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RESEARCH ARTICLE

FAST DISINTEGRATING TABLETS - A NEW ERA IN NOVEL DRUG DELIVERY SYSTEM

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Abstract

Among all dosage forms, fast-Disintegrating tablets are one of the most commonly used dosage forms, especially in children, because their nervous system and muscular system are not well developed compared to them in adults. and in adult patients with Parkinson's disease or hand tremors. Some fixed dosage forms, such as capsules and tablets, now have difficulty swallowing (dysphagia), which results in many cases of non-compliance and renders therapy ineffective. The most preferred routes of administration for various drugs are oral dosage forms and the oral route with specific limitations such as first-pass metabolism by the liver, psychiatric patients, at-risk patients, and non-cooperators. FDTs dissolve easily in saliva without the need for water. Fast- Disintegrating tablets dissolve in saliva in a minimum of less than 60 seconds., And these are really fast-digesting tablets. FDT formulations contain super disintegrants to increase the rate of tablet degradation in the buccal cavity. FDTs have advantages because they are easy to manufacture, have the right dosage, good chemical and physical strength, and are an ideal alternative for children and adult patients. FDTs have a faster rate of degradation, faster absorption, so that in vitro drug release time increases and this property of the drug (dosage form) increases bioavailability. FDT formulations have specific advantages in both conventional tablet and liquid dosage forms. There are many technologies for spray drying, cotton candy process, sublimation, melt granulation, direct freeze pressing / lyophilization, phase transition process, mass extrusion, etc. This overview provides brief information on FDT, including the definition, benefits, needs or requirements of FDT, key characteristics FDT, limitations, various challenges in the development of FDT, marketed tablet formulations that cause rapid digestion and so on.

Introduction:-

The basic need and necessity of today is the creation of drugs in a presentable form. A dosage form is a method of drug delivery system that is used to deliver a drug to a living body. Various types of dosage forms are available, such as tablets, syrups, suspensions, suppositories, injectable, transdermal, and patches with different types of drug delivery mechanisms. These classic / modern dosage forms have some advantages and disadvantages. Therefore, the development of an ideal drug delivery system is a major challenge for the pharmacist in the presence scenario. To achieve the desired effect, the drug must be delivered to the area of surgery at a concentration and rate that

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maximizes the therapeutic effect and minimizes adverse effects. To develop a suitable dosage form, it must undergo an in-depth study of the physicochemical principles that govern specific drug formulations.[1].

Oral drug routes have a wide acceptability of up to 50-60% of the total dosage form. Fixed dosage forms are popular for easy administration, proper dosing, self-medication, pain prevention and most importantly and that is patient adherence. Capsules and tablets are the most popular uses for solid dosage forms; and one of the major disadvantages of these dosage forms for some patients is their difficulty swallowing. Ingestion of oral dosage forms is usually performed with drinking water. Sometimes people cannot swallow the usual dosage forms such as a tablet without water, in case of motion sickness (kinetosis) and sudden bouts of coughs in colds, allergies and bronchitis. For this reason, tablets that dissolve or disintegrate easily in the mouth have attracted a great deal of attention [2]. Swallowing problems are common in geriatric patients due to fear of swallowing, hand tremor, dysphasia, and in young people due to delayed muscles and nervous system, and in patients with schizophrenia, leading to poor patient compliance. Almost a third of the population (mostly children and adults) have difficulty swallowing, resulting in poor adherence to oral tablet drug therapy leading to a reduction in the overall effectiveness of the therapy. For this reason, tablets that dissolve or decompose easily in the mouth have attracted a great deal of attention.[3].

The United States Food and Drug Administration (USFDA) defines a rapidly Disintegrating tablet (FDT) as "a solid dosage form containing a drug or active ingredient that dissolves easily within an hour to seconds when placed on the tongue" [3]. Rapid digestion in drug delivery systems was first developed in the late 1970's as an alternative to conventional dosage forms for pediatric and geriatric patients. These tablets dissolve or dissolve in saliva usually in less than 60 seconds [5]. To meet these medical needs, pharmaceutical engineers have developed a new form of oral dosing, known as oral disintegrating (dispersible) tablets (ODTs) or rapidly disintegrating (Disintegrating) tablets (FDTs) or oral melts. MDT), fast-release tablets that dissolve quickly in saliva, usually within seconds, without the need to drink water.

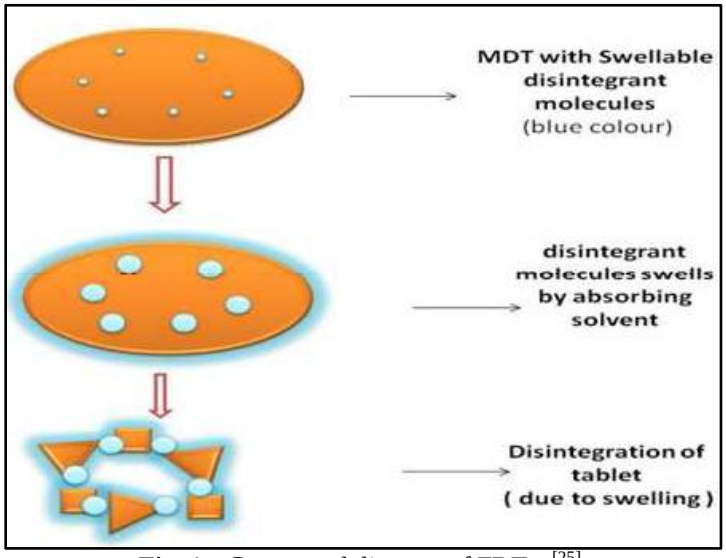

Fig. 1:- Conceptual diagram of FDTs. [25].

