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Review Article

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Fast Dissolving Tablets- A Novel Approach

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ABSTRACT

In the present scientific scenario the drug delivery technology has become highly competitive and rapidly evolving with ever increasing demand. Fast dissolving tablet (FDT) is one such type of an innovative and unique drug delivery system which is swiftly gaining much attention in the research field of rapid dissolving technology. Oral route is the most expedient and safest route of drug delivery because of wide range of drugs are administered through this route. Recently researchers have developed fast dissolving tablet (FDT) which dissolve or disintegrate rapidly in mouth saliva without intake of water. This novel drug delivery such as FDT or MDT (mouth dissolving tablet) have overcome many disadvantages like dysphagia or non accessibility of water while travelling. When compared with conventional dosage form FDT can be a useful alternative as well. This review article contains different techniques used for preparing FDT, silent features, various patented technologies, mechanism of super disintegration, challenges faced and the limitations

Keywords: Oral route, Mouth dissolving tablet, Super disintegrants, Dysphagia, Fast dissolving Tablet.

INTRODUCTION

Conventional dosage forms are pioneer of drug administration systems. The most widely used and accepted is the oral route of drug administrations. The oral dosage forms are widely used for ease of self-administration and low cost as compared to other dosage forms [1]. It is however associated with some drawbacks such as dysphagia (difficulty in swallowing), low bioavailability and delayed onset of action. In order to overcome these issues researchers have long explored the “oral cavity” to harness its drawback to enhance the drug’s permeability as well as bioavailability. The “oral cavity” has a good permeability because of mucosal lining being relatively less keratinized in the buccal mucosa [2]. Drug absorbed via “oral cavity” directly enters into systemic circulation by a jugular vein ensuring, a rapid onset of action, avoidance of first pass metabolism, and drug degradation in gastric region and enzymatic hydrolysis in intestine [3]. Keeping in mind the advantages of the “oral cavity”, an Oral Dispersible Tablet, commonly known as the Fast Dissolving Tablets are a widely accepted formulations. According to European pharmacopoeia “ODT (Oral Dispersible Tablet) should disperse or disintegrate in less than 3 minute when placed on tongue”. Fast dissolving drug delivery system (FDDDS) is a newer concept which combines the advantages of both liquid and solid formulations and at the same time, offer advantages over the traditional dosage forms.

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 (croscarmellose) and sodium starch glycolate (primogel), poly vinyl pyrollidoneetcprovide immediate disintegration of tablets and facilitate the design of delivery system with desirable characterstics. These types of formulations are widely recommended for the drugs used in emergency. e.g., Cardiac agents, Asthama, Brain stroke, Anti-hyper-lipidemic etc. [4]

2. Criteria for Fast dissolving Drug Delivery System:

The criterion for FDT is underlined in table 1: [5]

Parameters	Acceptance/Rejection
Water Required for swallowing	No
Compatible with Taste Masking	Yes
Portable	Yes
Fragility Concern	No
Good Mouth Feel	Yes
Patient Compliance	Yes
Leave Residue in oral cavity/Grittiness	No
Sensitive to Environmental factors (humidity, temperature)	No
Suitable for Conventional tablet processing and packaging	Yes
Economic	Yes

Table 1: Criteria for FDT

3. Salient Feature of Fast Dissolving Drug Delivery System:

• Patient Compliance is easy and the administration of tablet especially for patients suffering from dysphagia, cardiac and renal complications/victims, bedridden patients, and patient who refuse to swallowthe dosage form such as pediatric, geriatric & psychiatric patients [6].
• Oral disintegration of tablet eliminates the use of water which is suitable for patients who are traveling and cannot access water easily.
• Quick onset of action due to rapid disintegration followed by dissolution.
• Increased Bioavailability, due to absorption via mouth buccal mucosa which has better permeability properties.
• Pregastric absorption if any will result in improved bioavailability reduced dose and side effects, improving clinical efficiency [8].
• The FDT will give a good mouth feel, especially in pediatric patients due more emphasis on organoleptic properties.
• FDT will be safer than conventional dosage forms as it eliminates choking, or airway obstruction.
• Better business opportunities like, product differentiation, product endorsement, patent extensions and life cycle management [9].
• Favorable in cases which require an immediate and rapid onset of action e.g. motion sickness, sudden episodes of allergic attack or coughing.

Dual advantage of solid (higher stability) and liquid (better bioavailability) dosage forms [10].

4. Drugs Eligible for Fast Dissolving Tablet's-

The eligibility criteria for drugs to be formulated as Fast Dissolving Tablets are low dose, good stability in aqueous media, good mechanical strength [11] and compatibility with excipients [12,13]

Table 2

Class of Drug	Drug
Analgesic/Anti-inflammatory Agents	Picroxicam, Ibuprofen, Mefenamic Acid
Anti-Bacterial Agents	Erythromycin, Tertacycline, Doxycycline, Rifampin
Anti-Emetic	Ondansetrone, Dolasetron, Granisetron, Promethazine
Anti-Fungal	Griseofulvin, Miconazole
Anti-Malarial	Chlorquine, Amodiaquine
Anti-Gout	Allopurinol, Probenecid
Anti-Hypersentive	Amlodipine, Nefidipine
Anti-Coagulants	Glipizide, Tolbutamide
Anti-Protozoal	Benznidazole, Tinidazole
Anti-Thyroid	Carbimazole
Cardiac Inotropic Agents	Digitoxin, Digoxis
Gastro-Intestinal Agents	Omeprazole, Ranitidine, Famotidine
Nutritional Agents	Vitamin A, Vitamin B, Vitamin D, etc
Oral Vaccines	Influenza, Hepatitis, Polio, Tuberculosis, etc.

5. Techniques for Preparing Fast dissolving Tablets

Many techniques have been reported for the formulation of Fast dissolving tablets or Orodispersible tablets. Here we have discussed the six major techniques which are widely used for the formulation of these tablets [14,15].

