



DISPERSIBLE TABLET: CURRENT TREND AND FUTURE PROSPECTIVE

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Abstract: Dispersible drug delivery systems are now widely used to improve drug delivery. Bioavailability and compliance with the patient. Dispersible tablets have evolved over the last three decades. Considerable recognition as a preferable option to traditional tablets and capsules due to improved Compliance with the patient, increased solubility and stability profiles. Dispersible tablets may be preferred Choice in particular with drugs that are sensitive to GI fluids, to mask the acrid taste of drugs, and to Patients in the categories of pediatric, geriatric, bedridden, postoperative and who may experience trouble swallowing traditional tablets and capsules. These kinds of tablets are disintegrating quickly to create the suspension in the water. Superdisintegrants are the most significant component of a dispersible tablet. Dispersible tablet on contact with water to become wet and swell extensively to disintegrate the tablet rapidly. This inspection includes a detailed updated concept of Dispersible tablets. The success and utility of the formulation have resulted in the yield of many dispersible tablets Technology. This review includes requirements for dispersible tablets, main characteristics, advantages, Limitations, formulation challenges, different innovations for dispersible tablets, evaluations, patented Technologies, and different points along the grocery store.

Keyword: Dispersible, Tablets, Patient Compliance, Superdisintegrants, Taste Masking, Disintegration Time.

1. INTRODUCTION:

Preparation of drugs in a presentable shape. The basic requirement and the need for today. Dosage form is a substance of drug delivery system, practiced for the application of drugs to a living body. Several types of Dose forms are available, such as pills, syrups, Suspension, suppository, injection, transdermal Patches with different cases of drug delivery Mechanisms for this. These classical / modern dosage forms have some advantages and disadvantages, which is why the development of an ideal drug delivery system is a major challenge for the pharmacist in the present scenario. In parliamentary law to deliver the desired result, the drug should be handed over to its situation of action at that pace and concentration in order to reach the maximum healing effect and the minimum adverse effect [1]. The basic goal behind the maturation of any drug delivery system (DDS) is projected to achieve safety and security Effective therapy to the human organism. For decades to come, Oral drug delivery is becoming the major segment of the worldwide market in pharmaceuticals. It's going up day by day because it's the preferred road to drugs Administration [2]. The tablets have become tablets in recent day most favourable dosage forms compared to others Available dosage type. This dosage's success Type is because of benefits such as simplicity of use Manufacturing, convenience in administration and High dosing accuracy, stability and safety [3]. A pill is a type of compressed solid dosage containing a single dosage of one or more active ingredients offered by the compressing uniform volumes of molecules. [4]. they are normally meant for oral administration, although their role is not restricted to this. The oral tablets can be eaten up whole, chewed and swallowed, dissolved or dispersed in water before disposal or even put in the mouth under the tongue where absorption takes place. The

manner of administration will be limited by the type of pill. Lozenges can be grouped into several cases which include; the chewable tablet, the sublingual tablet, the effervescent tablet, the buccal tablet, tablets, dispersible tablet, sustained release tablet and delayed release tablet. The tablet type is majorly influenced by the types of ingredients in the tablet and the manufacturing process it gets through. Depending on the API and site of action, tablet can be distributed for local activity in the mouth or for systemic activity [5].

Pills have been privileged as a dosage form because; the oral route is convenient and relatively safe for drug disposal, compared to liquid dosage forms tablets have common advantages in terms of the chemical and physical stability of the dosage form, the preparation procedure enables sure dosing of the drug, they are convenient to handle and can be prepared in a versatile way with respect to their use and the delivery of the drug, they can be inexpensively made, They are less bulky compared to liquid dosage forms or even bulk powders.

Dispersible tablets are uncoated or film-coated tablets that can be distributed in liquid before administration giving a homogenous distribution. While the tablets and capsules are considered to be some widely accepted oral dosage forms Route of administration with proven advantages decades, they do have certain disadvantages, such as Difficulty swallowing in paediatrics as dysphasia, geriatric and bedridden patients. The concept of a novel the dispersible drug delivery system emerged from the desire to provide a patient with a conventional means of taking their medication. Oral administration most recently the most famous route of formulation is to become an administration due to its ease of consumption and pain Avoidance in relation to parenteral path, Versatility and, most importantly, patient compliance. Dispersible tablets is a special formulation should disintegrate easily in the urine to form a Suspension that could be drunk. It combines the ease of taking over and eventually enhancing Bioavailability of the liquid formulation with the precise dose. Active ingredients that are Unstable in aqueous solution can be unchanging as a Dispersible tablet [6].

