FAST DISSOLVING TABLETS: A NOVEL APPROACH TO ENHANCE THE BIOAVAILABILITY OF POORLY SOLUBLE DRUGS

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ABSTRACT

Fast disintegrating tablets (FDTs) have received ever-increasing demand during the last decade, and the field has become a rapidly growing area in the pharmaceutical industry. Oral drug delivery remains the preferred route for administration of various drugs. Recent developments in the technology have prompted scientists to develop FDTs with improved patient compliance and convenience. Upon introduction into the mouth, these tablets dissolve or disintegrate in the mouth in the absence of additional water for easy administration of active pharmaceutical ingredients. The popularity and usefulness of the formulation resulted in development of several FDT technologies. FDTs are solid unit dosage forms, which disintegrate or dissolve rapidly in the mouth without chewing and water. FDTs or orally disintegrating tablets provide an advantage particularly for pediatric and geriatric populations who have difficulty in swallowing conventional tablets and capsules. This review describes various ideal properties, characteristics, challenges in formulation, suitability of drug candidates, various technologies developed for FDT, patented technologies, evaluation methods and various marketed products.

KEYWORDS: Fast dissolving tablets, Oral route, Excipients, Superdisintegrants.

INTRODUCTION

Oral routes of drug administration have wide acceptance up to 50-60% of total dosage forms. Solid dosage forms are popular because of ease of administration, accurate dosage, self-medication, pain avoidance and most importantly the patient compliance. The most popular solid dosage forms are being tablets and capsules; one important drawback of this dosage forms for some patients, is the difficulty to swallow.[1] Drinking water plays an important role in the swallowing of oral dosage forms. Often times people experience inconvenience in swallowing conventional dosage forms such as tablet when water is not available, in the case of the motion sickness (kinetosis) and sudden episodes of coughing during the common cold, allergic condition and bronchitis. For these reason, tablets that can rapidly dissolve or disintegrate in the oral cavity have attracted a great deal of attention. Fast Dissolving tablets are not only indicated for people who have swallowing difficulties, but also are ideal for active people.[2]

Ideal Properties of Fast Dissolving Tablets

1. A Fast Dissolving Tablets should be dissolve or disintegrate in the mouth (in saliva) within seconds.
2. It should not require any liquid or water to show its action.[3]
3. Be compatible with taste masking and Have a pleasing mouth feel.
4. Be portable without fragility concern.
5. The excipients should have high wettability, and the tablet structure should also have a highly porous network.
6. It should not leave minimal or no residue in the mouth after oral administration of the tablet.
7. It should be less effective by environmental conditions like humidity, temperature etc.
8. More rapid drug absorption from the pre-gastric area i.e. mouth, pharynx and oesophagus which may produce rapid onset of action.[4,5]
9. Be adaptable and amenable to existing processing and packaging machinery.
10. Allow the manufacture of tablets using conventional processing and packaging Equipments at low cost.[6]
11. Allow high drug loading.
12. Have sufficient strength to withstand the rigors of the manufacturing process and post manufacturing handling.

Limitations of Fast Dissolving Tablets:[7-9]

a. The tablets usually have insufficient mechanical strength. So, careful handling is required.
b. The tablets may leave unpleasant taste and/or grittiness in mouth if not formulated properly.
c. Drugs with relatively larger doses are difficult to formulate into Fast Dissolving Tablets. e.g. Antibiotics like amoxicillin with adult dose tablet containing about 500 mg of the drug.
d. Patients who concurrently take anti-cholinergic medications may not be the best candidates for Fast Dissolving Tablets.
e. Similarly patients with Sjogren’s syndrome or dryness of the mouth due to decreased saliva production may not be good candidates for these tablet formulations.

**Salient Feature of Fast Dissolving Drug Delivery System**

1. Ease of Administration to the patient who cannot swallow.
2. No need of water to swallow the dosage form.
3. Rapid dissolution and absorption of the drug, which will produce quick onset of action.
4. Some drugs are absorbed from the mouth, pharynx and esophagus as the saliva passes down into the stomach (pre-gastric Absorption). In such cases bioavailability of drug is increased and improves clinical performance through a reduction of unwanted effects.
5. Good Mouth Feel property.
6. The risk of choking or suffocation during oral administration of conventional formulation due to physical obstruction is avoided.
7. Beneficial in cases such as motion sickness, sudden episodes of allergic attack or coughing, where an ultra rapid onset of action required.
8. An increased bioavailability, particularly in cases of insoluble and hydrophobic drugs, due to rapid disintegration and dissolution of these tablets.
10. Pre-gastric absorption can result in improved bioavailability, reduced dose and improved clinical performance by reducing side effects.
11. Pre-gastric drug absorption avoids the first-pass metabolism; the drug dose can be reduced if a significant amount of the drug is lost through the hepatic metabolism.[10]

**Criteria for Drug Selection**

a. It should not have bitter taste.
b. The dose should be less than 20 mg.
c. Molecular weight should be small to Moderate.
d. Should be of good solubility in water and saliva.
e. It should have partially non-ionized at the oral cavities p\[\text{H}\].
f. It should have ability to diffuse and partition into the epithelium of the upper GIT (log p > 1, or preferably > 2)
g. Should have extensive First pass metabolism.
h. Should have oral tissue permeability.

**Challenges in the Formulation of Fast Dissolving Tablets**

1. **Mechanical strength and disintegration time**
   Disintegration time will be delayed if the mechanical strength is strong. So a good compromise between these two parameters is always essential.

2. **Taste masking**
   Effective taste masking of the bitter drugs must be done so that the taste of the drug is not felt in the oral cavity.

3. **Mouth feel**
   The particles generated after disintegration of the mouth dissolving tablets should be as small as possible. Orodispersible tablets should leave minimal or no residue in mouth after oral administration. Moreover addition of flavors and cooling agents like menthol improves the mouth feel.

4. **Sensitivity to environmental conditions**
   Orodispensible tablets generally should exhibit low sensitivity to environment conditions such as humidity and temperature.

5. **Cost**
   The technology adopted for a mouth dissolving tablets should be acceptable in terms of cost of the final product.

**Need for Development of Fast Dissolving Tablets**

The need for non-invasive delivery systems persists due to patient’s poor acceptance and compliance with existing delivery regimes, limited market size for drug companies and drug uses, coupled with high cost of disease management.

