IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

Review on Formulation and Evaluation of Mouth Dissolving Tablet

Rutuja M. Sawarkar and Tanvi S. Nimkar
New Montfort Institute of Pharmacy, Ashti, Wardha, India

Abstract: *Now day's formulation research is breaking barriers of conventional methods. Recently, MDTs have take over an important position in the market by overcoming previously administration problems and contributing to extension of patient life, which have difficulty in swallowing tablets and capsules. Upon introduction into the mouth, these tablets dissolve/ disintegrate in the mouth without additional water for easy administration of pharmaceutical ingredients. These dosage forms are also used to attain instant a higher concentration of drug in body for immediate actions. These are novel dosage forms which dissolve in mouth cavity within a few seconds. This article attempts at discussing ideal properties, advantages, limitation, choice of drug candidates, need of formulation, approaches for preparation of MDTs, Patented technologies on MDTs and Evaluation tests of MDTs.*

Keywords: Mouth dissolving tablets, fast Dissolving Tablets, Superdisintegrants, patented technology, MDT's, FDT

I. INTRODUCTION

In recent decades, a variety of pharmaceutical research has been conducted to develop new dosage forms. Considering quality of life, most of these efforts have been focused on ease of medication. Among the various dosage forms developed to improve the ease of administration, the mouth dissolving tablet (MDT) is the most widely preferred commercial products. The oral cavity is an attractive site for the administration of drugs because of ease of administration. Various dosage forms like Tablets, Capsules, Liquid preparations are administered by oral route. During the last decade, mouth dissolving tablet (MDT) technologies that make tablets disintegrate in the mouth without chewing and additional water intake have drawn a great deal of attention.

The MDT is also known as fast melting, fast dispersing, rapid dissolve, rapid melt, and or quick disintegrating tablet. All MDTs approved by the Food and Drug Administration (FDA) are classified as orally disintegrating tablets. Recently, the European Pharmacopeia adopted the term orodispersible tablet for a tablet that disperses or disintegrates in less than 3 minutes in the mouth before swallowing. Such a tablet disintegrates into smaller granules or melts in the mouth from a hard solid to a gel-like structure, allowing easy swallowing by patients.

The disintegration time for good MDTs varies from several seconds to about a minute. Orally disintegrating tablets provide an advantage particularly for pediatric and geriatric populations who have difficulty in swallowing conventional tablets and capsules. Additionally, pediatric patients may suffer from ingestion problems as a result of underdeveloped muscular and nervous control.

Moreover, patients traveling with little or no access to water, limit utility of orally administered conventional tablets or capsules. Mouth dissolving of tablet results in quick dissolution and rapid absorption which provide rapid onset of action. Moreover, drug candidates that undergo pregastric absorption when formulated as MDTs may show increased oral bioavailability. It provides good stability, accurate dosing, easy manufacturing. Pre-gastric absorption can result in improved bioavailability and as a result of reduced dosage, improved clinical performance through a reduction of unwanted effects.

Mouth dissolving tablet (MDT) It is a tablet that disintegrates and dissolves rapidly in the saliva, within a few seconds without the need of drinking water or chewing. A mouth dissolving tablet usually dissolves in the oral cavity within 15 s to 3min. Most of the MDTs include certain super disintegrates and taste masking agents.[1]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

IDEAL PROPERTIES OF MDT

1. It should not require water to dissolve or disintegrate in the mouth in a couple of seconds
2. It ought to permit heavy drug loading
3. It ought to work well with other excipients and flavor masking
4. It ought to feel good in the mouth
5. There should be little to no residual in the mouth after oral administration
6. It ought to be strong enough to endure the strains of manufacture
7. It need to be somewhat insensitive to external factors such as humidity and temperature.
8. It ought to be versatile and compatible with current processing and packaging equipment
9. It ought to make it possible to produce tablets at a reasonable cost using standard packaging and processing machinery.

