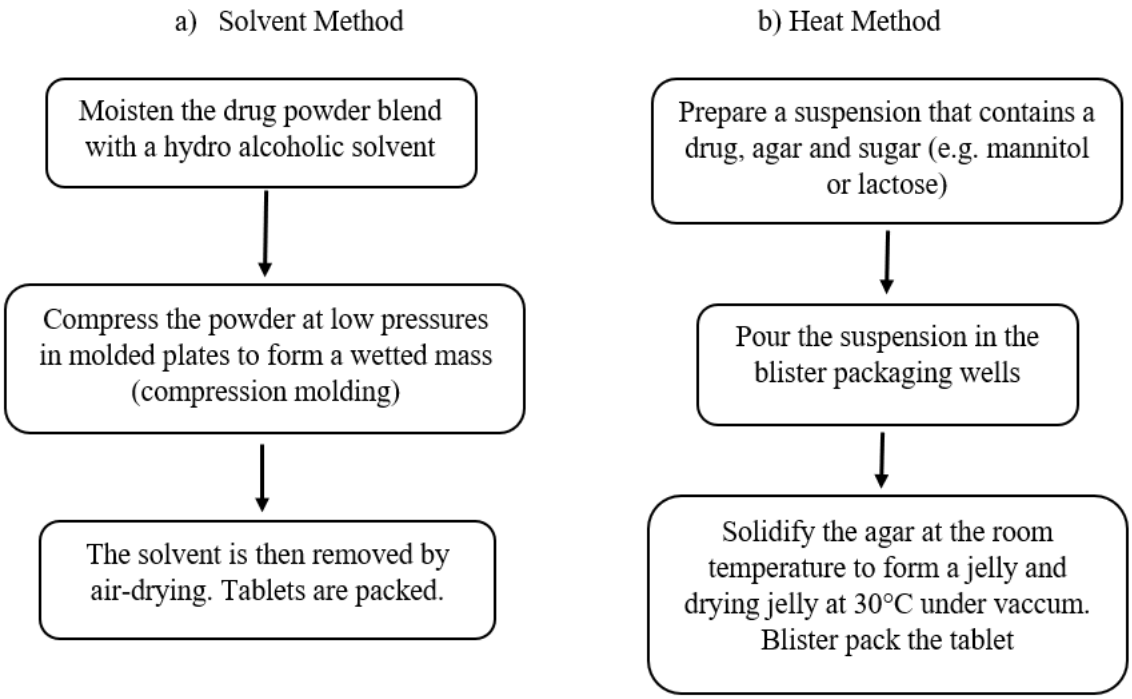

Figure 4: Procedure of Tablet Molding [20]

Spray drying

Spray drying is a process that can be used to produce highly porous, fine powders. Without exception, spray dryers are used in the pharmaceutical industry to produce highly porous powders. Alle et al. have reported the use of this process to produce rapidly dissolving tablets. In this method, ingredients of hydrolyzed and non-hydrolyzed gelatin as carriers, mannitol as a filler, sodium starch glycolate or crosscarmellose sodium as a disintegrant, and an acidic material (e.g. citric acid) and/or alkaline material (e.g. sodium bicarbonate) for enhancement of decay integrated and dissolution. Characteristic of the spray drying process is that this process gives rapid dissolution (within 20 seconds) when the dosage form comes into contact with the aqueous medium. [16,23]