Dispersible tablets usually disintegrate within three minutes when set in water or a modest amount of breast milk. On the foundation of recent developments dispersible tablets can be separated in two phases:

1. One which directly disintegrates or dissolves in the mouth without a need of drinking water and
2. Second which requires the addition of water to form a dispersion within seconds of time, and easy to take with the patient. In both the cases, bioavailability of the drug is significantly larger due to instant distribution and solubility than those observed from conventional tablet dosage form [7].

The measure by step disintegration process of dispersible tablets is given in figure 1.



Fig 1: Disintegration process of dispersible tablet

Ideal properties of Dispersible tablets [8, 9]

- Ideally Rapid dispersible tablets require less amount of water for oral administration, the preparation should be easily disintegrated or dissolved in urine within a few seconds to minutes.
- The formulation would have been adequate Hardness and should be complimentary of any variety. To match the rigors of the fabrication operation and handling of the finished product by target patient.
- The drug loading capacity of dispersible tablets; It was anticipated to be gamey.
- The formulation was supposed to be free of Any bitter or unpleasant taste with a better taste The organoleptic characteristics.
- It should be available at a low cost of production. And the method should be lucid with the current one Processing and packing machines.
- It would be cost-effective.
- More reliability should be obtained compared to Liquid delivery type.

Problem associated with Dispersible Tablets [10,11]

- Drugs absorbed at specific site cannot be imparted in these dosage forms.
- These tablets show high friability, less hardness than conventional tablets.
- Drugs with relatively larger doses are difficult to pronounce.
- Hygroscopic properties of formulation require extra moisture protection with special promotional material for proper stability & safety of the merchandise.

Good words for the use of dispersal formulations [7]:

- To be scattered in a small quantity (5 to 10ml) of liquid (fresh water or milk).
- Use of a clean and appropriate container is recommended to spread out the tablets.
- The liquid can be softly stirred to aid dispersion before swallowing.
- As a dimension of the active substance may remain in the container after swallowing, it is advisable to wash it with a diminished quantity of urine or milk and swallow again.
- The dispersible tablets should not be split or chewed.
- Careful handling of dispersible tablets is necessary as, they are much more delicate than the regular tablets (more friable, less resistant to rubbing).
- Dispersible tablets must be applied right away after removal from the blister packaging. Their stability outside of the blister cannot be assured.

Table 1: List of dispersible tablets available in the marketplace.

| Sr. No. | Active Ingredients | Brand Name | Indication | Technology Used | Manufacturer |
|---------|--------------------|---------------------|---|--------------------|-------------------------|
| 1. | Nimesulide | Nimulid-MD | Pain, Osteoarthritis | Direct compression | Panacea |
| 2. | Rofecoxib | Biotech Zyrofmeltab | Osteoarthritis, Rheumatoid arthritis, Acute pain in adults, and Primary dysmenorrhea, Migraine | Freeze drying | Zydus Cadila |
| 3. | Mosapride Citrate | Mosid-MD | Gastroesophageal Reflux Disease, Heartburn, Acidity, Indigestion, and Stomach pain | Lyophilization | Torrent Pharmaceuticals |
| 4. | Piroxicam | Feledine Melt | Pain, Swelling, and Joint stiffness from arthritis | Freeze drying | Pfizer |
| 5. | Famotidine | Maxalt ODT | Heartburn, Acid indigestion, Sour stomach, Zollinger–Ellison syndrome and Multiple endocrine adenomas, GERD | Direct compression | Merck |
| 6. | Mirtazapine | Remeron Sol Tab | Depressive disorder | Freeze drying | Organon |
| 7. | Olanzapine | Olanexinstab | Bipolar disorder, Treatment resistant depression (TRD) | Lyophilization | Ranbaxy |

2. BASIC COMPONENTS OF DISPERSIBLE TABLET FORMULATION

2.1 Drug:

High dose drugs that are extremely water soluble, poorly compressible and hygroscopic pose the biggest challenge in the design of a dispersible tablet the excipients must be carefully chosen in order to achieve the Tablet matrix of high compressibility and low compressibility Watery solubility and hygroscopicity. [22, 23]

2.2 Disintegrants:

A disintegrants accelerates the pace at which a tablet breaks up in urine. The current research will use so-called super disintegrates, so-called because of high disintegrates efficiency attributed to their singular ability to take up water and puff up. Various cases of synthetic, semi synthetic and natural super disintegrates are used. Natural super disintegrates includes Plantago Ovata seed mucilage, Lapidium Sativum mucilage, Gum Karaya, Fenugreek Seed mucilage, Guar gum, Cassia Fistula gum, Locust bean gum (5% w/w), Hibiscus Rosa-sinensis Linn mucilage, Isaphghulla Husk (10%), Soy polysaccharides, Xanthum Gum, Gallen Gum. List of different types of superdisintegrants along with their concentration in dispersible tablets are given in table 2. [24,25]