Requirements of fast Disintegrating tablets

Patient factors [3]

Suitability of fast Disintegrating tablets is for those patients (particularly pediatric and geriatric patients) who having the difficulties to swallow traditional tablets and capsules with an 8-oz glass of water. These include the following:

1. Patients who can'tswallow or chewing solid dosage forms.
2. Patients in compliance due to fear of choking.
3. Elder patients who are facing the problem of depression who may not be able to swallow the solid dosage forms
4. An eight-year-old patient with allergies desires a more convenient dosage form than antihistamine syrup.
5. A middle-aged patient undergoing radiation therapy for breast cancer may be too nauseous to swallow her H2-blocker.

6. A schizophrenic patient who may use to try to hide a conventional tablet under his or her tongue to avoid their daily dose of an atypical antipsychotic.
7. A patient with persistent nausea, who may be a journey, or has little or no access to water.

Effectiveness factor [5]

The increased rate of bioavailability and rapid onset of action are the main advantages of these products. The spread of saliva in the oral cavity causes pregastric absorption of certain ions of the formula in cases where the drug is readily soluble. The buccal, pharyngeal, and gastric areas are all areas of many drug intake. Pre-gastric absorption prevents the initial passage of metabolism and can be a great advantage for drugs undergoing hepatic metabolism. In addition, safety profiles can be improved for drugs that produce multiple toxic metabolites mediated by first-pass hepatic metabolism and gastric metabolism, and for drugs with oral absorption of multiple ion fractions.

Manufacturing and marketing factors.[11]

As a drug is nearing the end of its patent life, it is easy for pharmaceutical manufacturers to manufacture a particular drug in question in a newly developed dosage form. The newly developed dosage form allows manufacturers to expand market exclusivity, unique product diversity and expand patent protection. For example, Eisai Inc. Aricept FDT, a donepezil extension line for Alzheimer's disease, was launched in Japan in 2004 and the United States. In 2005, Ranbaxy issued a generic call in the United States in response to the drug.

Advantages of fast Disintegrating tablets .[6, 7]

1. We can swallow the tablet without water.
2. FDTs are easily accessible to children, the elderly and patients with mental disabilities.
3. Appropriate dosing compared to fluids.
4. The drug is easily digestible and absorbable, offering a rapid onset of action.
5. The bioavailability of medicines increases as other medicines are absorbed from the mouth, pharynx and esophagus by saliva passing through the stomach.
6. This is an advantage of liquid medicines in terms of administration or transport.
7. Initial metabolism is reduced, offering better bioavailability and thus reducing dose and side effects.
8. offer better security.
9. Suitable for continuous / controlled release activities.
10. High doses of drugs are allowed.

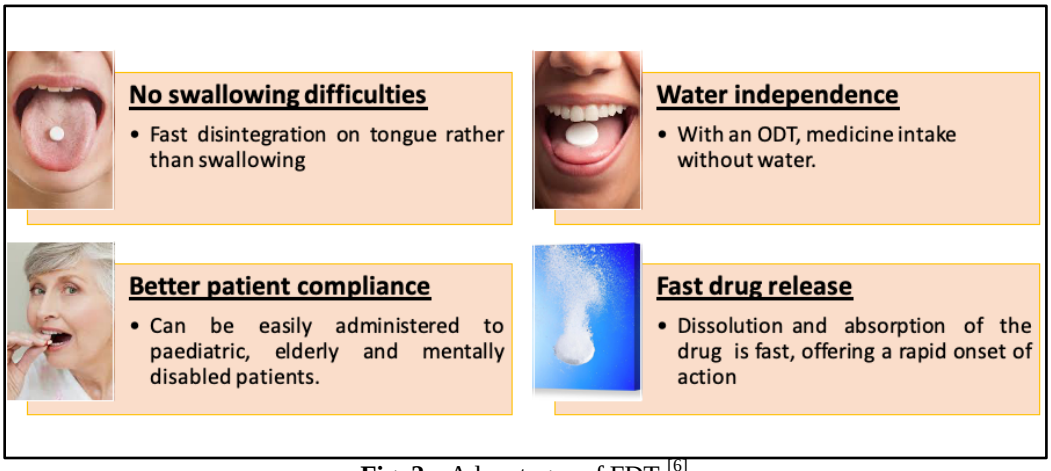

Fig. 2:- Advantages of FDT [6]

Limitations of FDTs [4, 5]

1. The main disadvantages of FDT are related to the mechanical strength of the tablets.
2. FDT has very porous and softly shaped metrics or compressed into low compression tablets. This makes the tablets fresher and more fragile, which is difficult to hold.
3. It is difficult for my taste buds to prepare FDT; special care should be taken before developing such a drug.
4. Many hygroscopic FDTs may not maintain physical integrity under normal humidity conditions requiring special packaging.

5. Candidates with dry saliva production may be poor candidates for these tablet formulations.
6. General bioavailability is the rate of saliva absorption.
7. Stability of the drug and dosage form.
8. Easy to administer to patients who cannot swallow, such as the elderly, stroke victims, patients at risk, renal failure patients and patients who refuse to swallow, such as pediatric patients, geriatric and psychiatric patients.
9. No water is required to swallow the dosage form, which is a more convenient feature for patients who travel and do not have easy access to water.
10. Rapid digestion and absorption of the drug, which results in a rapid onset of action.
11. Some medicines are absorbed from the mouth, pharynx and esophagus as saliva passes through the stomach. In such cases, the bioavailability of the drug is increased.
12. Pre-gastric absorption may increase bioavailability and may result in dose reduction;
13. If side effects are reduced, it may be due to improved clinical performance.
14. Feeling good in the mouth feels that this property helps to change the perception of the drug as a bitter pill, especially in pediatric patients.
15. The risk of contamination or contamination during oral administration of a conventional product due to physical obstruction is avoided, thus increasing safety.
16. Have business opportunities such as product differentiation, product promotion, patent renewal and lifecycle management.
17. Useful in cases such as motion sickness, sudden periods of allergic attack or cough, where ultra-rape action is required.
18. Due to the increased bioavailability, especially in the case of insoluble and hydrophobic drugs, due to the rapid degradation and degradation of these tablets. Stability over time because the drug remains in a solid dosage form until consumed. Thus, it combines the advantages of a solid dosage form with strength and a liquid form with dose bioavailability.
19. Easily adaptable and adaptable to existing processing and packaging machines.
20. Allow a high dose of the drug, cost effective.