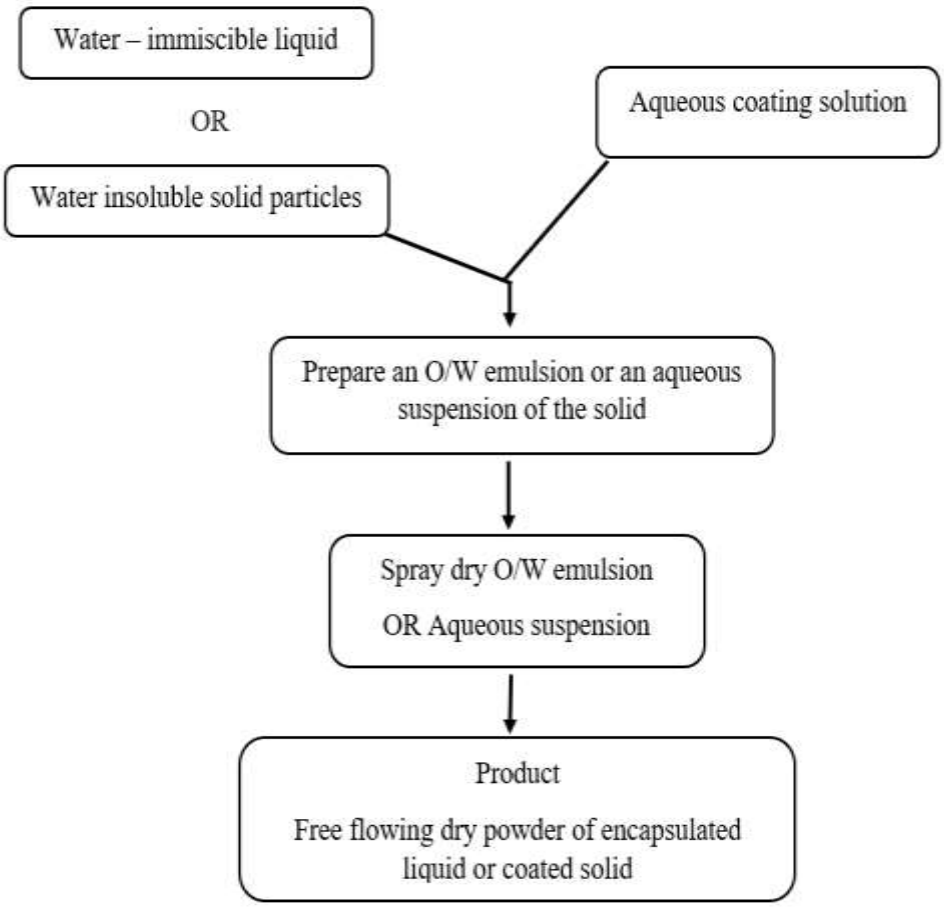

Figure 5: Flow chart for coating liquid and solid particles using spray-drying process

Sublimation Technique

The basis of this method is to add inert solid components that volatilize readily, (e.g. camphor, ammonium bicarbonate, naphthalene, urea, urethane etc) to different tablet excipients and the mixture is then compressed into tablets. Volatile material is then eliminated through sublimation, which generate a porous structure. Mannitol and camphor had been used as a tablet matrix material and subliming the material respectively. Camphor used to be iminated by way of subliming in vacuum at 80°C for 30 minutes to enhance pores in the tablets.[9]

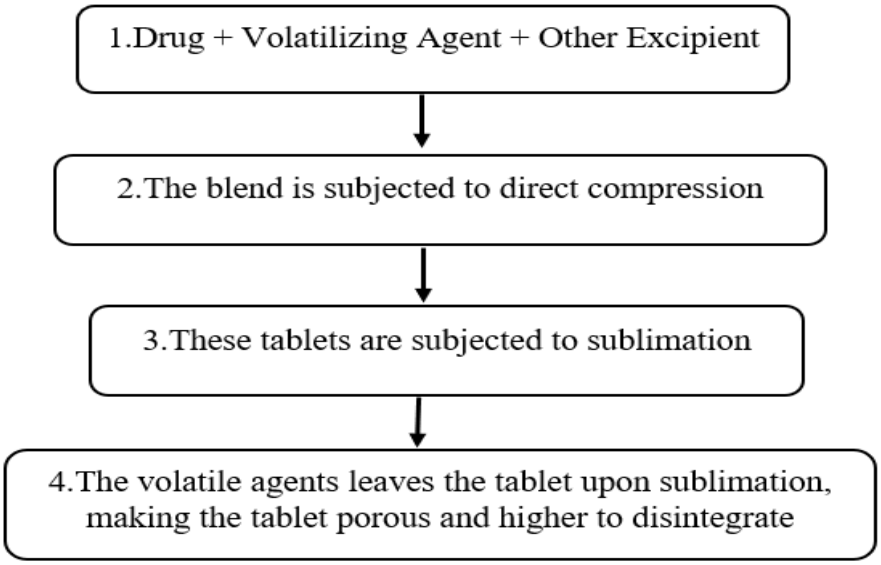

Figure 6: Step by step Formation of ODTs by Sublimation [20]