Table 2. List of synthetic and semisynthetic Super disintegrates with their concentration in dispersible tablets

| Sr.no. | Super-Disintegrant | Conc.in dispersible tablet (%w/w) |
|--------|---------------------------|-----------------------------------|
| 1. | Starch USP | 5-20 |
| 2. | Starch 1500 | 5-50 |
| 3. | MCC (Avicel) | 10-20 |
| 4. | Alginic Acid | 1-5 |
| 5. | Sodium Alginate | 2.5-10 |
| 6. | Explotab | 2-8 |
| 7. | Polyplasdone (XL) | 0.5-5 |
| 8. | Amberlite (IPR 88) | 0.5-5 |
| 9. | Ac-Di-So | 1-3 |
| 10. | Crosslinked pvp | 2 – 5 |
| 11. | Methyl Cellulose | 2-10 |
| 12. | Colloidal Silicon Dioxide | 1-5 |
| 13. | Sodium starch glycolate | 10 |

2.3 Binder:

The binder and solvent in wet granulation have a profound effect on the dissolution properties of the oral contraceptive. The aqueous solubility of the binder will affect tablet disintegration properties, and this is easily documented. Table 3 gives the list of binders and their concentration in dispersible tablets [23,24].

Table 3. List of Binders

| Sr.no. | Binder | Conc.in dispersible tablet (%w/w) |
|--------|--|-----------------------------------|
| 1. | Disaccharides: Sucrose, Lactose | 2-20 |
| 2. | Sugar alcohols: Xylitol, Sorbitol or Maltitol; Starches, Cellulose or modified cellulose such as Microcrystalline cellulose and cellulose ethers such as Hydroxypropyl cellulose (HPC) | 5-10 |
| 3. | Sugar alcohols: Xylitol, Sorbitol or Maltitol | 5-15 |
| 4. | Protein: Gelatin | 1-8 |
| 5. | Synthetic polymers: Polyvinylpyrrolidone (PVP), Polyethylene glycol (PEG) | 10-15 |

2.4 Diluents:

A diluents, or filler facilitates the compression of a formulation and gives tablet strength and acceptable appearance. Diluents can be generally categorized by their aqueous solubility and choice is dependent on the physical. [23,24].

Table 4. List of Diluents and Fillers

| Water insoluble | Partially soluble | Water soluble |
|----------------------------|---|---------------|
| Calcium carbonate | Pre-gelatinized starch | Dextrose |
| Calcium phosphates | Low-substituted Hydroxypropyl cellulose | Lactose |
| Magnesium carbonate | - | Mannitol |
| Microcrystalline cellulose | - | Sorbitol |
| Starch | - | Sucrose |

2.5 Lubricants:

Stearic acid salts, such as magnesium Stearate, are potentially unsuitable in dispersible tablet formulations because they are hydrophobic and may make a scum giving an unpleasant appearance. Paradoxically, most commercial dispersible tablets are lubricated using magnesium Stearate. Commonly used lubricants in their concentration in dispersible tablets are summarized in the table 5 [27,28].

Table 5. List of Lubricants (Water soluble)

| Sr. No. | Lubricants | Concentration in dispersible tablets (%w/w) |
|---------|--------------------------|---|
| 1. | Boric acid | 1 |
| 2. | Sodium benzoate | 5 |
| 3. | Sodium oleate | 5 |
| 4. | Sodium acetate | 5 |
| 5. | Sodium lauryl sulfate | 0.5-5 |
| 6. | Magnesium lauryl sulfate | 1-2 |

Table 6: List of Lubricants (Water- insoluble)

| Sr. No | Lubricants | Concentration in dispersible tablets (%w/w) |
|--------|--------------------------------------|---|
| 1. | Sterate (Calcium, Sodium, Magnesium) | 0.25-5 |
| 2. | Talc | 1-10 |
| 3. | Sterotex | 0.25-1 |
| 4. | Wazes | 1-5 |
| 5. | Sterowet | 1-5 |
| 6. | Glyceryl behapet | 1-5 |

2.6 Superdisintegrants

As dispersible tablets need faster disintegration. Yeah, well, the pharmacist needs to produce Disintegrates, i.e. Superdisintegrants that are efficient at low levels Concentration and greater disintegration Efficiency and are more effective Intragranular. Simply suffer the drawback that it is Hygroscopic and not applied for moisture Sensible Drugs. This superdisintegrants act by swelling and due to swelling pressure exerted in the outer direction or radial direction, it causes tablet to break or the accelerated absorption of urine leading to a tremendous growth in the mass of granules to promote decomposition [29].

3. MECHANISM OF ACTION OF DISINTEGRATES IN DISPERSIBLE TABLET

3.1 Swelling

General mechanism of action for tablet disintegration is swelling tablets through high porosity expression poor Disintegration due to deficiency of sufficient swelling force. On the other hand, sufficient swelling force is exercised in the pill with low porosity. It is worthwhile to mention that if the packing Fraction is very high; fluid is unable to perforate in the tablet and disintegration is again slow down [30, 31].