Challenges to develop FDTs [3, 10]

Palatability

Most drugs are not tasty, FDTs often contain the active ingredient in a form that lurks in the taste. After administration, the FDTs break down or dissolve in the patient's oral cavity and release the active ingredients that come into contact with the taste buds. rather, concealing the taste of the medication could be critical to patient compliance[3, 11].

Mechanical strength and disintegration time

To break the FDT in the oral cavity, porous and soft matrices can be compressed or compressed into tablets with very low compression force, which can make the tablet brittle and / or brittle, difficult to hold. and often require specialized peelable blister packs, which can increase costs. There are only 2 technologies, such as wow tab and durasolv, that can harden the tablets sufficiently and pack them in multi-dose bottles.

Hygroscopicity

Many oral disintegrant dosage forms are hygroscopic and cannot maintain physical integrity under normal conditions of temperature and humidity [3, 11] Therefore, they require protection against moisture requiring special product packaging [3].

Amount of drug

The use of technologies used for FDT is limited by the amount of drug that can be included in each unit dose. In lyophilized dosage forms, the drug dose should be less than 400 mg for insoluble drugs and 60 mg for soluble drugs. This parameter is especially challenging when rapidly melting oral films or platelets. [3]

Aqueous solubility

Water-soluble drugs present several problems in formation because they form eutectic mixtures, which result in a lowering of the freezing point and the formation of a glassy solid, which may collapse during drying due to lack of support. collapse is sometimes prevented by the use of various matrix-forming excipients, such as mannitol, which arouse crystallinity and thus impart stiffness to the amorphous compound [3].

Size of tablet
The speed of tablet administration depends on its size. It is stated that the simple size of the tablet to swallow is 7-8 mm, while the simple size for holding is even larger than 8 mm. Therefore, it is difficult to achieve a tablet size that is easy to use and easy to administer [3, 5].

Mouth feel
FDT cannot be broken down into large particles in the oral cavity. The Diffn particles generated after FDT decay should be as small as possible. The addition of various flavors and refrigerants, such as menthol, can improve the mouthfeel [5].

Sensitivity to environmental conditions
FDTs should be less sensitive to environmental conditions such as humidity and temperature, as most materials used in FDTs should be soluble in a minimum amount of water [5].

Criteria for excipient used in formulation of FDTs [5, 10-13]
1. Their individual characteristics should not affect the FDT.
2. It should be easy to disassemble.
3. It should not interact with drugs or other excipients.
4. When selecting a binder (one or a combination of binders), the final integrity and strength of the product must be taken into account.
5. The melting point of the excipients used should be in the range of 30-35 ° C.
6. It should not impair the effectiveness and organoleptic properties of the product.
7. The nature of the binder can be liquid, semi-solid, solid or polymeric.

Excipients used in FDT preparation [5, 13-20]
Among the further excipient like one super disintegrant, a diluent, a lubricant and optionally a swelling agent, a permeabilizing agent, sweeteners and flavouring agents FDTs should contain at least one.

Table 1:- Name and weight percentage of various excipients in FDTs [1, 15]

Sr. No.	Name of excipient	% used
1	Super disintegrants	1-15 %
2	Binders	5-10 %
3	Antistatic agent	0-10 %
4	Diluents	0-85 %

The need for faster decomposition increases during the day. The pharmacist must therefore formulate disintegrants, i.e. super disintegrants, which are effective at low concentrations and have greater disintegration efficiency and are more effective intragranular. The action of these super disintegrants occurs by inflammation and the inflammatory pressure exerted in the outer or radial direction causes the tablet to explode or the water to be rapidly absorbed, leading to a large increase in the number to improve grain disintegration.

Factors which are used to considered for selection of super disintegrants [5, 16, 23]
Disintegration
The disintegrant should be easily incorporated into the saliva of the tablet to create the volume expansion and hydrostatic pressure required for rapid disintegration in the mouth.

Compatibility
It is desirable to have an FDT with acceptable stiffness and less friability at a given compression force for the production of solid tablets, which eliminates the need for special packaging while increasing production speed.

Mouthfeel
Large particles can cause a hard mouthfeel. Therefore, small particles are preferable. However, when the tablet comes in contact with water, it forms a gel-like consistency, creating a gummy texture that many consumers do not like.

Flow

In a typical tablet formulation, the superintegrants used should comprise at least 2-5% by weight. tablet formulation. The level of disintegrant may be higher with FDT formation [16].

Table 2:- List of super disintegrants [5, 23]

Sr.no	superdisintegrant	Mechanism of action	Specific properties
1	Croscarmellose sodium	Swell 4-8 fold in <10s Swelling and wicking action	Effective in low concentration ,high swelling Capacity cross-linking of carboxyl ester group
2	Crospovidone	Combination of swelling and wicking action swell 7-12 folded in <30 s	The effective concentration is 1-3% rapidly disperses and swells in water
3	Cross-linked alginic acid	Hydrophilic colloidal sub-tance which has high sorption capacity	The combination of swelling and wicking action causes disintegration.
4	Gellan gum	Strong swelling properties upon contact with water	Anionic polysaccharide of linear tetra saccharides ,good super disintegrant
5	Sodium starch glycolate	Strong swelling properties upon contact with water swell 7-12 folds in <30s	Rapid absorption of water result in swelling upto 6 % high concentration cause gelling
6	Soy polysaccharide	Rapid Disintegrating	Does not contain starch and sugar so can be used in products meant for diabetics
7	Xanthan gum	Extensive swelling properties for faster disintegration	High hydrophilicity and low gelling tendency ,low water solubility

Bulking materials [7, 23]