Melt granulation

The melt granulation technique is a technique by which pharmaceutical powders are effectively agglomerated by a melt in a binder. The advantage of this process over a traditional granulation process is that no water or organic solvents are required. Because no drying step is required, the technique is much less time-consuming and uses much less energy than wet granulation. It is a useful method to prolong the dissolution rate of poorly water-soluble drugs like griseofulvin. This strategy for producing ODT with adequate mechanical integrity involves the use of a hydrophilic waxy binder.[24]

Cotton candy process

This technique is so named as it makes use of a unique spinning mechanism to produce floss-like crystalline structure, which mimic cotton candy. It is additionally recognized as the candy floss technique.[24] Cotton candy technique includes formation of matrix of polysaccharides or saccharides by means of simultaneous action of flash melting and spinning. The matrix formed is in part recrystallized to have extended flow properties and compressibility. This candy floss matrix is then milled and blended with active ingredients and excipients and subsequently compressed to ODT. This technique can accommodate excessive doses of drug and provides extended mechanical strength. However, excessive technique temperature limits the use of this technique.[25]

Mass-extrusion

This technology involves softening the active mixture using the solvent combination of water-soluble polyethylene glycol and methanol and then ejecting the softened mass through the extruder or syringe to get a cylinder of product into regular segments using a heated blade to shape the tablet . The dried cylinder can also be used to coat granules for bitter tablets, giving it style masking.[26]

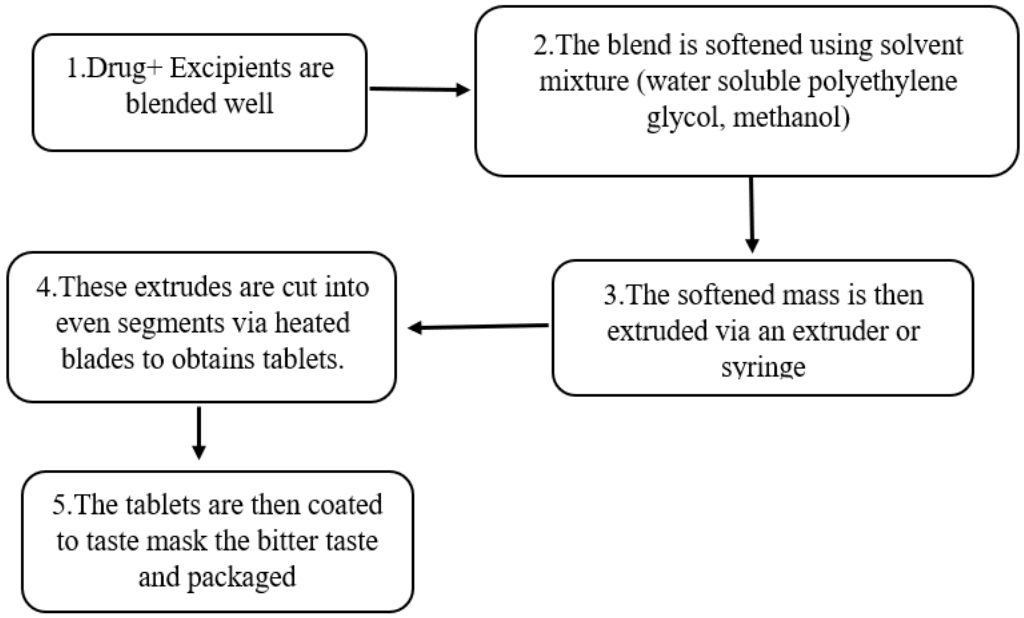

Figure 7: Formulations by Mass Extrusion [20]

Phase transition

MDTs were prepared by compressing powder containing erythritol (mp: 122°C) and xylitol (mp: 93-95°C) and then heating at about 93°C for 15 minutes. After heating, the average pore size of the tablets was expanded earlier, and the tablet hardness was additionally increased earlier. The extent of tablet hardness associated with heating and storage no longer depended on the crystal land of the lower melting point sugar alcohol.