**Patient factors**

Fast disintegrating dosage forms are particularly suitable for patients, who for one reason or the other; find it inconvenient to swallow traditional tablets and capsules with an 8-oz glass of water. These include the following:

1. Geriatric patients mainly suffering from conditions like hand tremors and dysphasia.
2. Pediatric patients who are unable to swallow easily because their central nervous system and internal muscles are not developed completely.
3. Traveling patients suffering from motion sickness and diarrhea that do not have easy access to water.
4. Patients with persistent nausea for a long period of time are unable to swallow. Especially cancer patients after taking their chemotherapy are too nauseous to swallow the H2 blockers, which are prescribed in order to avoid gastric ulceration.
5. Mentally challenged patients, bedridden patients and psychiatric patients.

**Effectiveness factor**

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

Manufacturing and marketing factors
As a drug nears the end of its patent life, it is common for pharmaceutical manufacturers to develop a given drug entity in a new and improved dosage form. A new dosage form allows a manufacturer to extend market exclusivity, unique product differentiation, value-added product line extension and extend patent protection, while offering its patient population a more convenient dosage form. This leads to increased revenue, while also targeting underserved and under treated patient populations.

Ingredients Commonly used for Fast Dissolving Tablets Preparation
In the formulation of Fast Dissolving Tablets the most important additives are as follows-

1. Superdisintegrants[15]
Fast Dissolving Tablet requires faster disintegration, that’s why superdisintegrants is needed in formulating Fast Dissolving Tablets. Superdisintegrant used is the one that effective at low concentration and have greater disintegrating efficiency and they are more effective intra-granularly. The problem is, it is hygroscopic therefore not used with moisture sensitive drugs. And this superdisintegrants act by swelling and due to swelling pressure exerted in the outer direction or radial direction, it causes tablet to burst or the accelerated absorption of water leading to an enormous increase in the volume of granules to promote disintegration.

Example: croscarmellose sodium, crospovidone, carmellose, carmellose calcium, sodium starch glycolate ion exchange resins (e.g. Indion 414) Sodium starch glycolate has good flowability than croscarmellose sodium. Cross povidone is fibrous nature and highly compactable.

Selection of Superdisintegrants[16]
Although superdisintegrants primarily affect the rate of disintegration, but when used at high levels they can also affect mouth feel, tablet hardness and friability. Hence, various ideal factors to be considered while selecting an appropriate superdisintegrants for a particular formulation should:

- Produce good mouth feel to the patients. Thus, small particle size is preferred to achieve patient compliance.
- Have good flow, since it improves the flow characteristics of total blend.

Mechanism of Action of Superdisintegrants[17]
The tablet breaks to primary particles by one or more of the mechanisms listed below:

- By porosity and capillary action.
- By swelling.
- Because of heat of wetting.
- Due to release of gases.
- By enzymatic action.
- Due to disintegrating particle/particle repulsive forces.
- Due to deformation.

Porosity and capillary action (Wicking)
Capillary action (fig 1) is always the first step in tablet disintegration. Suitable aqueous medium into which tablet is placed, penetrates into the tablet and replaces the air adsorbed on the particles there by weakens the intermolecular bond and breaks the tablet into fine particles. Water uptake by tablet depends upon hydrophilicity of the drug /excipients and on tableting conditions. For these types of disintegrants maintenance of porous structure and low interfacial tension towards aqueous fluid is necessary which helps in disintegration by creating a hydrophilic network around the drug particles.

![Fig 1: Porosity and capillary action (Wicking)](image_url)
(Disintegrant pull water into the pores and reduces the physical bonding forces between the particles)

Swelling
The general mechanism of action for tablet disintegration is swelling. Tablets with high porosity show poor
disintegration due to lack of adequate swelling force. On the other hand, sufficient swelling force is exerted in the tablet with low porosity. It is worthwhile to note that if the packing fraction is very high, fluid is to penetrate in the tablet and disintegration is again slows down.

![Fig: 2: Swelling of Granules due to Superdisintegrants](image)

Swelling index of the superdisintegrants is commonly studied in simulated saliva. Volume occupied by the material at the end of 4 h should be noted and swelling index is calculated by the formula.

\[
\text{Swelling Index} = \left(\frac{\text{Final volume} - \text{Initial volume}}{\text{Initial volume}}\right) \times 100.
\]

- **Because of heat of wetting (air expansion)**\(^{[17]}\) When disintegrants with exothermic properties gets wetted, localized stress is generated due to capillary air expansion, which helps in disintegration of tablet. This explanation, however, is limited to only a few types of disintegrants and cannot describe the action of most modern disintegrating agents.

- **Due to release of gases** Carbon dioxide released within tablets on wetting due to interaction between bicarbonate and carbonate with citric acid or tartaric acid. The tablet disintegrates due to generation of pressure within the tablet. This effervescent mixture is used when pharmacist needs to formulate very rapidly dissolving tablets or fast disintegrating tablet. As these disintegrants are highly sensitive to small changes in humidity level and temperature, strict control of environment is required during manufacturing of the tablets. The effervescent blend is either added immediately prior to compression.

- **Due to disintegrating particle/particle repulsive forces** Another mechanism of disintegrating attempts to explain the swelling of tablet made with ‘non-swellable’ disintegrants. Guyot-Hermann has proposed a particle repulsion theory (Fig 2) based on the observation that non swelling particle also cause disintegration of tablets. The electric repulsive forces between particles are the mechanism of disintegration and water is required for it. Researchers found that repulsion is secondary to wicking.

- **Due to deformation: (Elastic recovery)** Most materials, which undergo a plastic deformation during compression, try to return to their initial shape as soon as possible (stored potential energy). In the tablet matrix, there is no means to recover the former shape. But as soon as water penetrates into the tablet matrix and the forces, which keep the particles together, are diminished, those particles have the ability to expand back.

- **By enzymatic reaction** Here, enzymes present in the body act as disintegrants. These enzymes destroy the binding action of binder and helps in disintegration. Actually due to swelling, pressure exerted in the outer direction or radial direction, it causes tablet to burst or the accelerated absorption of water leading to an enormous increase in the volume of granules to promote disintegration.
In (fig 3) elastic particles are shown before compression (red). After compression, these particles are plastically deformed. After penetration of water into the tablet, these particles return back to their initial shape.

2. Taste-Masking Agents

Taste masking of drug may be achieved with preventing the exposure of drug to the tongue through processing or adding competing taste-masking agents. Exposure of solubilized drug to the oral cavity can be prevented by encapsulation in polymer systems or complexation. The approaches are as follows:

- Layering the drug onto inert beads using a binder followed by coating with a taste-masking polymer.
- Granulating the drug and coating with a taste masking polymer.
- Spray drying the drug dispersed or dissolved in a polymeric solution to get taste-masked particles.
- Complexation by the use of inclusion in cyclodextrins.
- Psychological modulation of bitterness.
- Coacervation to form microencapsulated drug within a polymer.
- Formation of pellets by extrusion spherization.