MOUTH DISSOLVING PHENOMENON

Superdisintegrants are given far greater consideration when creating mouth dispersing pills. By inducing swelling and water absorption in the pill, they offer quick disintegration. The swelling mechanism of the superdisintegrants wets the carrier's surface, which enhances tablet disintegration and causes increased dissolution to occur. The swelling capacity in the dissolving liquid and matrix density both affect how well superdisintegrants act. A greater degree of disintegration is caused by a matrix with a higher swelling capacity and density.[2]

ADVANTAGES OF MDT

1) Administration to the patients who can not swallow, such as the elderly, stroke victims, bedridden patients, patients affected by renal failure & patients who refuse to swallow such as pediatric, geriatric & psychiatric patients.
2) Rapid drug therapy intervention.
3) Achieve increased bioavailability/rapid absorption through pregastric absorption of drugs from mouth, pharynx & oesophagus as saliva passes down.
4) Convenient for administration and patient compliant for disabled, bedridden patients and for travelers and busy people, who do not always have access to water.
5) Good mouth feel property helps to change the perception of medication as bitter pill particularly in pediatric patients.
6) The risk of chocking or suffocation during oral administration of conventional formulations due to physical obstruction is avoided, thus providing improved safety.
7) New business opportunity like product differentiation, product promotion, patent extension and life cycle management.[3]

LIMITATIONS OF MDTS

It includes

- The tablets commonly have insufficient mechanical strength. Hence, conscientious handling is necessary.
- The tablets may leave an unpalatable taste and grittiness within the mouth if not formulated properly.
- Patients who simultaneously take anticholinergic drugs are not suitable candidates for MDTs[4]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

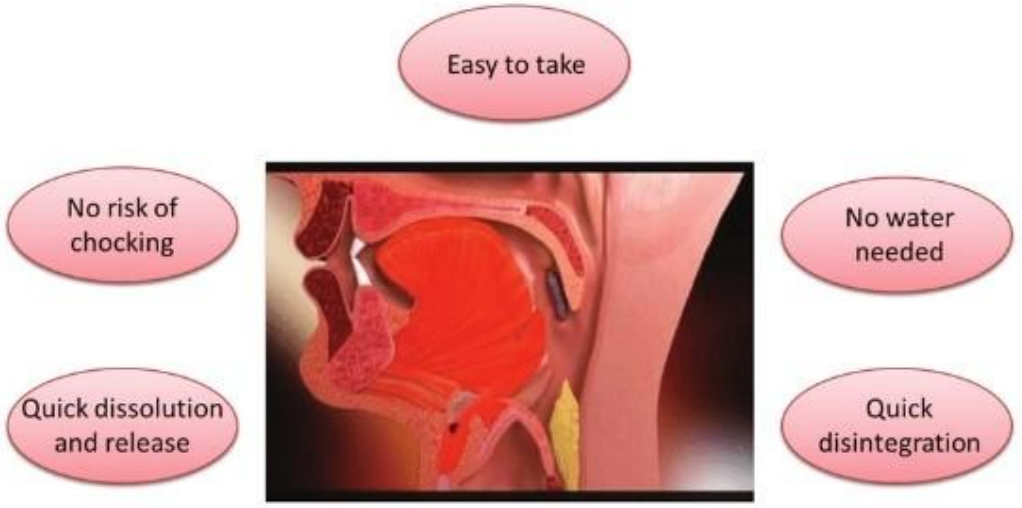

Fig.1 Advantages of mouth dissolving tablet.

FORMULATION OF MDT

The ideal properties of a medicine for oral absorption and pregastrointestinal absorption from MDTs are: Free from bitter taste Dose lower than 20 mg Small to Moderate molecular weight Good solubili ty in saliva Ability to permeate through oral mucosal tissue.

Bulking materials:

Bulking ingredients play a big role in the creation of fast-melting tablets. The substance provides diluent, filler, and cost-cutting properties. Additionally, increasing bulk also lowers the concentration of the active ingredient in the composition. Bulking agents enhance the textural qualities, which in turn promote the disintegration in the mouth. For increased aqueous solubility and good sensory perception, more sugarbased bulking agents are advised for this delivery system, such as mannitol, polydextrose lactitol, DCL (direct compressible lactose), and starch hydrolystate. Bulking agents are incorporated into the final composition in amounts ranging from 10% to 90% by weight.