Phase transition process

Kuno et al.[27] investigated this process by compressing powder containing two sugars alcohols. One with high and another with low melting point, and they are heated at a temperature between their melting point and then compressed finally in order to get the tablets. Example of sugar alcohols are erythriol (m.p. 122°C), xylitol (m.p. 93-95°C), trehalose (97°C), and mannitol (166°C). After heating, tablet hardness was increased due to an increase in interparticle bonds or the bonding surface area in tablets induced by phase transition of lower melting point sugar alcohol.

Nanonization

A recently developed Nanomelt technological know-how includes a reduction in the particle size of drug to nanosize through milling the drug the use of a proprietary wet-milling technique. The nanocrystals of the drug are stabilized towards agglomeration through surface adsorption on chosen stabilizers, which are then included into ODTs. This method is, particularly advantageous for poorly, water soluble drugs. Other benefits of this technological know-how consist of quick disintegration/dissolution of nanoparticles leading to accelerated absorption and subsequently greater bioavailability and reduction in dose, price advantageous manufacturing process, traditional packaging due to excellent durability, and broad vary of doses (up to 200 mg of drug per unit).[28]

Direct compression

Direct compression represents the easiest and the most affordable tablet manufacturing method for ODTs as they can be fabricated the usage of conventional tablet manufacturing and packaging equipment and additionally due to

availability of tableting excipients with multiplied flow, compressibility and disintegration properties, particularly tablet disintegrants, effervescent marketers and sugar primarily based excipients.[15]

PATENTED TECHNOLOGIES

Rapid-dissolving characteristic of ODTs is generally attributed to fast penetration of water into tablet matrix resulting in its fast disintegration. Several technologies have been developed on the basis of formulation aspects and different processes and resulting dosage forms vary on several parameters like mechanical strength, porosity, dose, stability, taste, mouth feel, dissolution rate and overall bioavailability. [14,15,29,30]

Zydis Technology

Zydis formulation is a unique freeze-dried tablet in which drug is physically entrapped or dissolved within the matrix of fast dissolving carrier material. This product is made to dissolve on the tongue in 2 to 3 seconds. Zydis products are packed in blister packs to protect the formulation from moisture in the environment.[14,31]

Advantages

- Buccal pharyngeal and gastric regions are all areas of absorption from this formulation. Any pre-gastric absorption avoids first-pass metabolism and can be an advantage in drugs that undergo a great deal of hepatic metabolism.
- The Zydis formulation self-preserving because the final water concentration in the freeze-dried product is too low to allow for microbial growth.
- 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 therefore 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.

Durasolv Technology

Durasolv is CIMA's second generation fast dissolving or disintegrating tablet formulation to produce stronger tablets for packaging in conventional blisters or bottles. Durasolv has a much higher mechanical strength due to the higher compression pressure during tabletting. A disadvantage of Durasolv is that the technology is not compatible with larger doses of active ingredient, as the formulation is subjected to high pressure during compaction. The drug powder coating in Durasolv can crack during compaction, exposing the bitter-tasting drugs to the patient's taste buds. So this technology is well suited for tablets with a small amount of active ingredients.

Orasolv Technology.