3. Sweeteners

Sucrose and other natural sweeteners, such as sorbitol, can be used in effervescent products, although artificial sweetening agents are customary. However, the application of artificial sweeteners is restricted by health regulations. Saccharin or its sodium and calcium salts are used as sweeteners.

Aspartame is also employed as a sweetener in effervescent tablets. Earlier, cyclamates and cyclamic acid were the artificial sweeteners of choice, but their use has now been restricted. Some commonly used sweeteners are:

- Sorbitol, Mannitol, Maltitol solution, Maltitol, Xylitol, Erythritol, Sucrose, Fructose, Maltose, aspartame, Glycerin, sugars derivatives etc.

4. Binders

- Main role of Binders is to keep the composition of these fast melting tablets together during the compression stage.
- Binders can either be liquid, semisolid, solid or mixtures of varying molecular weights such as polyethylene glycol.
- The right selection of a binder or combination of binders is essential to maintain the integrity and stability of the tablet.
- The temperature of the excipient should be preferably around 30–35°C for faster melting properties.
- Further, its incorporation imparts smooth texture and disintegration characteristics to the system.

Example: Binders commonly used are cellulose polymers such as ethyl cellulose, hydroxypropylcellulose (HPC) and hydroxypropylmethylcellulose (HPMC), alone or in admixtures povidones, polyvinyl alcohols and acrylic polymers.

Acrylic polymers used are the ammoniomethacrylate copolymer, polyacrylate and polymethacrylate. Among the cellulose.
5. **Antistatic Agent**

An antistatic agent is a compound used for treatment of materials or their surfaces in order to reduce or eliminate buildup of static electricity generally caused by the triboelectric effect. An additional thickening agent, generating a stabilized suspension, is added to avoid settling of the particles and moreover provide a pleasant mouth feeling.

Example: colloidal silica (Aerosil), precipitated silica (Sylod.FP244), micronized or non micronized talc, maltodextrins, beta-cyclodextrins, etc. Magnesium stearate, stearic acid, sodium stearyl fumarate, micronized polyoxyethylene glycol (micronized Macrogol 6000), leucine, sodium benzoate are used as lubricant.

6. **Lubricants**

Lubricants remove grittiness and assist in the drug transport mechanism from the mouth down into the stomach.

Example: Magnesium stearate, stearic acid, leucine, sodium benzoate, talc, magnesium lauryl sulphate, liquid paraffin etc.

7. **Flavours**

Example: Peppermint flavour, clove oil, anise oil, eucalyptus oil. Flavoring agents include, vanilla, citrus oils, fruit essences etc.

8. **Fillers**

Example: Directly compressible spray dried Mannitol, Sorbitol, xylitol, calcium carbonate, magnesium carbonate, calcium phosphate, pregelatinized starch, magnesium trisilicate, aluminium hydroxide etc.

9. **Surface Active Agents**

Example: sodiumdocylsulfate, sodiumlaurylsulfate, Tweens, Spans, polyoxyethylene stearate.

**Formulation Methodology Employed For Fast Dissolving Tablets**

**Conventional Technologies**

**Freeze Drying or Lyophilization**[^15]

A process, in which water is sublimated from the product after freezing, is called freeze drying. Freeze dried forms offer more rapid dissolution than other available solid products. Lyophilization can be used to prepare tablets that have very porous open matrix network into which saliva rapidly moves to disintegrate lyophilized mass after it is placed in mouth. Apart from the matrix and active constituents, the final formulation may contain other excipients, which improve the process characteristics or enhance the quality of final product. These include suspending agents, wetting agents, preservatives, antioxidants, colors and flavors. The preferred drug characteristics for freeze drying formulations are water insoluble, low dose, chemically stable, small particle size and tasteless.

**Advantage**

Pharmaceutical substances can be processed at non elevated temperature, thereby eliminating adverse thermal effects.

**Disadvantage**

(i) Due to high cost of equipments lyophillization is relatively expensive and time consuming manufacturing process.

(ii) Fragility, which make the use of conventional packing difficult and poor stability during storage under stressful condition.^[18, 19]

**Sublimation[^17]**

This process involves addition of some inert volatile substances like urea, urethane, naphthalene, camphor, etc to other excipients and the compression of blend into tablet. Removal of volatile material by sublimation creates pores in tablet structure, due to which tablet dissolves when comes in contact with saliva. Additionally several solvents like cyclohexane, benzene etc can also be used as pore forming agents. Fast dissolving tablets with highly porous structure and good mechanical strength have been developed by this method.

**Spray Drying[^15]**

A highly porous and fine powder is prepared by spray drying an aqueous composition containing support matrix and other components. This is then mixed with active ingredient and compressed into tablet.

The formulations contained hydrolyzed and unhydrolyzed gelatin as a supporting agent for the matrix, mannitol as a bulking agent and sodium starch glycocolate/croscarmellose as a disintegrant. Disintegration and dissolution were further enhanced by adding an acid (e.g. citric acid) or an alkali (e.g., sodium bicarbonate). The suspension of above excipients was spray-dried to yield a porous powder which was compressed into
Tablets. Tablets manufactured by this method disintegrated in < 20 sec. in an aqueous medium.

**Principle of the Spray-Drying**

**Moulding**
Molded tablets are prepared by using water soluble ingredients so that the tablets dissolve completely and rapidly. The powder blend is moistened with a hydro-alcoholic solvent and is molded into tablets under pressure lower than that used in conventional tablet compression. The solvent is then removed by air drying.

**Advantage**
(i) moulded tablets possess porous structure, which facilitates rapid disintegration and easy dissolution.
(ii) Moulded tablets offer improved taste due to water-soluble sugars present in dispersion matrix.

**Disadvantage**
But moulded tablets lack good mechanical strength and can undergo breakage or erosion during handling and opening of blister packs. However, adding sucrose, acacia or polyvinyl pyrrolidone can increase mechanical strength.

** Compression moulding:** The powder mixture previously wetted with a solvent like ethanol/water is compressed into mould plates to form a wetted mass.

**Heat moulding:** A molten matrix in which drug is dissolved or dispersed can be directly moulded into Fast Dissolving Tablets.

**No vacuum Lyophilization:** This process involves evaporation of solvent from a drug solution or suspension at a standard pressure.

**Mass Extrusion**
In this technique, a blend of active drug and other ingredients is softened using solvent mixture of water soluble polyethylene glycol, using methanol and then the softened mass is extruded through the extruder or syringe to get a cylinder of product, which is finally cut into even segments with the help of heated blades to get tablets. The dried cylinder can be used to coat the granules of bitter tasting drugs and thereby masking their bitter taste.