3.2 Porosity capillary action (wicking)

While we rank the drug into the appropriate aqueous medium, the Medium enters into the pad of paper and puts back the air absorbed on the particles, which softens the intermolecular bond and Breakdowns the tablet into fine particles. Water uptake by Tablet depends upon hydrophilicity of the drug/excipient and on tabulating environments. For these types of disintegrates, Maintenance of porous structure and low interfacial tension towards aqueous fluid is essential which helps in Disintegration by the manufacture a hydrophilic system around the atoms [30, 31].

3.3 Heat of wetting (air expansion)

When disintegrates through exothermic properties gets wet, Localized stress is created due to capillary air expansion, this aids in breakdown of the pill [30, 31].

3.4 Due to release of gases

Carbon dioxide released within tablets continuously wetting Due to contact between bicarbonate and carbonate with citric Acid or tartaric acid. The tablet disintegrates due to generation of pressure inside the tablet. As these disintegrates are highly Sensitive to small changes in humidity level and temperature, Strict control of the environment is taken during fabrication of the lozenges. The effervescent blend is either added immediately prior to compression or can be added into the Separate fraction of preparation [30, 31].

3.5 By enzymatic reaction

These enzymes destroy the binding activity of the binder and helps In disintegration. In reality, due to swelling, pressure exerted in the outer direction or radial direction, it causes tablet to break or the accelerated absorption of urine leading to an enormous Increase in the volume of granules to promote decomposition [30, 31].

3.6 Due to disintegrating particle repulsive forces⁵ (Secondary to wicking)

The swelling of tablets made through 'non- swellable' Disintegrates. Guyot-Hermann has planned particle repulsion Theory 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 [30, 31].

3.7 Due to deformation

During the tablet compression, disintegrated particles become deformed and these deformed particles get into their normal Structure when they come in contact with aqueous media or water. Occasionally, the swelling capacity of starch remained Improved when granules where extensively deformed during Compression [30, 31].

4. TECHNIQUES FOR PREPARING DISPERSIBLE TABLETS

The various techniques are being utilized or adopted to Prepare dispersible tablets. [32]

1. Freeze drying or Lyophilization
2. Sublimation
3. Mass extrusion
4. Melt Granulation
5. Spray drying
6. Molding
7. Nanonization
8. Direct compression
9. Cotton candy process
10. Phase transition process

4.1 Freeze drying or Lyophilization

Freeze drying is the proficiency in which water is sublimed from the product when it is blocked. This technique produces an amorphous porous construction that can melt quickly. A Typical process involved in the manufacturing of ODT using this technique. The active drug is dissolved/ dispersed in an aqueous solution of a carrier or polymer. The mixture is dosed through weight and poured in the wells of the preformed Blister packages. The trays holding the blister packs pass through liquid nitrogen freezing tunnel to freeze the drug Solution or dispersion. Then the frozen blister packs are placed in refrigerated cabinets to continue the freeze-drying. After Freeze-drying the aluminium foil backing is useful on a blister sealing Machine. Finally, the blisters are packaged and shipped [33].

Advantages of freeze drying the major advantage of using this technique is that the tablets Produced by this technology have a very low disintegration Time and have great mouth feel due to fast melting effect.

Disadvantages of freeze drying This technique is expensive and time consuming; fragility makes conventional packaging unsuitable for these products and poor stability under stressed condition.

4.2 Sublimation

Sublimation has been used to produce dispersible tablets with high porosity. A porous matrix is formed by compressing the volatile ingredients along with other excipients into tablets, which are finally subjected to a process of sublimation (Compressed tablets were subjected to the process of sublimation in vacuum oven at 60⁰c for 6 hr or Compressed tablets were subjected to the sublimation process in hot air oven at 60°C for 2 hr) As shown in fig. 1. Inert solid ingredients with high volatility (e.g., Ammonium bicarbonate, ammonium carbonate, benzoic acid, camphor, hexamethylenetetramine, naphthalene, phthalic anhydride, urea and urethane) have been used for this purpose. Solvents such as cyclohexane and benzene were also suggested for generating the porosity in the ground substance [34, 35].