Emulsifying agents:

Emulsifying agents are crucial excipients for creating tablets that dissolve quickly because they speed up medication release without the need for chewing, swallowing, or water. Emulsifying chemicals are also helpful in stabilising immiscible blends and improving bioavailability. For the creation of fastacting tablets, a variety of emulsifiers are advised, including alkyl sulphates, propylene glycol esters, lecithin, sucrose esters, and others. These substances can be included in the final composition in amounts varying from 0.05 to 15 percent by weight.

Lubricants:

Even though they are not necessary excipients, lubricants can help make these tablets more appeal in once they dissolve in the mouth. Lubricants take away stickiness and help transfer drugs from the lips down into the stomach.

Flavours and sweeteners:

The products are made more edible and attractive for patients by adding flavours and tastemasking chemicals. These substances help to mask the bitterness and unpleasant tastes of some active compounds.

Table 1: Enlists various existing superdisintegrants and also their mechanism of action

Name of superdisintegrants	Brand	Concentration (%)	Mechanism of action
Sodium Starch Glycolate	Explotab,Primogel	2-8%	Swelling
Micro crystalline cellulose	Avicel, Celex	2-15%	Water wicking
Cross linked povidone	Cross providone	2-5%	Swelling, Water wicking

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

Low substuted hydroxy propyl cellulose	LH-11, LH-12 (Grades)	1-5%	Swelling
Crosscarmellose sodium	Ac-Di-Sol	1-3%Direct compression 2-4% wet granulation	Wicking and swelling
Pregelatinized starch	Starch 1500	1-20%	Swelling

Superdisintegrants:
An excipient called a disintegrant is added to a tablet or capsule mixture to help the compacted mas s break apart when it is placed in a fluid environment.

Advantages:
- Effective in lower concentrations
- Less effect on compressibility and flowability.

SELECTION OF SUPERDISINTEGRANTS:
Superdisintegrants typically alter disintegration rate, but when administered at large doses, they can also affect tablet hardness, friability, and tongue feel. Therefore, a number of desirable criteria that should be taken into account when choosing a suitable superdisintegrant for a given formulation include:
- When a tablet comes into contact with saliva in the mouth or oral cavity, they quickly disintegrate.
- Be able to make tablets that are less brittle by being compact.
- Give patients a positive mouthfeeling experience.
- Small particle sizes are therefore selected to ensure patient compliance.
- Flow well, as this enhances the whole blend's flow properties.[5]

MECHANISM OF SUPER DISINTEGRANTS ACTION IN THE FORMULATION OF MOUTH DISSOLVING TABLETS
There are various methods regarding disintegration. These are:

Through capillary action and porosity (wicking):
Capillary action is the first step to disintegrate any tablets. Whenever we put the tablet into any suitable aqueous solution, the aqueous solution slowly penetrates through the tablets. Then the tablet is getting free of any adsorbed air bubbles as it replaces by the aqueous medium. After that, all the intermolecular bond present in the tablet is broken down and forms fine particles. As the tablet is disintegrated within an aqueous solution, the effect of this action depends upon some factors like hydrophilicity (water-loving) character of excipients and the condition of the tablet. The porous structure of the particles and low interfacial tension between the particles and aqueous medium should be maintained properly for good disintegration because it creates a hydrophilic network around the drug particles.

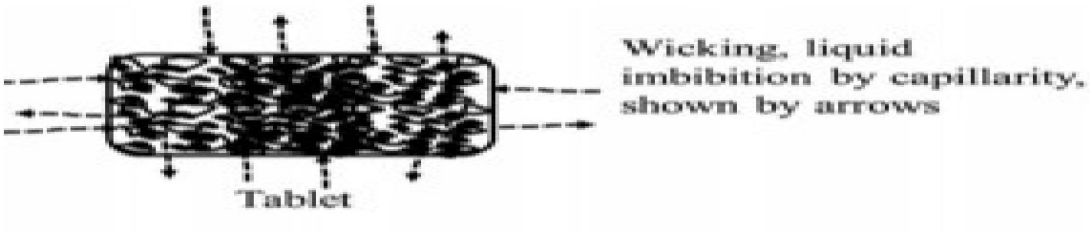

Fig. 2 Wicking

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

Through swelling:

Swelling is one of the most important factors regarding tablet disintegration. Tablets with low porosity are more preferable than tablets with high porosity because in the case of low porosity tablet there is sufficient swelling force but in case of high porosity tablet exerting swelling force is very less to disintegrate the tablet properly. The packing fraction of any tablet is also an important factor. If the tablet is highly packed then the medium is not penetrated properly hence the disintegration process slows down.

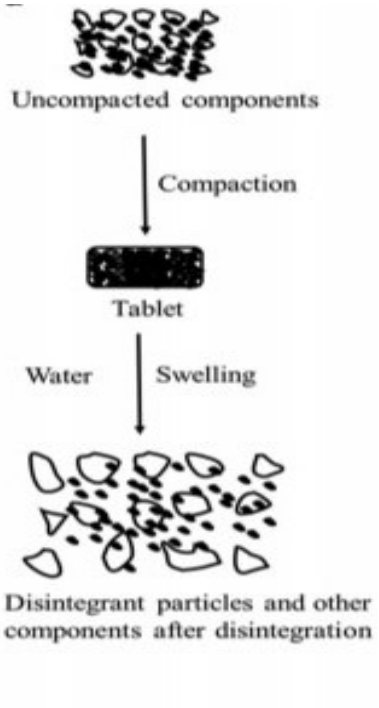

Fig.3 Swelling

Due to deformation:

After compression, the tablets are broken down into various particles that are deformed. Those deformed particles further regain their original structure when they have dealings with aqueous solutions. After compression, the starch particles were deformed completely hence the swelling capacity was improved. The particle size is increased after swelling that's why the breakdown of the tablet occurs.

Due to the release of gases:

Tablet contains some acidic substances like tartaric acid and citric acid. When these acidic substances dealt with carbonate and bicarbonate during wetting, it produces carbon dioxide in the mixture. This producing carbon dioxide gas exerts pressure within the tablet hence disintegration occurs. That mixture is called an effervescent mixture. These effervescent tablets have fast-dissolving or disintegrating properties. These ingredients should be kept in proper environmental conditions as it is highly sensitive to temperature and humidity of the air. It may be added to the formulation during the compression period or else.

Due to disintegrating particle-particle repulsive forces: This type of disintegration mechanism is applicable for those tablets that contain 'non-swellable' disintegrants. The scientist Guyot - Hermann first coined this theory regarding particle-particle repulsive forces. It proves that the particles can disintegrate without swelling. This type of disintegration occurs in aqueous medium and electric repulsive forces between particles are responsible for the disintegration of tablets.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

Through enzymatic action:

Our body consists of various enzymes in different organs. Those enzymes are biological catalysts or we can call it biological disintegrants. During the disintegration process, the bond present in the binder is broken down. After swelling, the particles exert some pressure on the radial direction due to increasing its size. Hence the tablet is ruptured in the solution.

Due to the heat of wetting (air expansion): It is also an important disintegration process. Some disintegrant having the properties to generate heat when we dissolve it in the solution. Those are called exothermic disintegrant. That generated heat is used to form localized stress by expanding capillary air which causes disintegration of tablets.