1. Freeze drying/ Lyophilisation
2. Tablet moulding
3. Spray drying
4. Direct Compression
5. Sublimation
6. Mass Extrusion

5.1 Freeze-Drying or Lyophillisation

Freeze drying 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].

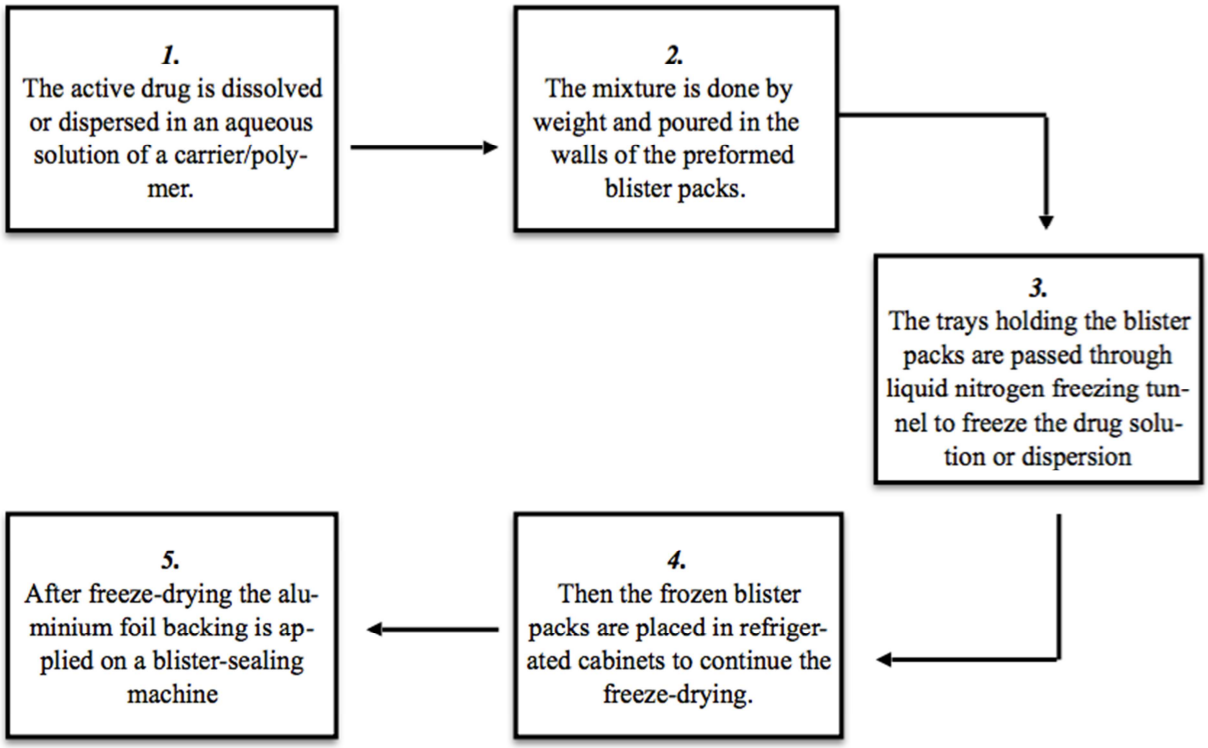

Figure 2 Steps by step procedure of Lyophillisation of FDT

The freeze-drying technique has demonstrated improved absorption and increase in bioavailability. The major disadvantages of lyophillisation 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]

5.2 Tablet Molding

Molding process is of two type's i.e. solvent method and heat method. The tablets manufactured by solvent method are less compact 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 [19]. 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 industrial manufacturer, compared to the lyophillisation technique [20]

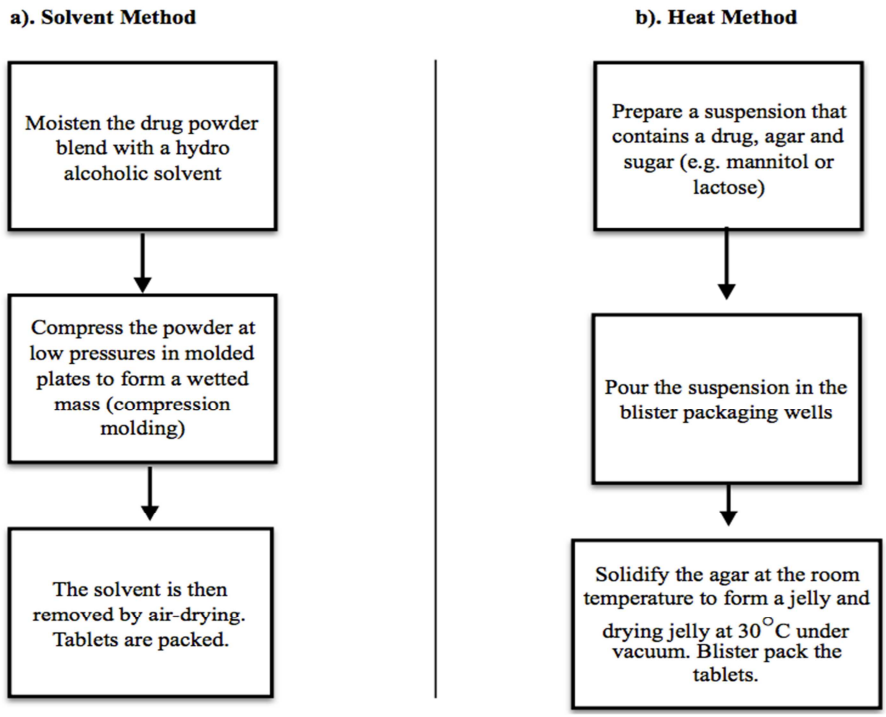

Figure 3 Procedure of Tablet Molding

5.3 Spray Drying:

In this technique, gelatin is used as a matrix and a supporting agent, mannitol as bulking agent, and superdisintegrants like crosscarmellose or sodium starch glycolate or crospovidone. The Tablets manufactured from the spray-dried powder containing bulking agent, superdisintegrant and 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[21]