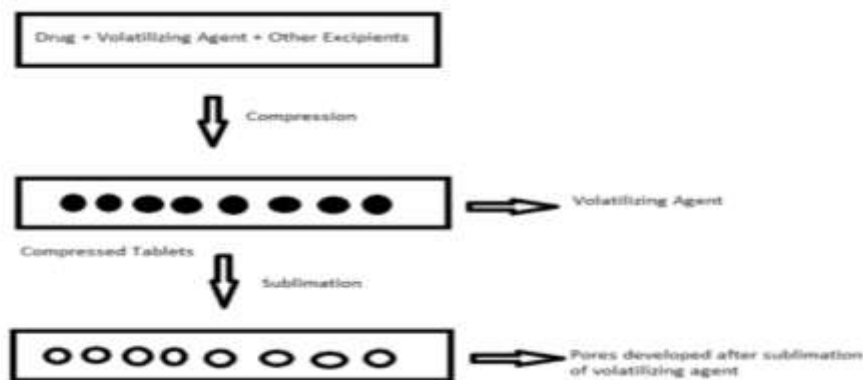


Fig. 2 Steps involved in sublimation

4.3 Mass extrusion

This technology contains softening the active blend using the Solvent mixture of water-soluble polyethylene glycol, using Methanol and expulsion of softened mass through the extruder or syringe to obtain a cylinder designed extrude which finally makes out into even segments using a heated blade to make pills. This Process can also be employed to coat granules of bitter drugs to disguise their taste. This method employed for preparing taste masked Granules. The tablet was developed with different Super disintegrate. E.g. Sodium starch glycolate, croscarmellose Sodium and crosspovidone etc [36].

4.4 Melt granulation

Melt granulation system is a procedure through which Pharmaceutical powders are efficiently agglomerated through a melt able binder. The welfare of this method associated to a Conventional granulation is that no water or organic solvents are necessary. For at that place is no drying step, the process is less time consuming and uses less energy than wet granulation. It is a Useful technique to enhance the dissipation rate of poorly water-soluble drugs such as griseofulvin 41. This methodology to prepare MDT with sufficient mechanical integrity, requires the exercise of a hydrophilic waxy binder (superpolystate, PEG-6- Stearate). Superpolystate is a pliable material with a melting point of 33-370C and an HLB value of 9. So its purpose not just work as a binder and increase the physical resistance of Tablets but will likewise facilitate the disintegration of the tablets as it dissolves in the mouth and solubilizes rapidly leaving no residues [37].

4.5 Spray drying

Spray dryers remain widely used in pharmaceuticals and Biochemical processes. Due to processing solvent is evaporated quickly; spray drying can produce highly porous, fine powder. Spray drying can be employed to formulate quickly Disintegrating tablets. This technique is grounded on a particulate Support matrix, which is outfitted with spray drying an aqueous Composition containing support matrix and other components to exercise a highly porous and fine powder this is then mixed with active components and pressed into pills. The Tablets made from this technology are claimed to decompose within 20 minutes [36].

4.6 Molding

In this method, molded tablets are made by using water soluble Ingredients so that the tablets dissolve completely and quickly. The powder blends are moistened with a hydro alcoholic Solvent and is formed into tablets under pressure Lower than that applied in conventional tablet compression. The Solvent is then transferred by gentle wind-drying. They are very less compact than compressed tablets. In this process, porous Structure is formed and enhances the dissolution rate [38].

4.7 Nanonization

In this technology contains reduction in the particle size of a Drug to nano size by milling the drug using a patented wet milling Technique. The nano-crystals of the drug are stabilized against agglomeration by surface absorption on selected Stabilizers which are then incorporated into mouth dissolving Tablets. Other advantages of this technology include fast Disintegration/dissolution of nanoparticles leading to better

Absorption and hence higher bioavailability and reduction in Dose, cost effective manufacturing process, conventional Packaging due to the exceptional durability and wide range of Doses i.e. 200 mg of drug per unit [39].

4.8 Direct compression

This process by which tablets are compressed directly from Mixtures of the drug and excipients without any preliminary Treatment. It provides advantages over the other manufacturing Processes of tablets, such as wet granulation and delivers high Efficiency. The variety to be compressed need have Satisfactory flow properties and cohere under pressure, thus making pre-treatment as wet granulation unnecessary. In many instances, the superdisintegrants have a major part in the disintegration and dissolution process of mouth dissolving tablets made by direct compression. The choice of a suitable type and an optimal amount of disintegrates is vital for ensuring a high disintegration rate. The addition of other formulation mechanisms such as water-soluble excipients or Effervescent agents can further enhance dissolution or disintegration properties [40].

4.9 Cotton candy process

It is also known as the “candy floss” method and forms the basis of the technologies such as flash dose (Fuisz Technology). It utilizes an inimitable spinning mechanism to Yield floss like crystalline structure which mimics cotton candy. ODT is formed using a candy floss or shear form Matrix; the matrix is formed from saccharides or Polysaccharides processed into amorphous floss by a simultaneous action of flash melting and centrifugal force. The ground substance is then brought around or partially crystallized to provide a compound with good flow properties and compressibility. The candy floss can then be milled and blended with active components and later compressed into MDT. Nevertheless, the high processing temperature limits the utilization of this technology [41, 42].