OraSolv was Cima's first fast dissolving/disintegrating dosage form. In this system, the active drug is taste-masked, contains disintegrants. The breakdown of ODT in the mouth is caused by the action of an effervescent agent activated by saliva. The amount of effervescent is generally about 20-25% of the total weight of the tablet. The widespread effervescent couple usually includes an acid source (citric, tartaric, malic, fumeric, adipic, and succinic acids) and a carbonate source (sodium bicarbonate, sodium carbonate, potassium bicarbonate and potassium carbonate, magnesium carbonate). The microspheres are loosely compressed to maintain the integrity of the coating. The main disadvantage of the OraSolv formulations is their mechanical strength. For this reason, Cimade has developed a special handling

and packaging system for OraSolv. Manufacturing requires a controlled, low relative humidity environment and protection of the final tablets with moisture impervious blister packs.

Advantages

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 formulation and tablet size, the disintegration time of the tablet can be designed in the range of 10 to 40 seconds.

Disadvantages

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

Wowtab Technology

The WOW in the WOWTAB means that the tablet must be given without water. This technology uses sugar and sugar-like excipients. The two different types of saccharides are combined to get a tablet formulation with reasonable hardness and fast dissolution speed. The two different saccharides are those with high moldability such as maltose, mannitol, sorbitol and oligosaccharides. (good binding property) and low malleability like lactose, glucose, mannitol, xylitol (quick dissolution). Tablets made with this technology have sufficient hardness to maintain the physical properties of the dosage form during manufacture until it comes into contact with moisture, such as saliva, in the mouth. Due to the significant hardness, the WOWTAB formulation is more stable to the environment than Zydis and Orasolv. Erythritol has been found to be the best sugar for this type of formulation as it shows rapid disintegration that is unaffected by tablet hardness.

Flash Dose Technology

Flash dose technology has been patented by Fuisz. Nurofenmeltlet, a new form of ibuprofen as melt-in mouth tablets, prepared using flashdose technology is the first commercial product launched by Biovail Corporation. The Flash Dose technology uses a unique spinning mechanism so as to produce a floss-like crystalline structure, much like cotton candy. This crystalline sugar can then incorporate the drug.

Flashtab Technology

Flashtab technology has been patented by prograph arm. The active ingredient in the form of microcrystals was used to make tablets. Drug microgranules can also be made using conventional techniques such as coacervation, microencapsulation, and extrusion spheronization. All processing uses conventional tabletting technology. Prographarm Laboratories have patented Flash Tab technology. A tablet made by this system consists of an active substance in the form of microcrystals. Drug microgranules can be prepared using conventional techniques such as coacervation, microencapsulation, simple pan coating processes and extrusion spheronization. Conventional tableting technology was used throughout the processing. The microcrystals or microgranules of the active ingredient are added to the granulated excipient blend prepared by wet or dry granulation and compressed into tablets. The tablets produced are reported to have good mechanical strength and a disintegration time < 1 minute.

Oraquick Technology

Oraquick's fast dissolving/disintegrating tablet formulation uses patented taste masking technology. This taste-masking process uses no solvents whatsoever, resulting in faster and more efficient production. Little heat is generated during processing, so this technique is suitable for heat-sensitive drugs. KV Pharmaceuticals also claims that the matrix that surrounds and protects the drug powder in microencapsulated particles is more pliable. This technique gives tablets with good taste masking and rapid dissolution within seconds.

Nanocrystal Technology

NanoCrystal™ Fast dissolving technology provides for: Pharmacokinetic benefits of orally administered nanoparticles (<2 microns) in the form of a rapidly disintegrating tablet matrix. Nano Crystal colloidal dispersions of drug substance arem combined with water-soluble GRAS (Generally Regarded as Safe) ingredients, filled into blisters, and lyophilized. This method avoids manufacturing process such as granulation, blending and tabletting which is more advantages for highly potent and hazardous drugs. For fast dissolving tablets, Elans proprietary Nanocrystal technology can enable formulation and improve compound activity and final product characteristics. Decreasing particle size increases the surface area, which leads to an increase dissolution rate.

Lyoc

Lyoc technology is owned by Cephalon Corporation. CIMA is a subsidiary of Cephalon and currently manages Lyoc's research and development activities. This was the first freeze drying based technology introduced for ODTs. An oil-in-water emulsion is prepared and placed directly into blister cavities, followed by freeze drying. Inhomogeneities during freeze drying are avoided by incorporating inert fillers to increase sedimentation viscosity. A high filler content reduces the porosity of the tablets, which reduces disintegration.