**Nanonization**
In this process, the particles of the drug are reduced in size to nanoparticles by milling the drug in the proprietary wet milling process. The agglomeration can be prevented by surface adsorption of the nanocrystals. These are then compressed and changed into a tablet. This technique is very useful for less water soluble drugs. The bioavailability of the drug is increased as the disintegration time is reduced to a significant extent.

**Patented Technologies For Preparing Fast Dissolving Tablets**
The main patented technologies for Fast dissolving tablets are as follows-

**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. When zydis units are put into the mouth, the freeze dried structure disintegrated instantaneously and does not require water to aid swallowing. The zydis matrix is composed of many materials designed to achieve a number of objectives. To impart strength during handling, polymers such as gelatin, dextran or alginites are incorporated. These form a glossy amorphous structure, which imparts strength. To obtain crystallinity, elegance and hardness, saccharides such as mannitol or sorbitol are incorporated. Water is used in the manufacturing process to ensure production of porous units to achieve rapid disintegration. Various gums are used to prevent sedimentation of dispersed drug particles in the
manufacturing process. Collapse protectants such as glycines prevent the shrinkage of zydis units during freeze drying process or long term storage. Zydis products are packed in blister packs to protect the formulation from moisture in the environment.[24,25]

**Orasolv Technology**
Orasolv technology has been developed by “CIMA” labs. This technology involves taste masking of active drug. Effervescent disintegrating agent is also used. Conventional blenders and tablet equipments are used for preparation of tablets. Less force of compaction is used for manufacturing to obtain soft and quickly disintegrating tablets. There is a limitation of this technology that soft and fragile tablets are formed, therefore needed to be packed in specially designed pick and place package system.

**DuraSolv Technology**
DuraSolv is Cimas second-generation fast-dissolving/disintegrating tablet formulation. This is one of the suitable technologies to prepare products requiring low amounts of active drug. This technology uses drug, fillers and a lubricant to prepare the tablet. Conventional tableting equipment is used to prepare the tablet. Due to higher force of compaction used, tablets prepared are rigid. Dosage form can be packaged into conventional packaging system like blisters.[26]

**Wowtab Technology**
Wowtab Technology is patented by Yamanouchi Pharmaceutical Co. WOW means “Without Water”. The active ingredients may constitute upto 50% w/w of the tablet. In this technique, saccharides of both low and high mouldability are used to prepare the granules. Mouldability is the capacity of a compound to be compressed. Highly mouldable substance has high compressibility and thus shows slow dissolution. The combination of high and low mouldability is used to produce tablets of adequate hardness. Active ingredients are mixed with low mouldability saccharides and then granulated with high mouldability saccharides and then compressed into tablet. The Wowtab product dissolves quickly in 15 s or less. Wowtab product can be packed in both into conventional bottle and blister packs.[27]

**Flash dose Technology**
Flash dose technology has been patented by Fuisz. Nurofen meltlet, a new form of Ibuprofen as melt-in-mouth tablets. Flash dose tablets consist of self binding shear form matrix termed as “floss”. Shear form matrices are prepared by flash heat processing.[28]

**Flashtab Technology**
The Flashtab technology is yet another fast dissolving/disintegrating tablet formulation. Prographarm laboratories have patented the Flashtab technology. It utilizes most of the same excipients as in conventional compressed tablets. A disintegrating agent and a swelling agent are used in combination with coated drug particles in this formulation to produce a tablet that disintegrates in the mouth in less than one minute.[29]

**OraQuick**
KV Pharmaceutical claims its microsphere technology, known as MicroMask, has superior mouth feel over taste-masking alternatives. The taste masking process does not utilize solvents of any kind and therefore leads to faster and more efficient production. Also, lower heat of production than alternative fast-dissolving/disintegrating technologies makes OraQuick appropriate for heat-sensitive drugs. KV Pharmaceutical also claims that the matrix that surrounds and protects the drug powder in microencapsulated particles is more pliable, meaning tablets can be compressed to achieve significant mechanical strength without disrupting taste masking. OraQuick claims quick dissolution in a matter of seconds, with good taste-masking. There are no products using the OraQuick technology currently on the market, but KV Pharmaceutical has products in development such as analgesics, scheduled drugs, cough and cold, psychotropics and anti-infectives.[30]

**Pharmaburst Technology**
Pharmaburst™ is a “Quick Dissolve” delivery system patented by SPI Pharma. Pharmaburst is a co-processed excipient system with specific excipients, which allows rapid disintegration and low adhesion to punch faces mouladibility saccharine are used to obtain rapid melting strong tablet. The active ingredient mixes with low mouldability saccharides.[30]

**Nanocrystal Technology**
For fast disintegrating tablets, Elan’s 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 in dissolution rate. This can be accomplished predictably and efficiently using Nanocrystal technology. Nanocrystal particles are small particles of drug substance, typically less than 1000 nanometers (nm) in diameter, which are produced by milling the drug substance using a proprietary wet milling technique.

Nanocrystal Fast dissolving technology provides for:
- Pharmacokinetic benefits of orally administered nanoparticles (<2 microns) in the form of a rapidly disintegrating tablet matrix.
- Product differentiation based upon a combination of proprietary & patent-protected technology elements.
- Cost-effective manufacturing processes that utilize conventional, scalable unit operations.
- Exceptional durability, enabling use of conventional packaging equipment & formats (bottles &/or blisters).
- Wide range of doses (up to 200mg of API per unit).
- Use of conventional, compendial inactive components.
- Employment of non-moisture sensitive in-actives.
Nanocrystal colloidal dispersions of drug substance are combined with water-soluble GRAS (Generally Regarded as Safe) ingredients, filled into blisters and lyophilized. The resultant wafers are remarkably robust, yet dissolve in very small quantities of water in seconds. This approach is especially attractive when working with highly potent or hazardous materials because it avoids manufacturing operations (e.g., granulation, blending and tableting) that generate large quantities of aerosolized powder and present much higher risk of exposure. The freeze-drying approach also enables small quantities of drug to be converted into FDT dosage forms because manufacturing losses are negligible.\cite{31,32}

**Preformulation Studies Fast Dissolving Tablet\cite{35}\**

Preformulation study relates to pharmaceutical and analytical investigation carried out preceding and supporting formulation development efforts of the dosage form of the drug substance. Preformulation yields basic knowledge necessary to develop suitable formulation for the toxicological use. It gives information needed to define the nature of the drug substance and provide framework for the drug combination with pharmaceutical excipients in the dosage form. Hence, the following preformulation studies were performed on the obtained sample of drug.