Bulk materials are important to support the rapid melting of tablets. They contribute to the functions of the diluent, filler and cost reduction. Bulking agents help to improve the texture of the tablets, thereby improving disintegration in the mouth, in addition to increasing the volume and reducing the concentration of the active ingredient in the formulation. The bulking agents used for this dosage form should be more sugar-based, such as mannitol, polydextrose, lactose derivatives, such as direct compressible lactose (DCL), and starch hydrolyzate for higher water solubility and better sensory perception. Mannitol in particular has a high solubility in water and good sensitivity because it provides a cooling effect due to the negative heat of the solution. Bulking agents are added in the order of 10% to about 90% by weight in their final composition. The descending order of fragility of the excipients was classified as microcrystalline cellulose> alpha lactose monohydrate> spray dried lactose> anhydrous beta lactose> anhydrous alpha lactose >> calcium phosphate dihydrate. Frequently used sugar-based excipients are mainly bulking agents (such as dextrose, fructose, lactitol, maltitol, maltose, mannitol, sorbitol, starch hydrolyzate, polydextrose and xylitol), which show high water solubility and sweetness. property and provides comfort. feeling in the mouth.

Sugar based excipients can be of types on the basis of moulding and dissolution rate:

1. Type 1 saccharides: (lactose and mannitol) which exhibits low moldability but high dissolution rate.
2. Type 2 saccharides: (maltose and maltitol) which exhibit high moldability but low dissolution rate.

Emulsifying agents [5, 23]

Emulsifiers are widely used to form and rapidly dissolve tablets because they help to rapidly disintegrate and release the drug without the need for rubbing, swallowing or drinking water. Emulsifiers also improve essential ingredients and increase bioavailability. Various fast melting emulsifiers for tablet formulations include alkyl sulfates, propylene glycol esters, lecithin, sucrose esters, and the like. It can be added in the order of 0.05% to about 15% by weight of the final formulation.

Lubricants [5, 12]

Although they are not essential excipients, they can help make the tablets tastier after they have been broken down in the mouth. Lubricants can reduce discomfort and aid in the process of drug transfer from the mouth to the stomach.

Flavours (taste masking agents) and Sweeteners [5, 23]

Thanks to flavors and flavoring agents, the products are tastier and for patients. Mixing these ingredients helps to overcome the bitterness and bad taste of some active. Natural and synthetic flavors can be used to increase the organoleptic properties of fast tablet digestion. A wide variety of sweeteners are available, including sugar, dextrose and fructose, as well as non-nutritive sweeteners such as aspartame, saccharin sodium, sugar alcohols and sucralose. The addition of sweeteners also imparts a pleasant taste to most formulations.

Techniques for preparing fast Disintegrating tablets

Conventional technologies

Various conventional manufacturing techniques for FDTs.

Freeze-drying or lyophilization [2]

It is a pharmaceutical process that allows drying of heat-sensitive drugs and biological substances at short temperatures using a vacuum to extract water by sublimation. The drugs are dissolved or dispersed in an aqueous carrier solution, transferred to a preform in blister packs and purged with nitrogen to freeze, then placed in a refrigerator to complete the process. The characteristics of lyophilization techniques are that they have a high porosity and a specific surface area and are easily soluble in the mouth, which represents a high bioavailability of the drug. The main disadvantage of this system is its high cost, loss of processing time and vulnerability, which makes conventional packaging not suitable for packaging this dosage form and strength problems are under stress.

Advantages

The main advantage of using this technique is that tablets made with this technique have a very short breaking time and have a good mouthfeel due to the rapid melting effect.

Moulding method [19]

Tablets are used in the design using hydrophilic components to achieve maximum drug solubility. The powder mass is coated in a hydroalcoholic solvent and compressed into a dosage form. The solvent system is then allowed to evaporate. The taste of the drug particles is improved by spraying a solidified mixture of hydrogenated cottonseed oil, sodium carbonate, lecithin, polyethylene glycol with the active ingredient in a lactose-based tablet triturate. A characteristic of the molding method is that it is very porous because the solvents are removed by drying, leaving a porous mass that promotes faster melting.

Melt granulation [24, 25]

The melt granulation technique is a process in which pharmaceutical powders can be collected in a soluble binder. The advantage of this technique compared to conventional granulation is that no water or organic solvents are needed. Because there is no drying step, the process is less time consuming and requires less energy than wet granulation. This technique is useful for increasing the degradation of poorly water-soluble drugs such as griseofulvin.

Mass-extrusion [24, 25]

In this mixture, the additives are softened using a water-soluble substance, such as polyethylene glycol, with methanol as the solvent, after passing through an extruder to form thin rolls. It is further cut with a heated blade to form small tablets. A characteristic feature of this method is that these products can be used to mask the bitter taste of drugs that form small granules, thereby improving oral bioavailability.

Sublimation [18]

Rapid decomposition and decomposition factor are obtained by forming a porous mass by incorporating inert solid components which decompose rapidly, such as urea, camphor ammonium carbonate, ammonium bicarbonate and hexamethylenetetramine. They are mixed with other ingredients and pressed. The volatile material is changed by reducing the pressure and applying a low temperature, leaving the mass in a porous form. A characteristic of the sublimation method is that they are porous in nature, solvents such as cyclohexane and benzene can be used.