Table 2: List of patented technologies

Patented Technologies	Basic Process	Developed By
Zydis	Lyophilization/Freeze Drying	R.P. Scherer, Inc.
Orasolv	Direct Compression	Cima Labs, Inc.
Quicksolv	Lyophilization/Freeze Drying	Janssen Pharmaceuticals
Durasolv	Direct Compression	Cima Labs,Inc.
Wowtab	Direct Compression	Yamanouchim Pharma Tech. Inc.
Flashtab	Direct Compression	Prographarm Group
Flashdose	Cotton Candy Process	Fuisz Technology, Ltd.
Oraquick	Micromask, taste masking	KV Pharm.Co., Inc.
Lyoc	Lyophilization/Freeze Drying	Cephalon Corporation

EVALUATION OF ORODISPERSIBLE TABLETS

Evaluation of pre-compression parameters

The angle of repose

Angle of repose is determined by using funnel method. The accurately weighed blend is taken in a funnel. The height of the funnel is adjusted in such a way that the tip of the funnel just touches the apex of the heap of blend. The drug (as solid dispersion)-excipient blend is allow to flow through the funnel freely on to the surface. The diameter of the powder cone is measured and angle of repose is calculated using the following equation.[32]

$\theta = \tan^{-1}(h/r)$

Where, θ is the angle of repose "h" is the height in cms, "r" is the radius in cms.

Bulk density

A Bulk density is determined by pouring pre sieved (180 mesh) bulk drug into a graduated cylinder via a large funnel and measuring the volume and weight. The average weight of triplicate readings was computed[32]

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.

$$\text{Bulk Density} = \frac{\text{Mass of powder (M)}}{\text{Bulk volume of the powder (V)}}$$

Tapped density

It is determined by placing a graduated cylinder, containing a known mass of drug-excipients blend. The cylinder is allowed to fall under its own weight onto a hard surface from the height of 10 cm at 2 second intervals. The tapping is continued until no further change in volume is noted. Tapped density can be calculated by using following formula:[33]

$$\text{Tapped Density} = \frac{\text{Weight of powder (W)}}{\text{Tapped volume of the powder (V)}}$$

Carr's index

Carr's Index was measured for the property of a powder to be compressed; as such, they are measured for the relative importance of inter particulate interactions. The average of Triplicate (three) readings was noted down.[33]

$$\text{Tapped Density} = \frac{\text{Tapped Density} - \text{Bulk Density}}{\text{Tapped Density}} \times 100$$

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:

$$\text{Hausner's Ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

Evaluation of post-compression parameters

Hardness/crushing strength

The hardness of the tablet is measured by using conventional hardness testers like Monsanto hardness tester.[34] The limit is toward the lower range in order to help early disintegration in mouth.

Friability:

Friability of a tablet can be determined by using conventional friabilator, i.e., Roche friabilator. The instrument rotates at 25 rpm and tablet is placed. After 100 revolutions the tablets is reweighted and calculate the % friability using the formula.

$$\%\text{Fraibalility} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Initial Weight}} \times 100$$

Thickness

The thickness and diameter of the tablets used to be determined the use of a Micrometer screw gauge. Five tablets from every type of formulation had been used and common values had been calculated. It is expressed in mm.[34]

Water absorption ratio

A piece of tissue paper folded twice used to be positioned in a small Petri dish containing 6 ml of water. A tablet used to be put on the paper and the time required for whole wetting used to be measured. The wetted tablet used to be then weighed. Water absorption ratio (R), was once determined the usage of following equation, [36]

$R= [(W_a - W_b)/W_a] \times 100$

Where, W_a – Weight of tablet after water absorption

W_b – Weight of tablet before water absorption

Disintegration time

Initially the disintegration time for fast dissolving tablets was measured using the conventional test for tablets as described in the Pharmacopoeia. Tablets were placed in the disintegration tubes and time required for complete disintegration without leaving any residues on the screen was recorded as disintegration time.[37,38]

Weight variation

The weight variation test is carried out in order to ensure uniformity in the weight of tablets in a 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.