**Bulk Density (D_b)**

It is the ratio of total mass of powder to the bulk volume of powder. It is expressed in g/ml. This was determined by pouring an accurately weighed quantity of blend into a graduated cylinder and then the volume and weight was measured.

\[
D_b = \frac{M}{V_b}
\]

Where, Bulk density = \(D_b\), Weight of powder = \(M\) and Volume of packing = \(V_b\).

**Tapped Density (D_t)**

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

\[
D_t = \frac{M}{V_t}
\]

Where, \(M\) is the mass of powder and \(V_t\) is the tapped volume of the powder.

**Compressibility**

The compressibility index (Carr’s Index) was determined by using following equation,

\[
\text{Carr’s Index} = \left[ \left( D_t - D_b \right) \times 100 \right] / D_t
\]

Where, \(D_t\) is the tapped density of the powder and \(D_b\) is the bulk density of the powder.

**Angle of Repose (q)**

The friction forces in a loose powder can be measured by the angle of repose (q). It is an indicative of the flow properties of the powder. It is defined as maximum angle possible between the surface of the pile of powder and the horizontal plane.

The angle of repose was determined by the funnel method. The accurately weighed powder was taken in a funnel. The height of a funnel was adjusted in such a way that its tip just touches the apex of the heap of the powder. The powder was allowed to flow through funnel freely onto the surface. The diameter of the powder heap was measured and angle of repose was calculated using following equation,

\[
tan(\theta) = \frac{h}{r}
\]

\[
\theta = \tan^{-1} \left( \frac{h}{r} \right)
\]

Where, \(\theta\) is the angle of repose is the height in cms \(r\) is the radius in cms.

The powder mixture was allowed to flow through the funnel fixed to a stand at definite height (h). The angle of repose was then calculated by measuring the height and radius of the heap of powder formed. Care was taken to see that the powder particlals slip and roll over each other through the sides of the funnel.

**Relationship between angle of repose and powder flow property.**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Angle of repose (°)</th>
<th>Type of flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;20</td>
<td>Excellent</td>
</tr>
<tr>
<td>2</td>
<td>20 – 30</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>30 – 34</td>
<td>Passable</td>
</tr>
<tr>
<td>4</td>
<td>&gt;34</td>
<td>Very poor</td>
</tr>
</tbody>
</table>

**Drug Excipient Compatibility Study**

This study was carried out to detect any changes on chemical constitution of the drug after combined it with the excipients. Compatibility of the drug with excipients was determined by FT-IR spectral analysis.

**Evaluation of Fast Dissolving Table\cite{36-39}\**

**General Appearance**

The general appearance of a tablet, its visual identity and overall “elegance” is essential for consumer acceptance. Includes in are tablet’s size, shape, colour, presence or absence of an odour, taste, surface texture, physical flaws and consistency and legibility of any identifying marking.

**Hardness**

Hardness or tablet crushing strength (fc), the force required to break a tablet in a diametric compression was measured using Monsanto tablet hardness tester. It is expressed in Kg/cm².
Friability (F)
Friability is the loss of weight of tablet in the container due to removal of fine particles from the surface. Friability test is carried out to access the ability of the tablet to withstand abrasion in packaging, handling and transport.

Friability of the tablets was determined using Roche friabilator at 25 rpm/min for 4 min. This device subjects the tablet to the combined effect of abrasion and shock in a plastic chamber revolving at 25 rpm and dropping a tablet at 1 height of 6 inches in each revolution. Preweighed sample of tablets was placed in the friabilator and were subjected to the 100 revolutions. Tablets were dusted using a soft muslin cloth and reweighed. Twenty tablets were weighed and loss in weight (%) was calculated. The friability (F) is given by the formula,

\[ \% \text{ Friability} = \left( \frac{W_1 - W_2}{W_1} \right) \times 100 \]

Where, \( W_1 = \) Weight of tablet before test, \( W_2 = \) Weight of tablet after test

In - Vivo Disintegration Test
The time for disintegration of ODTs is generally < 1 min and actual disintegration time that patience can experience ranges from 5 to 30 s. The standard procedure are that the test was carried out on 6 tablets using the apparatus specified in I.P. -1996 distilled water at 37°C ± 2°C was used as a disintegration media and the time in second is taken for complete disintegration of the tablet with no palatable mass remaining in the apparatus was measured in seconds.

Wetting Time
Wetting time corresponds to the time taken for complete disintegration of the tablet to the hydrophilicity of the excipient. The Washburn Equation, (Washburn, 1921), is one of the most common equations for describing liquid penetration into porous solids. It states that the liquid penetration rate is directly proportional to that pore radius and is affected by the hydrophilicity of the powders, the liquid surface tension (i), the cosine of the contact angle θ and inversely proportional to the liquid viscosity (h).

\[ \frac{dx}{dt} = \frac{r \cos \theta}{2h} \]

Where \( x \) being the liquid penetration distance, thus \( x^2 \) the liquid penetration area, \( r \) is the capillary radius, \( i \) is the surface tension, \( h \) is the liquid viscosity, \( t \) is the time and \( \theta \) is the contact angle. It is obvious that pores size becomes smaller and wetting time increases with an increase in compression force or a decrease in porosity.

A linear relationship exists between wetting time and disintegration time. Thus wetting is the important step for disintegration process to take place. A piece of tissue paper folded double was placed in a Petri plate (internal diameter is 6.5 cm) containing 6 mL of water. The tablet was placed on the paper and the time for complete wetting of the tablet was measured in seconds. The method was slightly modified by maintaining water at 37°C.

Wetting Time and Water Absorption Ratio
A piece of tissue paper folded twice was placed in a small culture dish (i.d. = 6.5 cm) containing 6 ml of water. A tablet was placed on the paper and the time for complete wetting was measured. The wetted tablet was again weighed. Water absorption ratio, \( R \), was calculated using the formula;

\[ R = 100 \left( \frac{W_a - W_b}{W_b} \right) \]

Where, \( W_a \) and \( W_b \) are the weight after and before water absorption, respectively.