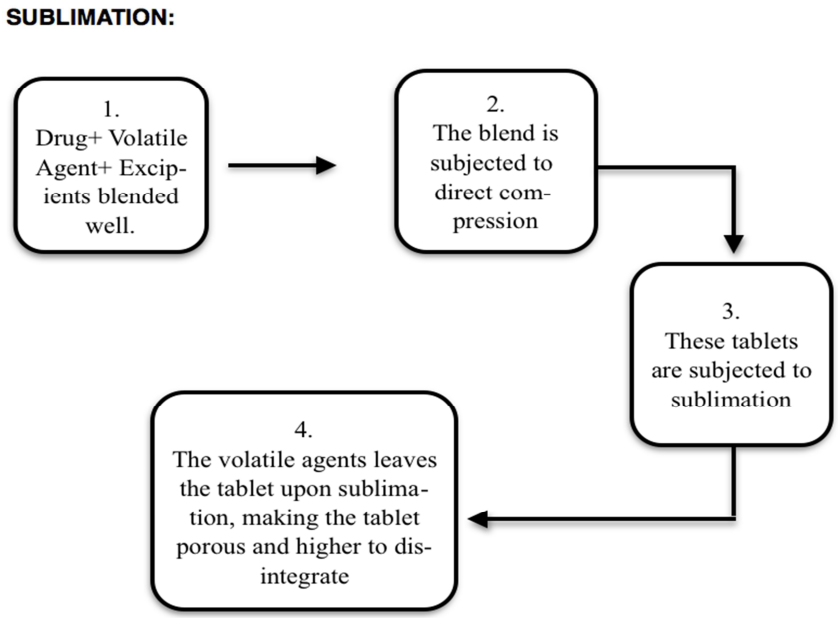

Figure 4 Step by Step Formation of FDT's by sublimation

5.4 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. By 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 [22].

5.5 Direct Compression:
Direct compression represents the most cost effective and simplest tablet manufacturing technique. Because of the accessibility of improved excipients especially superdisintegrants and sugar based excipients, this technique can now be utilized for preparation of Fast Dissolving Tablets [23].

5.5.1 Superdisintegrants:
Superdisintegrants are the principally affecting disintegration and ultimately 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.

5.5.2 Sugar Based Excipients:
This is another route to approach the direct compression technique. The use of sugar based excipients especially bulking agents like lactilol, dextrose, isomalt, fructose, maltilol, maltose, mannitol, sorbitol, polydextrose, xylitol, and starch hydrolysate which display high aqueous solubility and sweetness, and hence impart taste masking property and a pleasant mouth feel. 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 (maltilol and maltose) exhibit high mould-ability and low dissolution rate[24]

5.6 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 heated blade to form tablet. The dried cylinder can also be used to coat granules for bitter drugs and thereby achieve taste masking[25].

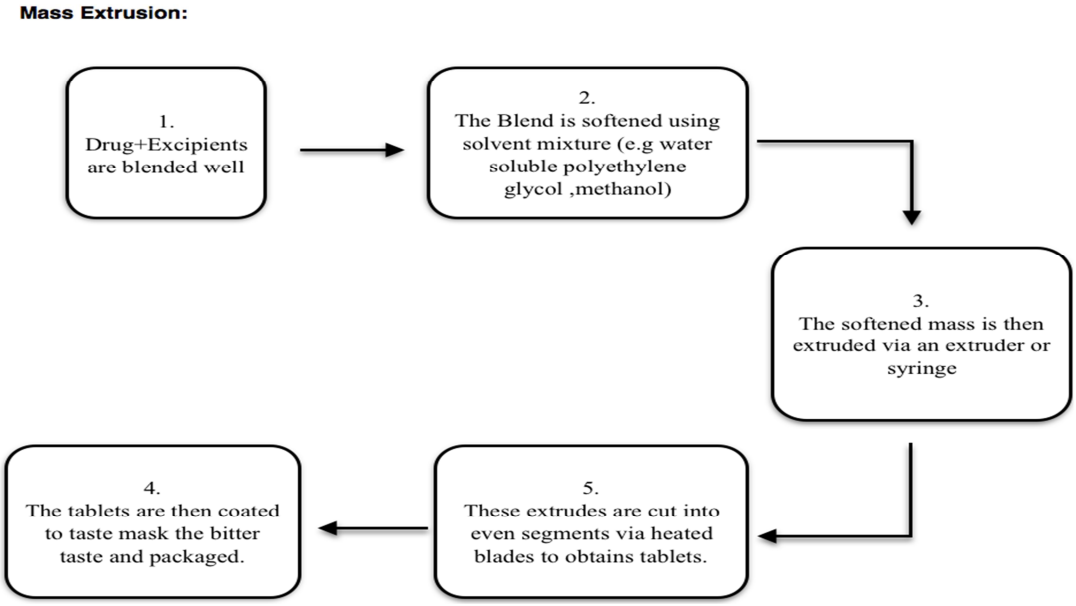

Figure 5 Formulations by Mass Extrusion

6. Patented Technologies for Fast Dissolving Tablets:
6.1 Zydis Technology
Zydis formulation is a unique technology of preparing fast dissolving tablet. It is freeze dried tablet technology in which drug materials are physically entrapped or dissolved within the matrix of fast dissolving carrier materials. Water is not required for swallowing because when "zydis unit" is put in mouth then the freeze dried structure disintegrates rapidly. Zydis material is composed of so many substances to achieve a number of objectives [26]. To provide strength during handling polymers such as dextran, alginate and gelatin are incorporated. Saccharides such as sorbitol or mannitol are incorporated to obtain good elegance, hardness and crystallinity. To prevent the shrinkage of