4.10 Phase transition process

It is concluded that a combination of low and high melting point sugar alcohols, as easily as a phase transition in the manufacturing process, are important for making MDTs without any particular apparatus. MDT was produced by Compressing powder containing erythritol (melting point: 122°C) and Xylitol (melting point: 93°, 95°C), and then heating at about 93°C for 15 minute. After warming, the median pore size of the tablets was increased and tablet hardness was also increased. The increment of the tablet hardness with heating and memory did not depend on the crystal state of the lower melting Point sugar alcohol [43].

5. PATENTED TECHNOLOGIES

5.1 Zydis Technology

Zydis technology contains softening the active drug using the solvent mixture of water-soluble polyethylene glycol, using methanol and expulsion of softened mass through the extruder to make an even segment using a heated blade to make pills. The even segments can also be applied to coat granules of bitter drugs and masking their taste [44,45].

5.2 Orasolv Technology

CIMA Labs developed Orasolv Technology. In this process active drug is a taste masked. It contains effervescent agents. Direct compression techniques are applied to form tablets at low compression strength in society to minimize oral dissolution time. The fragile and friable tablets are taken out and packed in specially designed pick and place system [44, 45].

5.3 Durasolv technology

This technology is patented by CIMA Labs. This process consists a drug, diluents and lubricant tablets are developed by this process have good rigidity. Pills are packed into conventional packaging system. This applied science is appropriate for products requiring low amount of active drugs [44, 45].

5.4 Wow Tab Technology

It is patented by Yamanouchi Wow means “without water”. Wow tab is an intra buccal soluble, compressed tablets consisting of granules made with saccharine of low and high mold ability. When low- and high-moldable saccharine is used alone tablets obtained do not have the desired properties of rapid disintegration and hardness, so combinations are used. It is applied to get a tablet of adequate hardness and

fast dissolution rate. The wow tab formulation is stable to the environment due to its significant hardness than the Saudis and Orasolv. The wow tab product is suited for both conventional bottle and blister package [46].

5.5 Oraquick

This technology is patented by K.V Pharmaceuticals. It utilizes taste masking microsphere technology called as micro mask, which provides superior mouth feel, significant mechanical strength, and quick disintegration/ dissolution of the ware [47]. This process calls for preparation of micro particles in the shape of a matrix that protects the drug, which can be compressed with sufficient mechanical strength. Low heat of production in this process makes it appropriate for heat-sensitive drugs. The oraquick fast-dissolving tablet preparation utilizes a patented taste masking technology. The taste masking method does not develop solvents of any kind, and consequently leads to faster and additional efficient production. As well, lower heat of manufacture than alternative fast- dissolving/disintegrating technologies makes [47].

5.6 Nano Crystal technology

Elan's proprietary NanoCrystal technology (Nanomelt™) can 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 nm in diameter, which are produced by milling the drug substance using a proprietary wet milling technique.

5.7 Pharmaburst technology

SPI Pharma, New Castle, patents this technology. The Pharmaburst ODT uses a proprietary disintegrate (Pharmaburst) that is based on mental blended with conventional tableting aids. It utilizes the Co processed excipients to develop ODT, which dissolves within 30-40 s. This technology involves dry blending of drug, flavor, and lubricant, followed by compression into tablets. The chemist is a Quick Dissolving delivery system in which there is the increase of active drug in a dry blend with Pharmaburst excipients and compress by tablet machine. The primary advantage of the Pharmaburst system is that we can grow our own robust "Quick Dissolve" formulations at lab scale within reasonable price. The chemist is a co-processed excipient system with specific accidents, which allows rapid disintegration and low adhesion to punches. The pharmacist is smooth and creamy and helps to disguise the taste and grittiness of the actives. Main advantages Pharmaburst is highly compatible, rapid disintegration and cost effective. The Quantity of Pharmaburst required in a formulation will depend on the type of activity and the amount per tablet [48].

5.8 Flash Tab

Flashtab have been patented by Prograte Pharm laboratories. Tablets are formed by this process contain of an active blend in the sort of micro crystal micro granules prepared by applying the conventional process like micro encapsulation, extrusion spheronisation. Flashtab tablet matrix consists of a scalable agent and a super disintegrant [44, 45].

5.9 Frosta technology

Akina patents this technology. The frosta technology is based on the compression of highly plastic granules at low pressure to prepare fast melting tablets. The highly plastic granules are composed of three components: a plastic cloth, (Maltrin QD M580 and MaltrinM180 are maltodextrin and corn syrup solids) a water- penetration enhancer (Mannogem EZ Spray) and a wet binder (sucrose, polyvinylpyrrolidone and hydroxypropyl methylcellulose). Apiece of the three components plays an indispensable part in obtaining tablets with higher strengthened faster disintegration time [49].