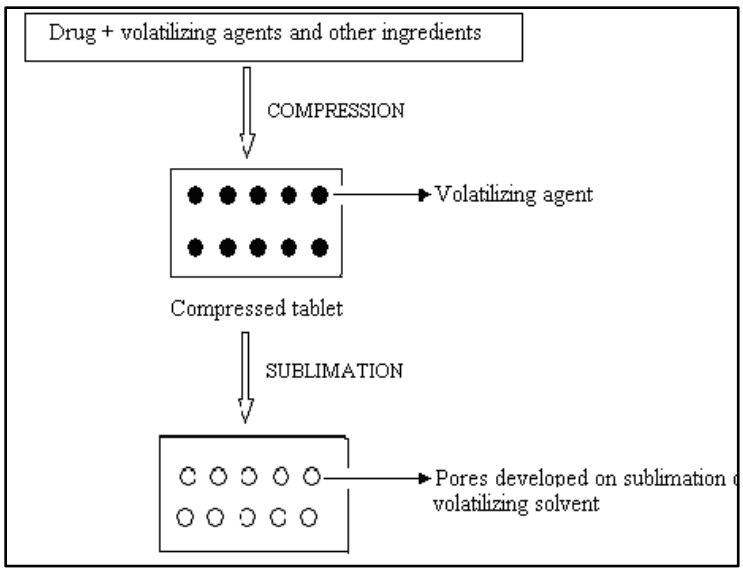

Fig. 3:- Schematic diagram of sublimation techniques for preparing fast Disintegrating tablets [24]

Direct compression [4]

Disintegrant technology (direct compression) is the most common technique in tablet production because it has several advantages:

1. High doses may be used and the final tablet weight may be skipped by other methods.
2. The easiest way to make tablets.
3. Usual equipment and commonly used aids are used.
4. Limited no. appropriate processing steps.
5. Cost effectiveness.

The size and hardness of the tablet will affect the effectiveness of the disintegrant. Hard and large tablets have a longer disintegration time than normally needed. Very smooth and small tablets have low mechanical strength. Therefore, the minimum class and concentration of disintegrant should be chosen to achieve rapid disintegration and high disintegration rates. Above the critical concentration level, however, the degradation time remains almost constant or even increases.

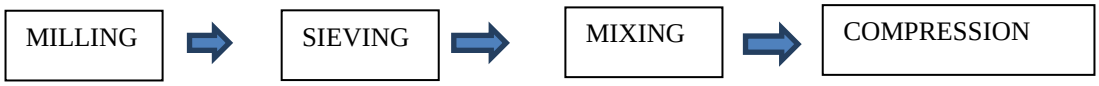

Fig. 4:- Process of direct compression [25]

Table 3:- general requirements, advantages and limitations of direct compression [25].

Sr.No	Ideal Requirement	Advantage	Limitation
1	Flowability	Cost effective production	Segregation
2	compressibility	Better stability of API	Variation in functionality
3	Dilution potential	Faster dissolution	Low dilution potential
4	Reworkability	Less wear and tear of punches	Reworkability
5	Stability	Simple validation	Poor compressibility of API
6	Controlled particle size	Low microbial contamination	Lubricant sensitivity

Cotton candy process [5]

This process is called because it uses a unique rotating mechanism to create a liquid crystal structure that mimics cotton candy. This process involves the formation of a matrix of polysaccharides as carbohydrates by the simultaneous action of flash melts and spins. The formed matrix is partially recrystallized to have better flow properties and compressibility. This cotton candy matrix is then ground and mixed with the active ingredients and

excipients and then pressed into FDT. However, other polysaccharides, such as polymaltodextrins and polydextrose, can be converted to fibers at temperatures 30-40% lower than sucrose. This change ensures the safe incorporation of thermolabile drugs into the formulation. Tablets made by this process are very porous in nature and provide a very pleasant mouthfeel due to the rapid contamination of sugars in the presence of saliva.

Spray-drying [21]

Using the above method, the components are mixed using hydrolyzed and non-hydrolyzed gelatin as a carrier, mannitol as a filler, sodium starch glycolate or croscarmellose sodium as a disintegrant and an acidic material (e.g. citric acid) and / or an alkaline material (e.g. decomposition) force. A characteristic of the spray drying method is that it provides a rapid solution (within 20 seconds) when the dosage form is in contact with an aqueous medium.

Phase transition process [25]

This process of FDT degradation by a phase transition in sugar alcohols with erythritol (edge point 122 ° C), xylitol (93-95 ° C), trehalose (97 ° C) and mannitol (166 ° C). Tablets are made by compressing a powder containing two high and low melting sugar alcohols and then heating to a temperature between their melting points. Prior to the heating process, the tablets did not have sufficient hardness due to low fit. The hardness of the tablet increases after heating due to the addition of interparticle bonds, because the connecting surface of the tablets is caused by the phase transition of the sugar alcohol with a low melting point.

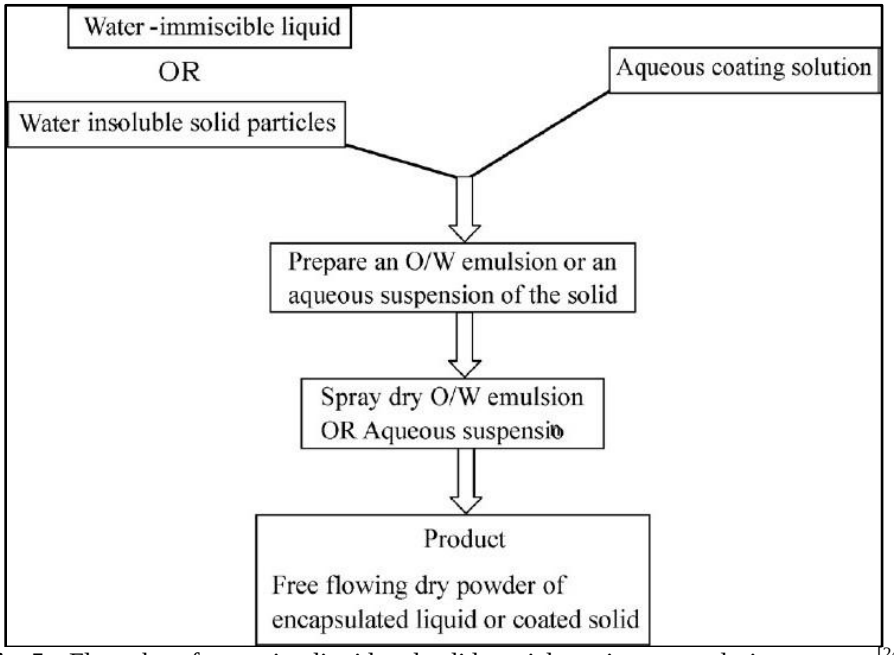

Fig. 5:- Flow chart for coating liquid and solid particles using spray-drying process [24]

Nanoionization[25, 27-29]

The newly developed nanotealing technology involves reducing the particle size of the drug to a nanoscale by grinding the drug using a patented wet milling technique. The drug nanocrystals were strengthened against agglomeration by surface adsorption of selected stabilizers, which were subsequently incorporated into the MDT. This technique is especially useful for poorly water-soluble drugs. Other advantages of this technology include rapid disintegration / melting of nanoparticles leading to increased absorption and thus higher bioavailability and reduced dose, cost-effective manufacturing process, conventional packaging due to exceptional durability. and a wider dose range (up to 200 mg drug per unit).