"zydis unit" during freeze drying process or long term storage glycine is generally used as collapse protectants. To protect the formulation from the moisture it should be packed in a blister[27]

6.2 Durasolv Technology

It is patented technology of CIMA LAB(US patent no.6,024,981) and is based on direct compression technology which uses suitable excipients with improved properties, especially superdisintegrants that accelerate the rate of disintegration and hence dissolution. [51].This technology is based on employment of conventional non-direct compression fillers (such as dextrose, mannitol, sorbitol etc) in the form of fine particles that quickly dissolve without producing a gritty or sandy sensation in the mouth. The water soluble and sometimes effervescent agents can also be use that assist in the disintegration process. The DuraSolv® technology is designed to provide stronger tablets without packaging precautions and can be packed in blisters. In this technology the tablet consists of drug materials, lubricants and fillers. [28].

6.3 Orasolv Technology

CIMA LAB has developed Orasolv technology. Orasolv is an effervescent direct compression tablet that disperses in mouth's saliva with the aid of almost hardly noticeable effervescence and dissolves in less than one minute, leaving the coated drug powder. The unpleasant flavor of the drug is addressed by coating of the drug powder and effervescence. The major disadvantage of Orasolv is its mechanical strength due to light compression. [52]

In Flash dose technology the matrices are prepared by flash heat processing. This technique is patented by fuisz. E.g. Nurofen is the first commercial product by this technology launched by BiovilCorporation [29].

6.4 Wow Technology

It is patented by Yamanouchi Pharmaceutical Corporation where wow tends for "without water". In this process high mouldability saccharide like oligosaccharide, mannitol is mixed with low mouldability saccharide like glucose, lactose and mannitol to obtain rapidly melting strong tablet [30].

6.5 Shearform Technology:

The core of this technology is preparation of floss. Floss is prepared by subjecting feed stock containing sugar carrier to flash heat process. Sucrose plus either mannitol or dextrose is mixed with surfactant and blended well. This is the primary floss mixture. In flash heat process, the carrier materials show an internal flow condition, which is heat induced and exits via spinning head, and simultaneously under centrifugal force, the floss is flinged.The floss produced by the above way are longer fibers and are further chopped converting them into smaller particles via a high shear mixer granulator. Recrystallization is completed by use of ethanol treatment (1%), spraying out floss, which subsequent evaporation, which increases flow and cohesive properties. This recrystallized matrix is then mixed with drugs and other excipients and subjected to compression. Tablets produced by this process are highly porous, have a good mouth feel, and have an immediate solubilisation of sugar as it comes in contact with saliva [31].

6.7 Flashdose Technology:

This technology is much like cotton candy, using a unique spinning mechanism to produce crystalline floss structure. The drug can then be incorporated into this crystalline sugar and compressed into a tablet. Such product has a high surface area for dissolution, dissolving rapidly on tongue and easy dispersion. The Flash dose tablets consist of self–binding shear form matrix termed as "floss" [32].

6.6 Ceform Technology:

The crux of this process is placing a dry powder containing pure drug and excipients into a rapidly spinning machine. Centrifugal force of the rotating head of this ceform machine, through small heated opening at high speed blends dry drug powder. This drug blend is liquefied to form a sphere, owing to the microburst of heat attained by carefully controlled temperature. This does not affect the stability of the drug. In the preselected oral dosage format the microspheres are blended and/or compressed [33].

6.8 Flashtab Technology:

This technology aims to make the drug have rapid release in GIT, micro encapsulated drug with effervescence, and easily flash dispersal tablet. Usually the polymer used is Eudragit for rapid release. This technology uses conventional approach of wet/dry granulation follow by classical method of compression. Micro-granules of drug, taste masking agents, disintegrating agent, and swelling agents are used to formulate drugs [34]. These tablets have good physical resistance, and highly suggested for hygroscopic materials for blister packing as materials like polyvinyl chloride/aluminum foils cater better moisture protection in comparison to conventional polyvinyl chloride or polypropylene foils.

6.9 Nanocrystal Technology:
The technology enhances dissolution rate by decreasing particles size and increasing surface area. Nano-crystal particles are drug particles (less than 1000 nm in diameter), produced by milling the drug substance, and obtained via wt. milling technique.

Nanocrystal fast dissolving technology provides, Wide range of doses per unit (up to 200 mg of API per unit), Based on proprietary and patent-protected technology elements products can be well classified. Enhanced Pharmacokinetics of oral drug. Utilization of non-moisture sensitive in actives, and is economic and Cost-effective. Combining drug Nano crystal colloidal dispersions and water-soluble GRAS (Generally Regarded as Safe) ingredients, then filled into blisters, and lyophilized product wafers are formed. They are highly robust, yet dissolve in very small quantities of water in seconds., which is agreeable when working with highly potent or hazardous materials reducing operations, like granulation, blending, andtableting. This approach is also enables small quantity of drugs to be converted into fast dissolving tablets because manufacturing loss is negligible[35].

6.10 Advantol 200:
Specially formulated for nutraceutical applications Advantol 200 is a directly compressible excipient system offering "Soft-Melt" functionality and it requires no special manufacturing equipment or tooling. To make robust “soft-melt” tablets it requires standard rotary tablet press with standard tooling under normal tableting temperature and humidity conditions.

6.11 Advatab:
AdvaTab™ technology (Eurand)designed and patented by Kyowa Hakko Kogyo (Tokyo, Japan) produces orally dissolving tablets based on a proprietary tablet composition. Via spray during the production process, each tablet is well lubricated. AdvaTab™ is produced using 10–30 times less hydrophobic lubricant and can be 30–40% stronger than conventional tablets[36].