Drugs that Formulated into Fast Dissolving Drug Delivery Systems

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibacterial Agent</td>
<td>Ciprofloxacin, Tetracycline, Erythromycin, Rifampicin, Penicillin, Doxycyclin, Nalidixic Acid, Trimethoprim, Sulphacetamide, Sulphadiazine etc.</td>
</tr>
<tr>
<td>Anti Helminthics</td>
<td>Albendazole, Mebendazole, Thiabendazole, Livermectin, Praziquantel, Pyantel Embonate, Dichlorophen etc.</td>
</tr>
<tr>
<td>Anti Depressants</td>
<td>Trimipramine Maleate, Nortrypioline HCL, Trazodone HCL, Amoxapine, Mianserin HCL, etc.</td>
</tr>
<tr>
<td>Anti Diabetics</td>
<td>Glibenclamide, Glipizide, Tolbutamid, Tolazamide, Gliclazide, Chlorpropamide etc.</td>
</tr>
<tr>
<td>Analgeses/Anti-inflammatory agents</td>
<td>Diclofenac Sodium, Ibuprofen, Ketoprofen, Mefenamic Acid, Naproxen, Oxyphenbutazone, Indomethacin, Piroxicam, Phenylbutazone etc.</td>
</tr>
<tr>
<td>Anti Hypertensive’s</td>
<td>Amoldipine, Carvedilol, Diltiazem, Felodipine, Minoxidil, Nifedipine, Prazosin HCL, Nimodipine, Terazosin HCL etc.</td>
</tr>
<tr>
<td>Anti Arrhythmics</td>
<td>Disopyramide, Quinidine Sulphate, Amiodarone HCL etc.</td>
</tr>
<tr>
<td>Anti Histineamines</td>
<td>Acrivastine, Cetrizone, Cininarzine, Loratadine, Fexofenadine, Triprolidine etc.</td>
</tr>
<tr>
<td>Anxiolytics, Sedatives, Hypnotics and Neuroleptics</td>
<td>Alprazolam, Diazepam, Clozapine, Amyloharbitone, Lorazepam, Haloperidol, Nitraze, Midazolam, Phenoarbitone, Thioridazine, Oxazepam, etc.</td>
</tr>
<tr>
<td>Diuretics</td>
<td>Acetazolamide, Clothiazide, Amiloride, Furosemide, Spironolactone, Bumetanide, Erthacrynic Acid, etc</td>
</tr>
<tr>
<td>Gastro-intestinal agents</td>
<td>Cinetidine, RanitidineHCL, Famotidine, Domperidone, Omperazol, Ondasetron HCL etc.</td>
</tr>
<tr>
<td>Corticosteroids</td>
<td>Betamethasone, Beclomethasone, Hydrocortison, Prednisolone, Methyl Prednisolone etc.</td>
</tr>
<tr>
<td>Anti Protozoal Agents</td>
<td>Mepronidazole, Tinidazole, Omidazole, Benzimidazole etc.</td>
</tr>
</tbody>
</table>
A Promising Future in Fast Dissolving Drug Delivery System (FDDS)[41,42]
Most of products are available in the same strengths as traditional dosage forms. There are not commercially available fast dissolving drug products for all our patient needs. Pharmacist may wish to consider compounding as a unique way to treat the unmet needs of individual patients. Pharmacists have been altered to exercise additional care when dispensing new prescription for this kind of drug delivery. More products need to be commercialized to use this system properly. Special In vitro and In vivo test methods to study the performance of these products are required.

Future challenges[43,41]
Fast dissolving intraoral products face many challenges as given below, these challenges are related to new technologies and products as they mature.

Table -List of Marketed Fast Dissolving Systems[44]