Oral disintegrating or fast Disintegrating thin films [25-29]

This is a new frontier in fast-release tablets that provide a convenient way to take medications and supplements. In this technique, an aqueous solution is prepared with a water-soluble film-forming polymer (pullulan, carboxymethylcellulose, hydroxypropylmethylcellulose, hydroxylethylcellulose, hydroxylpropylcellulose, polyvinylpyrrolidone or sodium alcohol). A flavor masking agent which is allowed to form a film upon evaporation

of the solvent. In the case of a bitter drug, a resin adsorbate or coated drug microparticles may be incorporated into the film. This film dissolves or dissolves easily when placed in the mouth and releases the drug in the form of a solution or suspension. Features of this system include thin paper films smaller than 2 × 2 inches, decomposition in 5 seconds, immediate drug delivery and taste imitation.

Patented technologies for fast Disintegrating tablets

The nature of the rapid melting of the FDT is often attributed to the rapid entry of water into the tablet matrix, leading to its rapid decomposition. Many technologies have been developed based on formulation aspects and various processes and patents of many pharmaceutical companies. The patented technology is described below: [30]

Zydis technology [30]

Zydis is a special lyophilised tablet in which the drug is physically trapped or dissolved in a matrix of fast-melting carrier material. When the zydis units are placed in the mouth, the lyophilized structure immediately breaks off and does not need water to help swallow. The zydis matrix is primarily composed of many materials designed to achieve multiple goals. Polymers such as gelatin, dextran or alginates are included to provide strength and resistance to treatment. This given shape is a shiny amorphous structure that supplies energy.

Limitations

1. The amount of medication used can normally be less than 400 mg for insoluble drugs and less than 60 mg for soluble drugs.
2. The particle size of the insoluble drug should not be less than 50 μm and not more than 200 μm to prevent sedimentation during processing.

Advantages

1. The buccal pharynx and stomach areas are all areas of absorption of this formulation. Any pre-gastric absorption prevents first-pass metabolism and may be an advantage of drugs that have a high liver metabolism.
2. The composition of Zydis is self-preserving because the final water concentration in the lyophilized product is too low to allow microbial growth.
3. Patients who have difficulty swallowing oral medications due to dysphagia, stroke or health problems such as gastroesophageal reflux, multiple sclerosis or Parkinson's disease.

Disadvantages

1. This lyophilization process is a relatively expensive manufacturing process.
2. The composition is because it is very light and fragile, and therefore should not be stored in a backpack or under a wallet.
3. Has poor stability at higher temperatures and humidity.
4. The water-insoluble drug can be taken up to 400 mg per tablet or less. On the other hand, the soluble drug can only be taken in 60 mg.

Orasolv technology [5, 10]

Orasolv technology was developed in CIMA laboratories. In this system, the active drug is stored in the taste. It also contains an effervescent disintegrant. Tablets are made by the direct compression technique with a certain short compression force in order to shorten the oral disintegration time. A tablet machine and conventional mixers are used to make the tablets. Tablets made with this technique are soft and fast and packaged with a specially designed selection and placement system.

Advantages [30]

The taste mask is double, easily digestible. This technology is used for drug strengths ranging from 1 mg to 750 mg. Depending on the formulation and size of the tablet, the disintegration time of the tablet can be designed to range from 10 to 40 seconds.

Disadvantages[30]

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

Durasolv technology [4, 5]

Durasolv is a patented technology of CIMA laboratories. Tablets made with this technology consist of a drug, filler and lubricant. The tablets are prepared with this standard tableting machine and have good hardness. They can be packaged in a conventional packaging system, such as blisters. Durasolv is another suitable technology for products that require small amounts of active ingredient.

Advantages [30]

DuraSolv technology is ideal for tablets with a small amount (125 mcg to 500 mg) of active ingredient and the tablets are compressed to a maximum hardness of 15-100 N, resulting in a more robust ODT. As a result, this technology allows for packaging flexibility; and then the tablets can be filled into bottles and blisters.

Disadvantages [30]

The technology is not compatible with larger doses of active ingredient because the formulation is exposed to high pressure during compression. The Durasolv powdered powder coating may break during compression and expose the bitter drug taste to the patient's taste.

Wow tab technology [4, 5, 30-31]

This tablet technology is patented by Yamanouchi Pharmaceutical Co. WOW means "no water". In this process, a combination of low formability carbohydrates and high formability carbohydrates is used to obtain a fast melting solid tablet. The combination of their high and low ductility is used to produce boards with sufficient hardness.

Advantages

This tab technology is patented by Yamanouchi Pharmaceutical Co. WOW means "Without water". In this process, a combination of low formability carbohydrates and high formability carbohydrates is used to obtain a fast melting solid tablet. The combination of their high and low ductility is used to produce boards with sufficient hardness.

Disadvantages

There was no significant change in bioavailability.

Flash dose technology [4, 23, 30]

Twelve flash technology implemented by Fuisz. Nurofen melt let, a new form of ibuprofen as an orodispersible tablet, prepared using flash dosing technology, is the first commercial product to be marketed by Biovail Corporation. Flash tablets consist of a self-binding matrix of a shear form called a thread. Shear matrices are prepared immediately by rapid heat treatment.