This results in tablets being -
• Hard and durable, yet allows easy wetting upon contact with saliva
• High drug loading
• coated drug particles for better mouth feel
• Not require special packaging, and can be packed in conventional packaging systems (push-through blisters and bottles)
• Unique as it can be paired with Eurand’s technologies like Microcaps (taste-masking) and Diffucaps(controlled release)

6.12 Frosta Technology:
The heart of this technology is producing strong tablets with high porosity via, compression of highly plastic granules at low pressures forming a fast melting tablet. These plastic granules can be classified into three units: a porous and plastic material, enhancer of water penetration, and a binder.

A porous, plastic material is water soluble or water dispersible. The inter-particle contacts which is vital to form bonds between particles is improved by plastic deformations of powders. If a porous and plastic material is polymeric,. When it comes in contact with the aqueous media it is crucial to avoid formation of a viscous layer of the material at the tablet surface .One way of making such tablets is to mix porous, plastic material with a water penetration enhancer at certain ratios. To prevent formation of a viscous layer on the tablet surface, the porous and plastic particles are separated by water-penetration-enhancing particles, The produces FDTs with desired hardness and fast disintegration time (2 seconds - 30 seconds) depending on the tablet size[37].

6.13 Ora-Quick Technology:
The KV Pharmaceutical claims its microsphere technology, known as Micro Mask, utilizing a unique patented taste masking technology. It does not use any type of solvent, thus leading to more quick and efficient tablet production. It also has lower heat production which is favorable for thermal-sensitive drugs. This technology claims faster dissolutions and better taste masking of tablet. Except for KV pharmaceuticals no other products manufactured by this technology are available in the market. This technology evaluates parameters such as: Rate of absorption and dissolution, pleasant mouth feel, taste, physical strength, bioavailability, and stability [38].

6.14 Pharmaburst Technology:
SPI Pharma, New castle, patents this technology. It utilizes the coprocessor excipients, dissolving within 30-40seconds. This technology incorporates, dry blending

Of drug, flavor, and lubricant followed by compression into tablets. Tablets obtained have sufficient strength so they can be packed in blister packs and bottles [39].

6.15 Lyoc:
Lyoc, is a patented technology of Farmlyoc. The technology aims in producing via lyophilisation, a porous and solid galenic of an oil-in-water emulsion placed in the blister alveolus. This emulsion paste is then freezed in blister containing bulk drug or drug microparticles. Loco product has poor mechanical strength due to porousity but good disintegration rate. Example of product is Phloroglucinol Hydrate-Farmlyco. Lyoc utilizes a freeze drying process but differ from Zydis in that the product is frozen on the freeze dryer shelves. To prevent inhomogeneity by sedimentation during this process, these formulations require a large proportion of undissolved inert filler (mannitol), to increase the viscosity of the in process suspension. It produces tablet by direct compression of powdered mixture with external lubrication [48].

7. Mechanism of Super disintegrants:
There are four major mechanisms for tablets disintegration as follows:

7.1 Swelling
Superdisintegrants which act by this mechanism work on the fundamental of "swell" and "burst"

When the Super-Disintegrant comes in contact with the water/saliva, the aqueous phase extras more adhesive force upon the superdisintegrant as compared to other excipients and drug resulting in swelling and trust or breaking apart of the tablet [41].

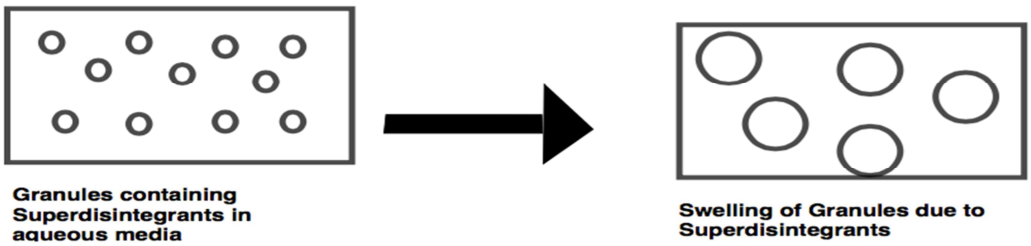

Figure 6 Diagrammatic Depiction of Mechanism of Swelling

Most of the Superdisintegrants follow this mechanism. Of them, the widely used are starch and its modifications. Given below is the list of the natural as well as the synthetic Superdisintegrants having swelling mechanism.

Table 3

Synthetic Superdisintegrants	Natural Superdisintegrants
Starch	Pectin
Modified Starch	Agar
Cross-linked PVP	Veegum
Cross-linked sodium CMC	Bentonite
Sodium Starch Glycolate	Ion exchange Resin (Indion 414)
Sta RX 1500 (Pregelatinized Starch)	

7.2 Porosity and Capillary Action (Wicking)
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 ultimate result of breakage of tablet. Here the porosity of the tablet is of the utmost 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.

7.3 Particle/Particle Repulsive Forces
Guyot-Hermann has proposed a particle repulsion theory. This theory states the swelling via tablet made of "non-swellable" disintegrants. This works on the principle of electric repulsive force of particles. It is mandatory for the tablet to come in contact with water thus generating repulsive force, making particles repel each other and thus the tablet disintegrates [42].