<table>
<thead>
<tr>
<th>S.No</th>
<th>Trade Name</th>
<th>Active Drug</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Allegra ODT</td>
<td>Fexofenidine</td>
<td>Sanofi Aventis</td>
</tr>
<tr>
<td>3.</td>
<td>Aricept ODT</td>
<td>Donepezil</td>
<td>Eisai Co.</td>
</tr>
<tr>
<td>4.</td>
<td>Alavert Quick Dissoving Tablets</td>
<td>Loratidine</td>
<td>Wyeth</td>
</tr>
<tr>
<td>5.</td>
<td>Bendryl Fastmelt</td>
<td>Diphenydramine &amp; Pseudoephedrine</td>
<td>Warner Lambert, NY, USA.</td>
</tr>
<tr>
<td>6.</td>
<td>Claritin Redi Tab</td>
<td>Loratidine</td>
<td>Schering Plough Corp., USA.</td>
</tr>
<tr>
<td>7.</td>
<td>Cibalginia Duefast</td>
<td>Ibuprofen</td>
<td>Eurand International</td>
</tr>
<tr>
<td>8.</td>
<td>Clarinex Reditabs</td>
<td>Desloratidine</td>
<td>Scheung-Plough</td>
</tr>
<tr>
<td>9.</td>
<td>Clonazepam ODT</td>
<td>Clonazepam</td>
<td>Par Pharmaceutical</td>
</tr>
<tr>
<td>10.</td>
<td>Fazaclo</td>
<td>Clozapine</td>
<td>Azurpharma</td>
</tr>
<tr>
<td>11.</td>
<td>Febrectol</td>
<td>Paracetamol</td>
<td>Prographarm, Chateauneuf, France</td>
</tr>
<tr>
<td>12.</td>
<td>Felden Fast Melt</td>
<td>Piroxicam</td>
<td>Pfizer Inc., NY, USA</td>
</tr>
<tr>
<td>15.</td>
<td>Klonopin Wafers</td>
<td>Clonazepam</td>
<td>Roche</td>
</tr>
<tr>
<td>16.</td>
<td>Maxalt MLT</td>
<td>Rizatriptan</td>
<td>Merck And Co., NJ,USA.</td>
</tr>
<tr>
<td>17.</td>
<td>Nurofen Flash Tab</td>
<td>Ibuprofen</td>
<td>Ethypharm</td>
</tr>
<tr>
<td>18.</td>
<td>Olanex Instab</td>
<td>Olanzapine</td>
<td>Ranbaxy Lab,Ltd.New Delhi, India.</td>
</tr>
<tr>
<td>19.</td>
<td>Propulsid Quicksolv</td>
<td>Cispride Monohydrate</td>
<td>Janssen Pharmaceuticals</td>
</tr>
<tr>
<td>20.</td>
<td>Pepcid RPD</td>
<td>Famotidine</td>
<td>Merck And Co., NJ, USA.</td>
</tr>
<tr>
<td>S.No</td>
<td>Name of the Drug</td>
<td>Category</td>
<td>Reason for formulation into Fast Dissolving System</td>
</tr>
<tr>
<td>------</td>
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<td>----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Aceclofenac</td>
<td>Non steroidal anti-inflammatory</td>
<td>To improve the patient compliance without compromising the therapeutic efficacy</td>
</tr>
<tr>
<td>2</td>
<td>Aceclofenac</td>
<td>Non-steroidal anti-inflammatory</td>
<td>To show the effect of various superdisintegrants on the disintegration time and drug release rate.</td>
</tr>
<tr>
<td>3</td>
<td>Aceclofenac</td>
<td>Non-Steroidal anti-inflammatory</td>
<td>To enhance safety and efficacy, better compliance, solve the problem of difficulty in swallowing, enhance onset of action provide stable dosage form.</td>
</tr>
<tr>
<td>4</td>
<td>Aceclofenac</td>
<td>Non-Steroidal anti-inflammatory</td>
<td>To enhance dissolution rate.</td>
</tr>
<tr>
<td>5</td>
<td>Aceclofenac</td>
<td>Non-Steroidal anti-inflammatory</td>
<td>To improve solubility, dissolution rate and bioavailability.</td>
</tr>
<tr>
<td>6</td>
<td>Aceclofenac</td>
<td>Non-Steroidal anti-inflammatory</td>
<td>To enhance better patient compliance, and onset of action.</td>
</tr>
<tr>
<td>7</td>
<td>Aceclofenac</td>
<td>Non-Steroidal anti-inflammatory</td>
<td>To investigate the effect of different concentration of</td>
</tr>
<tr>
<td>8</td>
<td>Aceclofenac</td>
<td>Non-Steroidal anti-inflammatory</td>
<td>To increase the drug release profile in short duration of time.</td>
</tr>
<tr>
<td>9</td>
<td>Aceclofenac</td>
<td>Non-Steroidal anti-inflammatory</td>
<td>To investigate the effect of a natural superdisintegrant and synthetic superdisintegrants by comparing the formulations</td>
</tr>
<tr>
<td>10</td>
<td>Aceclofenac</td>
<td>Non-steroidal anti-inflammatory</td>
<td>To study the effect of functionality differences of superdisintegrants on tablet properties and to provide information on storage conditions of these tablets.</td>
</tr>
<tr>
<td>11</td>
<td>Aceclofenac</td>
<td>Non-steroidal anti-inflammatory drug</td>
<td>To improve the dissolution of aceclofenac through the formulation of mouth-dissolving tablets with appropriate mechanical strength, which would disintegrate in oral cavity, in less than 30 seconds, and would provide immediate relief from pain due to its faster dissolution in gastrointestinal tract.</td>
</tr>
<tr>
<td>12</td>
<td>Alfuzosin</td>
<td>Alpha adrenoceptor blocker</td>
<td>For rapid disintegration and dissolution characteristics with increased bioavailabilty</td>
</tr>
<tr>
<td>13</td>
<td>Alfuzosin Hydrochloride</td>
<td>Alpha adrenoceptor blocker</td>
<td>To enhance patient compliance</td>
</tr>
<tr>
<td>#</td>
<td>Drug Name</td>
<td>Category / Description</td>
<td>Methodology</td>
</tr>
<tr>
<td>----</td>
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<td>-------------------------------------------------</td>
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<tr>
<td>14</td>
<td>Amlodipine</td>
<td>Anti-anginal</td>
<td>Direct compression and sublimation methods</td>
</tr>
<tr>
<td>15</td>
<td>Atenolol</td>
<td>Anti hypertensive</td>
<td>Effervescent method, direct compression</td>
</tr>
<tr>
<td>16</td>
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<td>Anti-hypertensive</td>
<td>Direct compression</td>
</tr>
<tr>
<td>17</td>
<td>Atenolol</td>
<td>Anti hypertensive</td>
<td>Direct compression, sublimation method</td>
</tr>
<tr>
<td>19</td>
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<td>Anti hypertensive</td>
<td>Direct compression , sublimation</td>
</tr>
<tr>
<td>20</td>
<td>Azithromycin</td>
<td>Antibiotic</td>
<td>Direct compression, wet granulation</td>
</tr>
<tr>
<td>21</td>
<td>Baclofen</td>
<td>Centrally acting skeletal muscle relaxant</td>
<td>Direct compression</td>
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<tr>
<td>22</td>
<td>Carbamazepine</td>
<td>Anti-depressant</td>
<td>Direct compression</td>
</tr>
<tr>
<td>23</td>
<td>Carbamazepine</td>
<td>Tricyclic antidepressants</td>
<td>Wet granulation method</td>
</tr>
<tr>
<td>No.</td>
<td>Drug Name</td>
<td>Category</td>
<td>Objective</td>
</tr>
<tr>
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<tr>
<td>24</td>
<td>Carbamazepine</td>
<td>Anti-Depressant</td>
<td>To study the effect of various carriers on Solid Dispersion Technique</td>
</tr>
<tr>
<td>25</td>
<td>Cefixime</td>
<td>Cephalosporin antibiotic</td>
<td>To formulate mouth dissolve tablet that disintegrate rapidly in mouth and formulate tasteless complex of drug cefixime.</td>
</tr>
<tr>
<td>26</td>
<td>Cetrizine HCL</td>
<td>Non-sedative anti histamine</td>
<td>To formulate mouth dissolving tablets that have quick onset of action, not require water for swallowing of the tablet, less disintegration and dissolution time, hence providing faster relief to the patient.</td>
</tr>
<tr>
<td>27</td>
<td>Cetrizine dihydrochloride</td>
<td>Anti histaminic</td>
<td>To prepare mouth dissolving tablets of cetrizine in the oral cavity with enhanced dissolution rate and hence, improved patient compliance.</td>
</tr>
<tr>
<td>28</td>
<td>Celecoxib</td>
<td>Non steroidal anti-inflammatory</td>