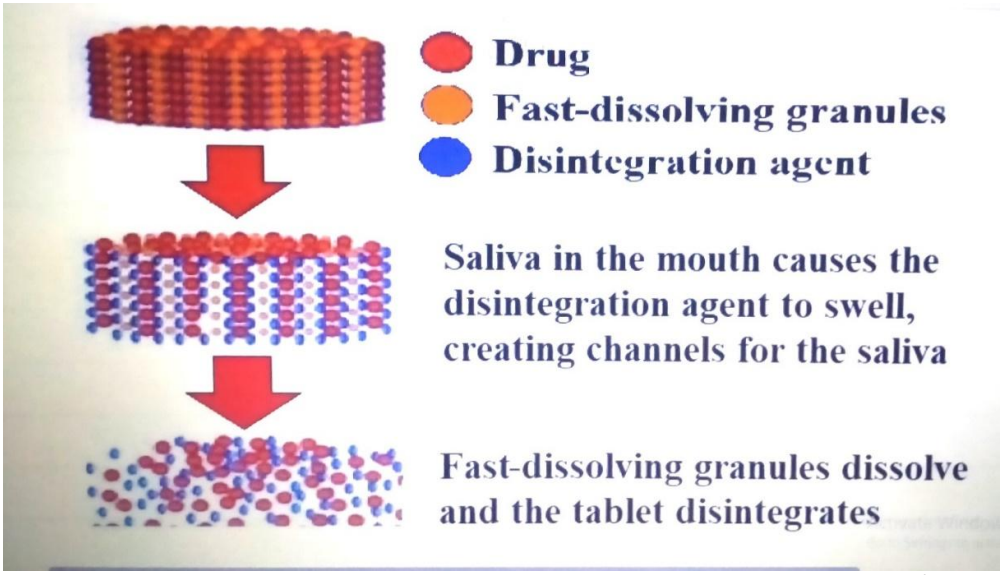

Fig 4: Mechanism of drug, fast-dissolving granules and disintegration granules[6]

TECHNIQUES FOR PREPARING MOUTH DISSOLVING TABLETS:

Some of the new advanced technologies which are commonly being used in last few decades are summarized as:-

1. Freeze drying/Lyophilization
2. Molding
3. Direct Compression
4. Cotton Candy Process
5. Spray drying
6. Sublimation
7. Mass Extrusion
8. Melt granulation
9. Nanonization
10. Fast Dissolving Films
11. Phase Transition Process
12. Three-dimensional Printing (3DP)

1. Freeze drying/Lyophilization :

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. The lyophilization process imparts glossy amorphous structure to the bulking agent and sometimes to the drug, thereby enhancing the dissolution characteristics of the formulation. A typical procedure involved in the manufacturing of MDT using this technique is mentioned here. The active drug is dissolved or dispersed in an aqueous solution of a carrier/polymer. The mixtures is done by weight and

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

poured in the walls of the preformed blister packs. The trays holding the blister packs are passed 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 applied on a blister-sealing machine. Finally the blisters are packaged and shipped. The freeze- drying technique has demonstrated improved absorption and increase in bioavailability