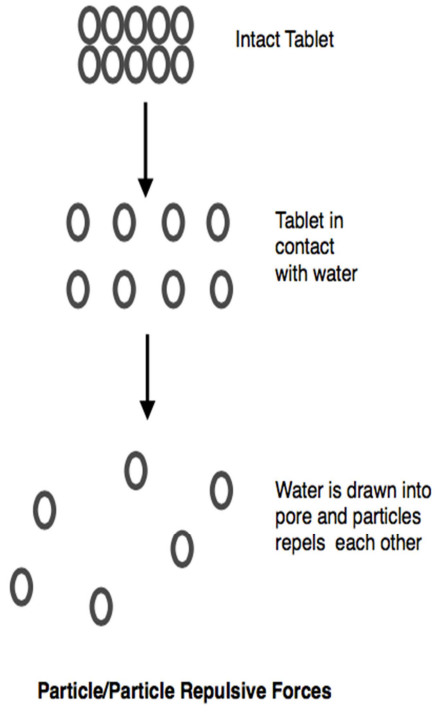

Figure 7 Diagrammatic description of Mechanism of Particle/Particle Repulsion

This mechanism uses the biological enzymes as disintegrants. Binder which are easily broken by salivary enzymes are used in the tablet. Upon the contact with the saliva these binders are catalyzed thus disintegrating the tablet. This mechanism also couples the swelling and burst phenomenon where the binder swells and bursts to release drug as granules. Examples: Binder Starch metabolised by Amylase; Sucrose by Invertase; Gums by Hemicellulose; Alginate by Carragenase.

7.5 Deformation

Starch grains are generally thought to be "elastic" in nature that is grains that are deformed under pressure will return to their original shape when that pressure is removed. But, with the compression forces involved in tableting, these grains are believed to be deformed permanently and are said to be "energy rich" with this energy being released upon exposure to water. In other words, the ability for starch to swell is higher in "energy rich" starch grains than it is for starch grains that have not been deformed under pressure [43].

8. Evaluation Parameters:

It is important to evaluate the formulated drugs in order to determine the quality of the tablet. Given below are the fundamental evaluation parameters [44, 45].

Table 4: Evaluation parameters of FDT

Parameters	Criteria
Weight Variation	Weight Variation tests are carried out according to either USP,IP,BP.
Hardness	Hardness of the tablet should be lesser than conventional tablet falling in the range of 3-4kg/cm^2
Friability	Friability should be within the range of 0.1-0.9%.
Mechanical Strength	Should possess adequate mechanical strength to absorb the transportation shock and avoid breakage of tablet
Tablet Porosity	Tablet porosity is conducted(as per ICH guideline)
Wetting time and water absorption	Use of simulated saliva to check the wetting time of tablet as well as water absorption
In-vitro Dispersion time	At optimum and fixed pH and temperature, time taken for dispersion of tablet in media is determined
Disintegration Studies	The time period at which the tablet starts to disintegrate in given aqueous media is determined
Dissolution Studies	Dissolution Studies carried out according to USP,IP,BP.
Stability Studies	Stability studies (including Accelerated Stability studies) are conducted according to the ICH guidelines
Content Uniformity	Content uniformity according to either USP,IP,BP.

9. LIMITATIONS OF MOUTH DISSOLVING TABLETS:

- Poor mechanical strength and Fragility require careful handling[41]
- Grittiness, residual taste or incomplete dissolution of tablet in mouth[42]
- Large doses difficult to formulate
- Patients on anticholinergic medications & patients with Sjogren's syndrome experiencing dryness of the mouth due to decreased saliva production, the tablet may not produce desired disintegration and effects [43].

10. Challenges of Fast Dissolving Tablet's:

Despite the advantages of this formulation, it faces number parameters that come across as a challenge. These are listed below [44].

Table 5: **Challenges faced while preparing FDT**

Parameter	Description
Palatability	Drug should be made palatable to the patient, for easy administration, and should be sweet in nature. This is a challenge as most drugs are bitter in taste.
Mechanical Strength	The tablet should have optimum mechanical strength, along its excipients added, should not break easily, nor be friable. This is a challenge as the drug should rapidly disintegrate in oral cavity and yet have good mechanical strength
Hygroscopicity	This formulation is hygroscopic in nature as it should dissolve/ disintegrate when it comes in contact with water. Thus the vital mechanism of the formulation is a challenge and a limiting step
Aqueous Solubility	Aqueous solubility becomes a major issue if the drug is hydrophobic in nature or highly Lipophilic, thus it won't dissolve/disintegrate in mouth leading to grittiness and residue in mouth.
Tablet Size	Oral dissolving tablets should have an optimum tablet size of 7-9mm, and should not exceed it.
Drug Concentration	Only potent drugs or drugs having a narrow therapeutic index, can be made into FDT's. These tablets are small in size utilizing minimum excipients and drug concentration. Hence all drugs are not suitable for this formulation.

CONCLUSION

Fast Dissolving tablets are considered to be contemporary dosage forms. These dosage forms and their route of administration results in better efficacy, rapid onset of action, enhanced bioavailability, and improved patient compliance. There are many marketed product of this category which have been introduced in the recent past. Some of the recent product in the Indian and global market are listed in table for ready reference (Table 6). The primary attractive factor of MDT is quick disintegration in oral cavity without the aid of water, along with sufficient mechanical strength. This feature makes this formulation a highly recommendable choice for geriatric and pediatric patients. FDT in the near future is expected to grow at a great and rapid pace, owing to the advancement in the scientific research and discovery of new excipients, resulting in a future-ready, combative arena of pharmaceutical drug delivery systems.

Table 6: Some FDT products in global market

Trade Names	Active Drug	Manufacturer
Alavert	Loratadine	Wyeth, U.S
Aricept ODT	Donepezil	Eisai Co, Japan
Allegra ODT	Fexofenadine	Sanofi Aventis, France
Clonazepam ODT	Clonazepam	Par Pharmaceutical, U.S
Dolib MD	Rofecoxib	Panacea
Domray MD	Domperidone	Ray Remedies, Ahmedabad
Febrectol	Paracetamol	Prographarm, Chateauneuf, France
Feldene Fast Melt	Piroxicam	Pfizer Inc., NY, U.S.A
Insure-MD	Nimesulide	SuzenPharma, Hyderabad India
Mirtazapine ODT	Mirtazapine	Teva Pharmaceuticals
Maxalt MLT	Rizatriptan	Merck and Co., NJ, U.S.A
Mosid-MT	Mosapride citrate	Torrent Pharmaceuticals, Ahmedabad, India
Niravam	Alprazolam	Schwarz Pharma
Nimulid-MD	Nimesulide	Panacea Biotech, New Delhi, India
Orapred ODT	Predinisolone	Sciele pharma, Atlanta U.S
OlanexInstab	Olanzapine	Ranbaxy Labs Ltd., New Delhi, India
Pepcid RPD	Famotidine	Merck and Co., NJ, U.S.A
Rofaday MT	Rofecoxib	Lupin
Romilast	Montelukast	Ranbaxy Labs Ltd., New Delhi, India
Valus	Valdecoxib	Glenmark
Zelapar TM	Selegiline	Amarin Corp., London , UK
Zofran ODT	Ondansetron	GlaxoWellcome, Middlesex, UK
Zotacet MD	Cetirizine HCl	ZotaPharma