5.10 Advantol™ 200

Advantol™ 200 is a directly compressible excipient system offering "Soft-Melt" functionality and especially formulated for nutraceutical applications. The SPI Pharma's Advantol platform uses proprietary co-processing engineering. Advantol requires no special manufacturing equipment or tooling. Advantage formulations utilize a standard rotary tablet press with standard tooling under normal tabulating temperature and humidity conditions to make robust "soft-melt" tablets [49].

5.11 Advatab

AdvaTab tablets disintegrate rapidly in less than 30 minutes. These pills are made using polymer-coated drug particles that are uniformly spread out in an ultra-fine, low-water content, rapidly disintegrating matrix with superior organoleptic properties. AdvaTab tablets are

pressed using a proprietary, patented, external lubrication system in which the lube is used solely to the tablet surface, resulting in robust tablets that are harder and less friable and can be packaged in bottles or blister [49].

5.12 Quicksolv technology

This technology is patented by Janssen Pharmaceuticals. It uses two solvents in formulating a matrix which disintegrates instantaneously. The methodology includes dissolving medium components in water and the solution or suspension is frozen. Then dry the matrix by removing water using an overabundance of alcohol (solvent extraction). Therefore, the product formed has a uniform porosity and adequate force for handling [47].

5.13 Zipler technology

In zipler technology water insoluble drugs or drugs as coated microparticles are used. The addition of a suitable amount of water-insoluble inorganic excipients combined with Disintegrants imparted an excellent physical conflict to the oral dissolving tablet (ODT) and the simultaneously maintained optimal disintegration. The usage of water-insoluble inorganic excipients offers better enhancement of disintegration in comparison to the most commonly used water-soluble sugars or salts. Tablets primarily of water-soluble components often tend to disintegrate rather than disintegrate and the concentrated viscous solution is taken shape which reduces the pace of water diffusion into the tablet core [50].

6. EVALUATION OF DISPERSIBLE TABLET

6.1 Pre-compression parameters

6.1.1 Angle of repose - Angle of repose was determined using funnel method. The blend is poured through a funnel that can be lifted vertically to a maximum cone height (h) is obtained. The radius of the heap (r) is measured and angle of repose (θ) is calculated using following formula [51].

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

Where, θ = Angle of repose

h = height of the pile r = radius of plane surface occupies by the powder

6.1.2 Bulk Density - The granular powder weighing 10 grams is placed in 100 ml measuring cylinder. The volume occupied by the powder was observed without disturbing the cylinder and bulk density was estimated by the following equation. [52, 58]

$$\rho_b = M / V$$

Where:

ρ_b - is bulk density, M- is the weight of powder, V- is the volume of powder.

6.1.3 Tapped density- Weigh 10 gram of granular powder and placed in a 100 ml measuring cylinder. The cylinder was then subjected for the specified number of taps (100) until the powder bed has reached the lower limit. The last mass was read and the tap density is computed by following equation. [59]

$$\rho_t = M / V_t$$

6.1.4 Compressibility index - the simplest method of measurement of free flow of powder is compressibility, an indication of the ease with which a material can be induced to flow is given by compressibility index which is calculated as follows.

$$\% \text{ C.I.} = \rho_t - \rho_b / \rho_t \times 100$$

The value below 15% indicates a powder which usually gives rise to excellent flow properties, whereas above 25% indicate poor flowability. [60, 54]

6.1.5 Hausner's ratio (H) - This is an indirect index of ease of powder flow. It is calculated by the following formula [55].

$$\text{Hausner's ratio} = \rho_t / \rho_b$$

Where,

ρ_b = Bulk density ρ_t = Tapped density

Lower Hausner's ratio (1.25) indicates better flow properties.

6.2 Post Compression Evaluation Parameters

6.2.1 Uniformity of weight - According to the US pharmacopoeia, the weight of individual twenty tablets is recorded and then all twenty tablets are weighed together on a digital balance and the mean of tablet weight is figured. Results are presented as mean value \pm standard deviation [56].

6.2.2 The fracture strength - which is determined as the force required for developing a tablet by radial compression is measured with a tablet hardness tester (Monsanto hardness tester). It is expressed in kg/cm [57].

6.2.3 Thickness - Tablet thickness can be measured using a simple procedure. Five tablets are taken and their thickness is measured using Vernier Caliper [58].