Table 3: Standard limit of weight variation [39]

Sr. No.	IP/BP	Limit	USP
1	80 mg or less	10%	130 mg or less
2	80 mg to less than 250 mg	7.5%	130 mg to 324 mg
3	250 mg or less	5%	More than 324 mg

Dissolution test

Dissolution study was conducted for all the formulation using USP type-II apparatus (Electro lab, Mumbai, India.). The dissolution test was per-formed using 900ml of phosphate buffer (PH 6.8) was taken as the dissolution medium at 50 rpm and 37°C±0.5°C. 5 ml of aliquots were periodically withdrawn and the sample volume was replaced with an equal volume of fresh dissolution medium. The samples will analyzed spectrophotometrically .[34]

Table 4: Different type of drug and polymer marketed

Drug	Polymer used	Type of formulation	Result	Reference
Candesartan cilexetil	Indion 204, tulsion 339, primogel, micro crystalline cellulose, magnesium stearate	Tablet	Better patient compliance	[40]

Lovastatin	Sodium starch glycolate, crosspovidone, crosscarmellose	Tablet	Rapid dissolution rapid onset of action	[41]
Lavocetrizine dihydrochloride	Kyron T-134, talc, colloidal silicon dioxide, sodium starch glycolate, microcrystalline cellulose, crospovidone	Tablet	99.73% of drug is released within 10 minutes	[42]
Primaquine phosphate	β-cyclodextrine, lactose, dextrose, cross povidone, sodium starch glycolate, Magnesium stereate, PVP	Tablet	Less disintegration time	[15]
Diclofenac sodium	Mannitol, crospovidone, microcrystalline cellulose, sodium starch glycolate, aspartame	Tablet	Better bioavailability and improved drug release	[43]
Triphala	Embelica officinalis, terminalia belerica, terminala chebula	Tablet	Less dispersible time	[44]
Meclizine HCL	Explotab, tulsion 334, Eudragit E100	Tablet	99.4% drug is release within 2 minutes	[45]
Quetiapine Fumarate	Pearlitol SD-200, magnesium stearate, camphor, Indion 414, sucralose	Tablet	Less disintegration time and greater drug release	[46]
Cyproheptadine HCL	Microcrystalline cellulose, magnesium stearate, mannitol	Tablet	98.64% drug is release within 30 minutes	[47]
Cinnarizine	Polyplasdone XL, Indion 414	Tablet	High patient compliance	[15]
Efavirenz	Crospovidone, aspartame, croscarmellose sodium, sodium starch glycolate, magnesium stearate, microcrystalline cellulose pH 102	Tablet	Faster drug release	[48]

CONCLUSION AND FUTURE PROSPECTIVE

Orally disintegrating tablets have higher patient acceptance, compliance, and can also provide enhanced biopharmaceutical properties, improved efficacy, and greater safety than traditional oral dosage forms. They have

enhanced patient compliance, convenience, bioavailability and rapid onset of action. However, frequent people are no longer very aware of this delivery system. Therefore, pharmacists are responsible for spreading the know-how related to this system. It is the pharmacist's duty to assist patients regarding its use, benefits, storage and maintenance. ODTs are said to maximize the porous structure of the tablet matrix and contain excellent disintegrating components in the highest concentration to achieve rapid disintegration and instantaneous dissolution of the tablet alongside suitable taste-protecting properties and excellent mechanical strength. Future challenges for many ODT manufacturers are to lower prices by discovering methods of manufacturing using traditional equipment, using versatile packaging that enhances mechanical energy and taste-masking capabilities. ODTs may be suitable for the oral administration of drugs such as protein- and peptide-based therapeutics that have limited bioavailability when administered with conventional tablets, as these products are normally rapidly broken down in the stomach.

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