REFERENCES

[1] D Bhowmik et al , Fast Dissolving Tablet: An Overview, *J.Chemical and Pharma.Research*, **2009**; 1(1), 163-17
[2] Kumari, S., Visht, S., Sharma, P.K., Yadav, R.K., Fast dissolving Drug delivery system : Review Article; *J. Pharmacy Research*, **2010,** 3(6),1444-1449
[3] Bandari, S., Mittapalli, R.K., Gannu, R., Rao, Y.M., Orodispersible tablets: An overview. *Asian J Pharm*, **2008,** 2, 2–11
[4] Gajare, G.G., Bakliwal, S.R., Rane, B.R., Gujrathi, N.A., Pawar, S.P., Mouth dissolving tablets: A review, *Int J Pharma Res &Deve*, **2011**, 3(6), 280 – 296
[5] Debjit, B., Chiranjib, B., Krishnakanth, Pankaj, R.Margret Chandira, Fast Dissolving Tablet: An Overview,*J Chemical and Pharma Res*,**2009**, 1(1), 163-177
[6] Bandari, S., Mittapalli, R. K. , Gannu, R., Rao, Y.M., Orodispersible tablets: An overview, *Asian J Pharma*, **2008,** 2(1), 2-11
[7] Ghadge, S.J., Keskar, S.R., Dube, R.K., Oral disintegrating tablets: An Overview,*Int J Universal Pharmacy and Life Sci*, **2011**,1(3), 35-50.
[8] Reddy, L.H., Ghosh, B., Rajneesh., Fast dissolving drug delivery system:AReview of the literature,*Indian J Pharm Sci*, **2002,** 64 (4),331-336
[9] Mohanachandran, P.S., Sindhumol, P.G., Kiran,T.S., Super disintegrants: An Overview,*Int J. Pharma. Sci. Review and Research*,**2011,**6(1),105-109
[10] Aurora, J., Pathak, V., Oral disintegrating technologies: Oral disintegrating dosage forms: An overview, *J.Drug DelivTechnol*, **2005**,5(3),50-54
[11] Kaur, T., Gill, B., Kumar, S., Gupta, G.D., Mouth Dissolving Tablets: A Novel Approach to Drug Delivery,*Int. J. of Current Pharma. Research*, **2011,** 3(1),1-7
[12] Mudgal, V. K., Sethi, P., Kheri, R., Saraogi, G.K., Singhai,A.K., Orally Disintegrating Tablets: A Review,*Int. Research J. Pharmacy*,**2011,**2(4),16-22
[13] Fu, Y., Yang, S., Jeong, S. H., Kimura, S., Park, K., Therapeutic Drug Carrier Systems, Orally Fast Disintegrating Tablets: Developments, Technologies, Taste- Masking and Clinical Studies; *Critical Reviews™ in Therapeutic Drug Carrier Systems*,**2004**, 21(6),433–475
[14] Gupta, A., Mittal, A., Jha, K.K., Fast Dissolving Tablet-A Review,*The Pharm Innovation*, **2012,** 1(1),1-7
[15] Gupta, A., Mishra,A.K., Gupta, V., Bansal, P., Singh, R., Singh, A.K., Recent Trends of Fast Dissolving Tablet - An Overview of Formulation Technology, *Int. J. Pharma.& Biological Archives*, **2010,** 1(1),1 – 10
[16] Shukla, D., Chakraborty, S., Singh, S., Mishra, B., Mouth Dissolving Tablets I: An Overview of Formulation Technology, *Scientia Pharmaceutica*, **2009,** 77(2),309–326
[17] Basu, B., Bagadiya, A., Makwana,S., Vora, V., Batt, D., Dharamsi, A., Formulation and evaluation of fast dissolving tablets of cinnarizine using superdisintegrant blends and subliming material,*J Advanced Pharma Tech & Res*, **2011,** 2(4), 266-73
[18] Bircan,Y., Comoglu, T., Formulation technologies of orally fast disintegrating tablets, *Marmara Pharm J*, **2012,** 16(1), 77-81
[19] Sharma, R., Rajput, M., Prakash, P., Sharma, S., Fast dissolving drug delivery system: A Review,*Int Res J Pharm*, **2011,** 2(11), 21-29
[20] Rai, R.R., Chirra,P., Thanda, V., Fast dissolving tablets: A novel approch to drug delivery–A Review,*Int J Preclinical and Pharma Res*,**2012,** 3(1), 23-32
[21] Badguja, B.P., Mundada,A.S., The technologies used for developing orally disintegrating tablets: A review,*Acta Pharm*,**2011,** 61,117–139
[22] Nagar, P., Singh, K., Chauhan,I., Verma, M., Yasir, M., Khan, A., Sharma, R., Gupta, N., Orally disintegrating tablets: Formulation, preparation techniques and evaluation, *J Applied PharmaSci*, **2011**,1(4),35-45.
[23] Ito, A., Sugihara, M., Development of Oral Dosage forms for elderly patients: Use of agar as Base of rapidly disintegrating oral tablets,*Chem Pharm.Bull*,**1996,**44(11),2132-2136
[24] Gauri, S., Kumar, G., Fast Dissolving Drug Delivery and its Technologies,*The Pharma Innovation*,**2012**,1(2),34-39
[25] Nagar, P.,, Singh, K., Chauhan, I., Verma, M., Yasir, M., Khan, A., Orally disintegrating tablets: formulation, preparation techniques and evaluation,*J Applied Pharma.Sci*,**2011,**1(4),35-45
[26] Panigrahi, D., Baghel, S., Mishra, B., Mouth dissolving tablet: An overview of preparation techniques, evalution and patented technologies,*J. Pharma.Research*, **2005,** 4(3), 33-8
[27] Deshmukh, V. N., Mouth Dissolving Drug Delivery System: A Review,*Int J. of PharmTech Research*,**2012,** 4(1),412-421
[28] Goel, H., Rai, P., Rana,V., Tiwary, A.K., Orally Disintegrating Systems: Innovations in Formulation and Technology, Recent Patents on Drug Delivery & Formulation, 2, **2008**, 258-274
[29] Mehta, K., Garala, K., Basu,B., Bhalodia,R., Joshi, B., Charyulu, N.R., An Emerging Trend In Oral Drug Delivery Technology: Rapid Disintegrating Tablets,*JPharma. Sci. and Tech*,**2010,** 2(10),318-329