Advantages

High surface area for dissolution

Disadvantage

1. The high temperature required to melt the matrix may limit the use of heat-sensitive, moisture-sensitive, and moisture-sensitive drugs.
2. The dosage form can only provide 600 mg of drug.
3. The tablets produced are extremely fresh, soft and sensitive to moisture.
4. Therefore, special packaging is required.

Pharmabust technology [5, 12]

Pharmaburst technology is patented by SPI pharma. Tablets made in this way contain a dry mixture of the drug, flavor and also lubricant, followed by compression of the tablets, which then dissolve within 30-40 seconds.Tablets made in this way have sufficient strength to be packaged in blisters and vials.

Flashtab technology [38, 39]

Flashtab technology is another fast-melting / disintegrating tablet formulation. Prographarm labs implement flashtab technology. It uses most of the same excipients as conventional compressed tablets. The disintegrant as well as the swelling agent are used in this formulation in combination with the drug particle coating to disintegrate the tablet in the mouth in less than a minute.

Oraquick technology [30-33]

K.V.S. Pharmaceutical has a patent on this technology. It uses a taste microsphere mask technology called micromask, which provides a better mouthfeel than a taste mask alternative, significant mechanical strength and rapid degradation / melting of the product. Not all types of solvents are used in the taste secretion process. This will therefore lead to greater and faster efficient production.

Advantages

Faster and more efficient production, suitable for heat-sensitive drugs.

Dispersible tablet technology [5]

Leak in Yugoslavia has issued patents for dihydroergotoxin and cimetidine dispersible tablets, which are said to dissolve in less than 1 minute upon contact with water at room temperature. In its basic form, dihydroergotoxin is poorly soluble in water. Better degradation of this dihydroergotoxinmethanesulfonate was observed for dispersible tablets containing 0.8 to 10%, preferably about 4% by weight of organic acids. One of the main excipients of cimetidine is the formation of ions, which is a disintegrant. It causes rapid swelling and / or a good ability to read tablets and thus rapid disintegration. Disintegrants include starch such as modified starch, microcrystalline cellulose, alginic acid, cross-linked sodium carboxymethylcellulose, and cyclodextrin polymers. The combination of two or more disintegrants provides better disintegration results.

Advatab technology [39]

Advatab tablets disperse rapidly orally, usually in less than 30 seconds, to allow rapid administration of the oral drug without water. These tablets are especially suitable for patients who have difficulty swallowing capsules and tablets. Advatab differs from FDT technologies in that it can be combined with complementary Eurand particulate technologies, such as Microcaps® state-of-the-art taste masking technology and its Diffucaps®, a controlled release technology.

Nanocrystal technology [5, 12, 30]

For fast tablet melting, Elans' patented nanocrystalline technology is able to create and improve the composite activity and properties of the final product. By reducing the particle size, the surface area increases, which leads to an increase in the melting rate. This can be predicted and effectively with nanocrystalline technology. Nanocrystalline particles are easily small drug particles, typically less than 1000 nanometers (nm) in diameter, made by grinding the drug using a patented wet milling technique.

Nanocrystal fast Disintegrating technology provides for

1. Pharmacokinetic benefits of orally administered nanoparticles (<2 microns) in the form of rapid disintegration of the tablet matrix.
2. Product diversity based on a combination of proprietary and patented technological elements.
3. Cost-effective production processes using standard, scalable unit operations.

Frosta technology (Akina) [5, 12, 13]

This technology is implemented by Akina. Frosta technology uses the basic concept of molding plastic granules and compression at short pressures to produce solid tablets with high porosity. The process involves mixing a porous plastic material with a water penetration enhancer and subsequent granulation with a binder.

Table 4:- Patents on diffierent fast Disintegrating drug delivery system or FDTs. [4, 6, 7, 40]

S.NO	AUTHOR	DRUG	METHOD/PLYMER	INFERENCE
1	Lee et aL(2013)	megestrol	Spray drying	Quicker dissolve and mask the taste of drug.
2	Szamost et aL(2013)	Phenyl propanolamine Lamina HCL	Direct compression	melt at 37.c and low compression force.
3	Constantine (2011)	Ondasetron	Polyethylene glycol	Used of the bioactive agent and treatment of dysphagia.
4	Singh et Al (2006)	Nimesulide	Sodium starch glycolate	Dissolve or disintegrate in digestive organ.

5	Aggarwal et aL(2005)	Galanthamine	Direct compression	Used in Alzheimer disease.
6	Callihan et aL(2005)	Aspirin	Direct compression	Mannose provide rapid disintegration and dissolution.
7	Szamost et aL(2013)	Ibuprofen	Direct compression	Provide excellent mouth feel.
8	Khawla et aL(2013)	Ibuprofen	Melt extrusion	Very low compression force.
9	Callihan et aL(2013)	Caffeine	Direct compression	Rapid dissolution.
10	John et aL (2013)	Active substance	Freeze drying	Rapid disintegration.
11	Abu-lzzakawla et aL(2013)	Iboprofen	Direct compression	Low melting point of compound use.
12	William et aL(2013)	efavirenz	Wet granulation	Used in HIV.
13	Gilis et aL(2013)	Galanthamine HBr	Direct compression	Used in treatment of Alzheimer dementia.
14	Warner Lambert Co.et aL(2012)	Active substance	Direct compression	Used low density granules.
15	Makino et aL(2012)	Active substance	Compression molding	High adequate strength disintegration and Disintegrating rate.