6.2.4 Friability - The friability of sample of six tablets is measured using a Roche Friabilator. This device subject the tablets to the combined effect of abrasion and shock in a plastic chamber revolving at 25 revolutions per minute and dropping the tablets at a peak of 6 inches in each rotation. Six pre-weight tablets are rotated at 25 rpm for 4 minutes. The tablets are then reweighed after removal of fines using 60 mesh screen and the percentage of weight loss is calculated [59].

$$\% \text{ Friability} = (\text{Loss in weight} / \text{Initial weight}) \times 100$$

6.2.5 Wetting time - The wetting time of the tablets can be measured using a simple procedure. Five circular tissue papers of 10 cm diameter are laid in a petri dish with a 10-cm diameter. Ten milli-liters of water-soluble dye (eosin) solution is added to petri-dish. A tablet is carefully laid along the airfoil of the tissue paper. The time needed for water to reach the upper surface of the tablet is noted as the wetting time [60].

6.2.6 Water absorption ratio - For measuring the water absorption ratio the weight of the tablet of sample is noted before continuing in the petri dish containing water and then the wetted tablet is removed from the petri dish and reweighed. The water absorption ratio, or can be defined by the following equation [61].

$$R = 100 (W_a - W_b) / W_b$$

Where, W_a = Weight of tablet after absorption W_b = Weight of tablet before absorption

6.2.7 In vitro disintegration test- The disintegration time was measured using disintegration test apparatus. One tablet is placed in each tube of the basket. This basket is immersed in water bath at $37 \pm 0.5 \text{ } ^\circ\text{C}$. The time needed for complete disintegration is recorded with standard deviation [62].

6.2.8 In vitro dispersion time test- To determine dispersion time 10 ml measuring cylinder is taken in which 6 ml distilled water is added and then sample tablet is dropped in it. The time needed for complete dispersion was determined [63].

6.2.9 In vitro dissolution test- The development of dissolution methods for ODTs is comparable to the approach required for conventional tablets and is practically identical. Dissolution conditions for drugs listed in a pharmacopoeia monograph, is a right place to pop out with scouting runs for a bioequivalent ODT. Other media such as 0.1 M HCL and buffer (pH 4.5 and 6.8) should be evaluated for ODT much in the same manner as their ordinary tablet counterparts. It has been suggested that USP 2 paddle apparatus is the most desirable and common choice for orally disintegrating tablets, with a paddle speed of 50 rpm commonly used [64].

6.2.10 Accelerated stability studies - The Orally disintegrating tablets are carried in suitable packaging and stored under the following conditions for a period as prescribed by ICH guideline for accelerated studies. (1) $40 \pm 10 \text{ } ^\circ\text{C}$ (2) $50 \pm 10 \text{ } ^\circ\text{C}$ (3) $37 \pm 10 \text{ } ^\circ\text{C}$ and Relative Humidity = $75\% \pm 5\%$ Available online on www.thepharmaresearch.info Singh et: al., The pharma Research, Volume 8, Issue1. Page 128-147 Page 141 The tablets are removed after a period of 15 days and analyzed for physical characterization (Visual defects, Hardness, Friability, Disintegration, and Dissolution etc.) and drug content. The information obtained is fitted into the first order equation to define the kinetics of degradation. Accelerated stability data are plotted according Arrhenius equation to determine the shelf life at $25 \pm 0.5 \text{ } ^\circ\text{C}$ [65, 66].

7. Future Prospects:

These dosage forms may be worthy for the oral delivery of drugs such as protein and peptide-based therapeutics that have limited bioavailability when administered by conventional tablets. These products usually degrade rapidly in the stomach. Should next generation drugs be predominantly protein or peptide based, tablets may no longer be the predominant format for dosing such moieties. Injections in the main are not preferred for use by patients unless facilitated by sophisticated auto-injectors. Inspiration is one good alternative system to deliver these drugs, but the increased research into Biopharmaceuticals so far has generated predominantly chemical entities with low molecular weights. The developer of enhanced oral protein delivery technology by ODTs which may release these drugs in the oral cavity are very hopeful for the deliverance of high molecular weight protein and peptide.

8. CONCLUSION:

The introduction of dispersible dosage Forms has overcome some of the topics to be found in the administration of drugs Paediatric and elderly patient. It constitutes a large proportion of the people of the world. Hence, patient demand and the accessibility of various technologies have increased the market share of Fast dissolving tablets, which in turn extends the patent life of a drug. Recent trends of patient-oriented practice demand design of patient-oriented dosage form to achieve patient compliance. The figure of the Formulation of associated factors leads to significant rates of non-compliance and thus there is a need to design the patient Addressed drug delivery system. Your mouth Dissolving tablets are suitable for a lot of people patient classes, including geriatrics, Paediatrics, clinical and other those may have problem accepting. By using such manufacturing technologies, many drugs can be phrased in the form of dispersible tablets to provide the advantages of liquid medication in the form of strong training. Holding back in view of the vantages of the delivery system, rapidly disintegrating dosage forms have been successfully commercialized, and because of increased patient demand, these dosage forms are required to become more populated.

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CONFLICT OF INTEREST

The authors declare that no conflict of interest.

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