[30] Puttalingaiah, L., Kavitha, K., Mani, T.T., Fast disintegrating tablets: An Overview of Formulation, Technology and Evaluation,*Res J Pharma. Biological Chem Sci.*,**2011,** 2(2),589-601
[31] Deshmukh, K.R., Patel, V., Verma, S., Pandey, A.K., Devangan, P., A review on mouth dissolving tablet techniques, *Int J Res Ayurveda Pharm.*,**2011,**2(1),66-74
[32] Goel, H., Rai, P., Rana,V., Tiwary, A.K., Orally Disintegrating Systems: Innovations in Formulation and Technology, *Recent Patents on Drug Delivery & Formulation*,**2008,** 2,258-274
[33] Fu, Y., Yang, S., Jeong, S.H., Kimura, S., Park, K., Orally Fast Disintegrating tablets; Developments, Technologies, Taste-masking and clinical Studies,*Critical review in therapeutic drug carrier system*, **2004,** 21(6), 450-460
[34] Junghanns, Jens-Uwe, A.H., Muller, R.H., Nanocrystal technology, drug delivery and clinical applications,*Int J Nanomedicine*, **2008,** 3(3), 295-309
[35] Kumar, R.,Patil, S., Patil, S.R., Paschapur, M.S., Formulation, evaluation of mouth dissolving tablets of fenofibrate using sublimation technique, *Int J Chem Tech Res*, **2009,** 1(4), 840-850
[36] Bi, Y.X., Sunada, H., Yonezawa, Y., Danjo, K., Evaluation of rapidly disintegrating tablets prepared by a direct compression method, *Drug DevInd Pharm*.,**1999**, 25, 571-581
[37] Nayak, A.K., Manna, K., Current developments in orally disintegrating tablet technology,*J Pharm Educ Res*, **2011,** 2(1), 21-34
[38] Prajapati, B., Ratnakar, N., A Review on recent patents on fast dissolving drug delivery system, *Int. J. PharmTech Res*., **2009,** 1(3), 790-798
[39] Saroha, K., Mathur, P., Verma, S., Syan, N., Kumar, A., Mouth dissolving tablets: An overview on future compaction in oral formulation technologies, *Der Pharmacia Sinica.*,**2010,** 1(1),179-187
[40] Mangal, M., Thakral, S., Goswami, M., Ghai, T., Superdisintegrants: An Update Review, *Int. J. of Pharmacy and Pharma. Science and Research*, **2012**,2(2),26-35
[41] Erande, K.,Joshi, B., Mouth Dissolving Tablet: A comprehensive Review, *Int. J. of Pharma Research and Review*,**2013,**2(7),26-28
[42] Shaikh, S., Khirsagar, R.V., Quazi, A.,Fast Disintergating Tablets an overview of formulations and technologies,*Int. J of Pharmacy and Pharma Sci*,**2010,** 2(3), 9-11
[43] Chaudhari, P.D., Chaudhari, S.P., Lanke, S.D., Patel, N., Formulation and in vitro evaluation of taste masked orodispersible dosage form of Levocetirizine dihydrochloride, *Indian J. Pharma Education and Research*,**2007,** 41(4), 319-327
[44] Khemariya, P., et al, Preparation and evaluation of mouth dissolving tablets of meloxica, *Int. J. Drug Delivery*, **2010,** 2(1), 76-9
[45] Habib, W., Khankari, R., Hontz, J., Fast-dissolving drug delivery systems, critical reviews in therapeutics, *Drug Carrier Systems*, ,**2000**,17(1), 61-72
[46] Seager, H., Drug delivery products and Zydis fast dissolving dosage form, *J. Pharm. Phamacol.*, **1998**, 50, 375-382
[47] Kuchekar, B.S., Badhan, A.C., Mahajan, H.S., Mouth dissolving tablets: A novel drug delivery system, *Pharma Times*, **2003**, 35,7-9
[48] Gavaskar,B., Kumar, S.V., Sharan, G., Nagaraju, M., Rao, Y. M., Present investigations and future prospects of oral disintegrating tablets: A Review, *Int J PharmaSci and Res*, **2010,** 1(8),14-28
[49] Chang, R.K., Guo, X., Burnside, B.A.,Couch ,R., Fast Dissolving Tablet., *Pharma Tech*,**2000,**24(6), 52-58
[50] U.S. Patent No. 6,024,981 (issued Feb. 15, **2000**).
[51] U.S. Patent.No.5, 178,878 (issued Jan. 12, **1993**).