<td>To improve the dissolution rate</td>
</tr>
<tr>
<td>29</td>
<td>Chlorpromazine HCL</td>
<td>Anti-emetic</td>
<td>To enhance the dissolution rate</td>
</tr>
<tr>
<td>30</td>
<td>Chlorthalidone</td>
<td>Anti- hypertensive</td>
<td>To improve its dissolution rate and bioavailability.</td>
</tr>
<tr>
<td>Page</td>
<td>Drug</td>
<td>Description</td>
<td>Method</td>
</tr>
<tr>
<td>------</td>
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<tr>
<td>31</td>
<td>Cinnarizine</td>
<td>H1 receptor antagonist</td>
<td>Mouth dissolving tablets were prepared by effervescent, superdisintegrant addition and sublimation technique by direct compression, from all these techniques, superdisintegrant addition technique was selected based on the least disintegration time</td>
</tr>
<tr>
<td>32</td>
<td>Cinnarizine</td>
<td>Calcium channel blocker.</td>
<td>For sufficient mechanical integrity content uniformity, acceptable palatability, rapid absorption and onset of action</td>
</tr>
<tr>
<td>33</td>
<td>Clonazepam</td>
<td>Anti-epileptic</td>
<td>To enhance patient compliance</td>
</tr>
<tr>
<td>34</td>
<td>Clonazepam</td>
<td>Benzodiazepine derivative</td>
<td>To enhance patient compliance</td>
</tr>
<tr>
<td>36</td>
<td>Diazepam</td>
<td>Anti-convulsant</td>
<td>To develop a rapidly disintegrating fast dissolving tablet of diazepam that can disintegrate in less than 3 minutes and release 85% of drug within 30 minutes in the oral cavity</td>
</tr>
<tr>
<td>37</td>
<td>Diclofenac</td>
<td>Non-Steroidal anti-inflammatory</td>
<td>To get fast relief from pain.</td>
</tr>
<tr>
<td>No.</td>
<td>Drug</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
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<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>38</td>
<td>Diclofenac sodium</td>
<td>Non-steroidal anti-inflammatory</td>
<td>To formulate fast dissolving tablets of Diclofenac sodium using different superdisintegrants.</td>
</tr>
<tr>
<td>39</td>
<td>Dicyclomine HCL</td>
<td>Anti spasmodic drug</td>
<td>To formulate and characterization mouth dissolving tablets of Dicyclomine Hydrochloride for rapid dissolution of drug and absorption, which may produce the rapid onset of action in the treatment of smooth muscle spasm of the GIT.</td>
</tr>
<tr>
<td>40</td>
<td>Domperidone</td>
<td>Anti emetic</td>
<td>To formulate and optimize mouth dissolving tablets of domperidone, having adequate mechanical strength, rapid disintegration and fast action</td>
</tr>
<tr>
<td>41</td>
<td>Domperidone</td>
<td>Anti-emetic</td>
<td>A³ full factorial design is applied for the optimization of the fast dissolving tablets of the domperidone. The concentration of superdisintegrants (sodium starch glycolate) and the amount of binder (starch paste) were taken as independent variable. The dependent variables selected</td>
</tr>
<tr>
<td>Page</td>
<td>Drug</td>
<td>Description</td>
<td>Method</td>
</tr>
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</tr>
<tr>
<td>42</td>
<td>Etoricoxib</td>
<td>Non-steroidal anti-inflammatory</td>
<td>To prepare optimized fast dissolving tablets of etoricoxib using various sublimating agent</td>
</tr>
<tr>
<td>43</td>
<td>Etoricoxib</td>
<td>Non-steroidal anti-inflammatory drug</td>
<td>To prepare mouth dissolving tablets of Etoricoxib using superdisintegrants in different concentrations.</td>
</tr>
<tr>
<td>44</td>
<td>Felodipine</td>
<td>Calcium channel blocker</td>
<td>To formulate a fast dissolving tablets of felodipine by using co-processed superdisintegrants to increase the water uptake with shortest wetting time, and to increase the disintegration time of the tablets by simple and cost effective direct compression technique</td>
</tr>
<tr>
<td>45</td>
<td>Flunarizine dihydrochloride</td>
<td>Selective calcium channel blocker</td>
<td>To disintegrate and dissolve rapidly once placed in the oral cavity</td>
</tr>
<tr>
<td>46</td>
<td>Fexofenadine hydrochloride</td>
<td>Non-sedating anti-histamine</td>
<td>To enhance patient compliance</td>
</tr>
<tr>
<td>47</td>
<td>Fexofenadine HCL</td>
<td>Non-sedating anti-histamine.</td>
<td>To improve bioavailability and enhance patient compliance.</td>
</tr>
<tr>
<td>Page</td>
<td>Compound</td>
<td>Category</td>
<td>Objective</td>
</tr>
<tr>
<td>------</td>
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<td>-----------</td>
</tr>
<tr>
<td>48</td>
<td>Glipizide</td>
<td>Anti-diabetic</td>
<td>To formulate and evaluate the fast dissolving sublingual tablet of glipizide.</td>
</tr>
<tr>
<td>49</td>
<td>Glipizide</td>
<td>Anti-diabetic</td>
<td>Sensory study on disintegration time and mouth feel attributes.</td>
</tr>
<tr>
<td>50</td>
<td>Glipizide</td>
<td>Anti-diabetic</td>
<td>To enhance patient compliance.</td>
</tr>
<tr>
<td>51</td>
<td>Glipizide</td>
<td>Anti-diabetic</td>
<td>For sensory study on disintegration time, and mouth feel attributes</td>
</tr>
<tr>
<td>52</td>
<td>Granisetron hydrochloride</td>
<td>Anti-emetic</td>
<td>To enhance bioavailability by studying their methods in the formulation of granisetron HCL</td>
</tr>
<tr>
<td>53</td>
<td>Granisetron hydrochloride</td>
<td>Anti-emetic</td>
<td>To improve the therapeutic efficacy</td>
</tr>
<tr>
<td>54</td>
<td>Granisetron</td>
<td>Anti-emetic</td>
<td>To develop a novel drug</td>
</tr>
<tr>
<td></td>
<td>Drug/ Compound</td>
<td>Description</td>
<td>Preparation Method</td>
</tr>
<tr>
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</tr>
<tr>
<td>55</td>
<td>Granisetron hydrochloride</td>
<td>Selective 5-HT3 Receptor antagonist.</td>
<td>Compression</td>
</tr>
<tr>
<td>57</td>
<td>Isosorbide mononitrate</td>
<td>Anti anginal drug</td>
<td>Compression</td>
</tr>
<tr>
<td>58</td>
<td>Isoxspurine hydrochloride</td>
<td>Vasodilator</td>
<td>Kneading and Coprecipitation Method</td>
</tr>
<tr>
<td>59</td>
<td>Loratidine</td>
<td>Anti histamine</td>
<td>Compression</td>
</tr>
<tr>
<td>60</td>
<td>Lorazepam</td>
<td>Anti-epileptic</td>
<td>Compression</td>
</tr>
</tbody>
</table>
CONCLUSION

FDDDS have better patient compliance and may improve biopharmaceutical properties, improves efficacy and better safety, compared with conventional oral dosage forms. After the FDTs, the new products as Fast Dissolving Oral Films (FDOFs) are intended for the application in the oral cavity and they are innovative and promising dosage form especially for use in elder patients. The development of fast dissolving drug products also provides an opportunity for a line extension in market place, a wide range of drugs (e.g. NSAIDS, antiulcer, antihistamine, Hypnotics & sedatives, antipsychotics, antiparkinsonism, antiemetic, antimigrane and antidepressants) can be considered for this dosage form. In future, this system is most acceptable and prescribed due to its quick action i.e. within a minute. Because of increasing patient demand, popularity of these dosage forms will expand the study in future.

REFERENCES


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