Table 5:- Work which is done on fast Disintegrating drug delivery system or FDTs[3, 4, 40]

s.no	Author	Drug	Method /polymer	inference
1	Durgabhavani et aL (2016)	valsartan	Vaccume drying technique	Improve disintegration time
2	Karia et aL (2015)	Olmesartan medozoinil	Co-processed excipient technique	Better in vitro drug release
3	Subbaiah et aL (2015)	Amoxicillin trihydratevand potassium clavunate	Direct compression	Improve disintegration time and in vitro drug release
4	Munde et aL (2015)	Lansoprazole	Direct compression	Improve in vitro drug release.
5	Metkari et aL (2014)	Carbamazepine	Direct comp.using solid dispersion	Good dissolution profile with short disintegration time.
6	Babu et aL (2014)	Carbamazepine	Direct compression	In vitro drug release increased.
7	Arunachalam et aL (2013)	Levofloxacin	Direct compression	Improve disintegration time.
8	Valera et aL (2013)	Amoxicillin trihydratevand potassium clavunate	Dry granulation method	Improve in vitro drug release.
9	Rawat et aL (2013)	Pioglitazone hydrocloride	Direct compression	Improved patient compliance.
10	Saroha et aL (2013)	Amoxicillin trihydrate	Direct compression	Better disintegration rate.
11	Bhati et aL (2013)	Metoclopramide hydrochloride	Direct compression	Improve patient compliance in pediatric and geriatric.
12	Layer et aL (2013)	Risperiodone	Granulation methodSolvent evaporation method	Enhanced dissolution and increase bioavailability.
13	Singh et aL (2013)	Amoxicillin trihydrate and potassium clavunate	Wet Granulation method	Improve in vitro drug release .
14	Rao et aL (2012)	fosinopril	Sublimation method	Increase rate of dissolution

				and bioavailability.
15	Rao et aL (2012)	fosinopril	Direct compression	Used in treatment of various cardiovascular disorder.
16	Bhupati et aL (2012)	Terbutaline sulphate	Direct compression	Maintain therapeutic concentration and enhance and bioavailability.

The technology can be used for almost any drugs including market place and extension of patent term of innovator. The clinical studies that shows the FDTs can improve patient compliance, provide a rapid onset time of action, and increase bioavailability. Considering the many benefits of FDTs, it is only a matter of time until a majority of oral formulations are prepared in FDT forms.

Lyo (Pharmalyoc) [5, 12, 13]

An oil-water emulsion was prepared and placed directly into the blister cavities, followed by lyophilization. Inhomogeneity during lyophilization can be prevented by adding an inert filler to increase the viscosity at the end of sedimentation. The high proportion of filler reduces the porosity of the tablets, thus reducing light refraction..

Sheaform technology [5]

The technology is based on the preparation of a thread also known as a shear from a matrix, which is produced by the object of feed. Broth containing sugar carrier by flash heat treatment. In this process, the sugar is simultaneously exposed to a centrifugal force and then to a temperature gradient, which raises the temperature of the mass to create an internal flow condition, allowing parts of it to move relative to a particular mass. The yarn produced is amorphous in nature, so it is further cut and recrystallized by various techniques..

Marketed products of fast Disintegrating tablets

The commercialised products of FDT which are available in the market are given in table no. 6 and 7.

Table 6:- Different fast Disintegrating tablets products available in Indian market [2-8]

Sr.no	Brand (trade) name	Active drug	Manufacturer/company
1	Acepod-O	cefpodoxime	ABL Lifecare, India
2	Acufix DT-TAB	cefixime	Macleods, India
3	Alepam	Amoxycillin trihydrate and potassium clavulanata	Scoshia remedy, India
4	Bigecef DT-TAB	Cefuroxime	Bestochem ,India
5	Clonazepam ODT	clonazepam	Par pharmaceutical
6	Dompan	Pantoprazole and domperidone	Medley pharmaceutical, India
7	Mosid-MT	Mosapride citrate	Torrent pharmaceuticals, Ahmedabad, India
8	Minoclav DT-TAB	Amoxycillin trihydrate and potassium clavulanata	Minova life sciences,India
9	Nulev	Hyoscyamine sulfate	Schwarz pharma, India
10	Nimulid MDT	nimesulide	Panacea Biotech ,Newdelhi, India
11	Numoxylin CV DT	Amoxycillin trihydrate and potassium clavulanata	Gepach international, india
12	Zyrofmeltab	Rofecoxib	Zydus cadila, India
13	Romilast	montelukast	Ranbaxy labs Ltd,New Delhi, India
14	Torrox MT	Rofecoxib	Torrent pharmaceuticals, ahemadabad, india
15	valus	Valdecoxib	Glenmark , India

Table 7:- Different fast Disintegrating tablets products available in international market[2-6]

SR.NO	Brand (trade) name	Active drug	Manufacture/company
1	Benadryl Fastmelt	diphenhydramine and psudoephedrine	Warner-Lambert ,NY,USA

2	Claritin redi tab	Loratadine	Schering- plough corp. USA
3	Domperidone Ebb	Domperidone	Ebb medical ,Sweden
4	Domperon	Domperidone	Astra pharma ,Bangladesh
5	Feldene fast melt	Piroxicam	Pfizer Inc, NY, U.S.A
6	Febrectol	Paracetamol	Prographarm,chateauneuf, France
7	Gaster D	Famotidine	Yamanouchi
8	ImpodiumIstant melt	Loperamide HCL	Janssen, UK
9	Maxalt MLT	Rizatriptan	Merk and co. ni. USA
10	Nasea OD	Ramosetoron HCL	Yamanouchi

Conclusion:-

Rapidly Disintegrating tablets are new dosage forms that have been developed and designed specifically to overcome some of the problems encountered with the usual rapid dosage form, ie difficulty swallowing the tablet in geriatric patients and paediatrician's. Fast-digesting tablets are designed to dissolve or dissolve in saliva, usually in less than 60 seconds (up to 5-60 seconds). Fast-Disintegrating tablets have better patient adhesion and intake can improve biopharmaceutical properties, greater bioavailability, convenience and be safer compared to conventional oral dosage forms. The popularity of the FDT has grown significantly in recent decades. FDT should be designed for psychotic patients, at-risk, geriatric, pediatric patients, for patients without access to water, patients who are busy traveling. FDT formulations are formulated using some of these standard and patented technologies, and FDTs have sufficient mechanical strength, rapid disintegration / melting of the oral cavity without water. The new technologies used to make FDT provide more effective dosage forms with many advantages and disadvantages.

Conflict Of Interests

Declare none.

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