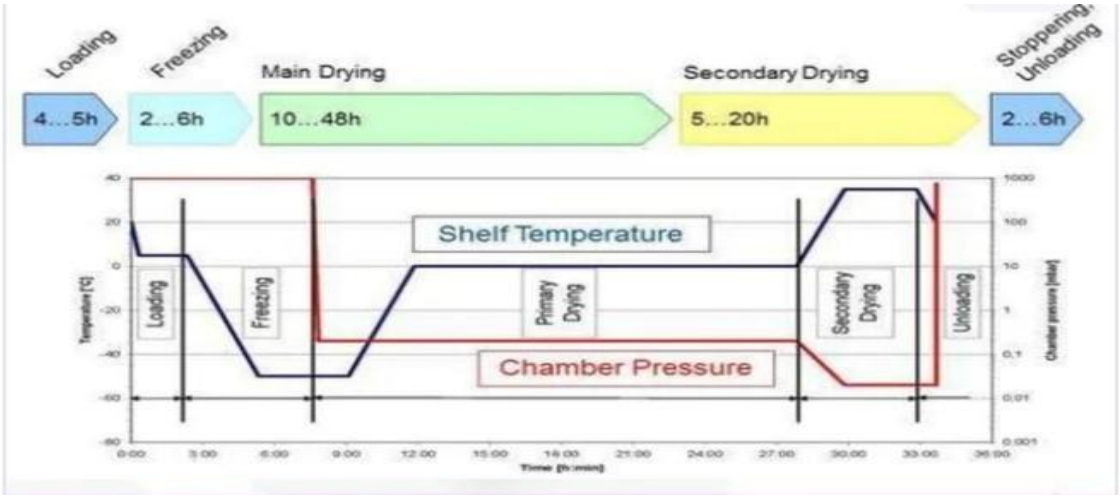

Fig. 5 Freeze drying process

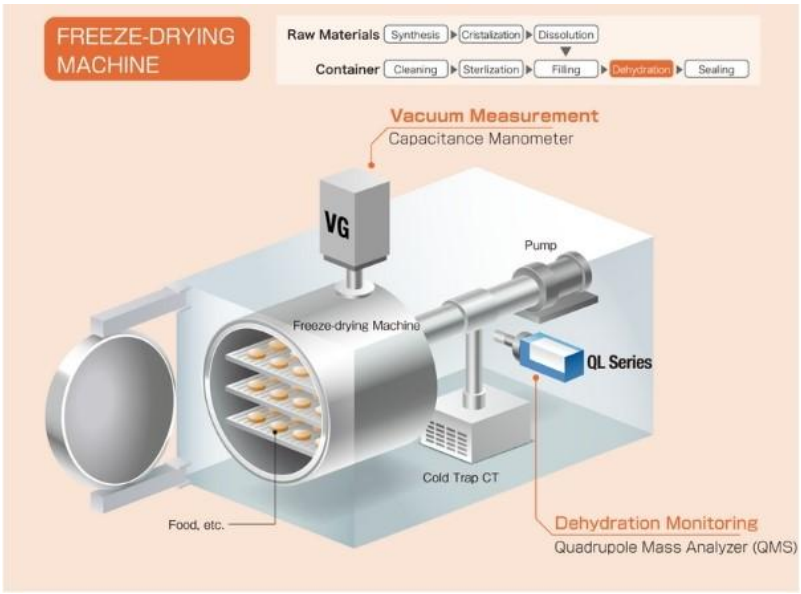

Fig.6 Freeze Drying Machine

Molding:

Molding process is of two type's i.e. solvent method and heat method. Solvent method involves moistening the powder blend with a hydro alcoholic solvent followed by compression at low pressures in molded plates to form a wetted mass (compression molding). The solvent is then removed by air-drying. The tablets manufactured in this manner are less compact than compressed tablets and posses a porous structure that hastens dissolution. The heat molding process involves preparation of a suspension that contains a drug, agar and sugar (e.g. mannitol or lactose) and pouring the suspension in the blister packaging wells, solidifying the agar at the room temperature to form a jelly and drying at 300C under vacuum. The mechanical strength of molded tablets is a matter of great concern. Binding agents, which

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

increase the mechanical strength of the tablets, need to be incorporated. Taste masking is an added problem to this technology. The taste masked drug particles were prepared by spray congealing a molten mixture of hydrogenated cottonseed oil, sodium carbonate, lecithin, polyethylene glycol and an active ingredient into a lactose based tablet triturate form. Compared to the lyophillization technique, tablets produced by the molding technique are easier to scale up for industrial manufacture

Direct Compression:

Direct compression represents the simplest and most cost effective tablet manufacturing technique. MDT can be prepared by using this technique because of the availability of improved excipients especially super-disintegrate and sugar based excipients.

(a) Super-disintegrants: The rate of disintegration gets affected by the addition of superdisintegrants and hence the dissolution. Other ingredients like water-soluble excipients and effervescent agents also increase the disintegration.

(b) Sugar based excipients:

The sugar based excipients which are commonly used are especially bulking agents (like dextrose, fructose, lactilol, maltilol, maltose, mannitol, sorbitol, starch hydrolysate, polydextrose and xylitol) which display high aqueous solubility and sweetness, and hence impart taste masking property and provide pleasing mouth feel. Mizumito et al classified sugar-based excipients into two types on the basis of molding and dissolution rate: Type 1 saccharides (lactose and mannitol) exhibit low mouldability but high dissolution rate. Type 2 saccharides (maltose and maltilol) exhibit high mouldability but low dissolution rate.

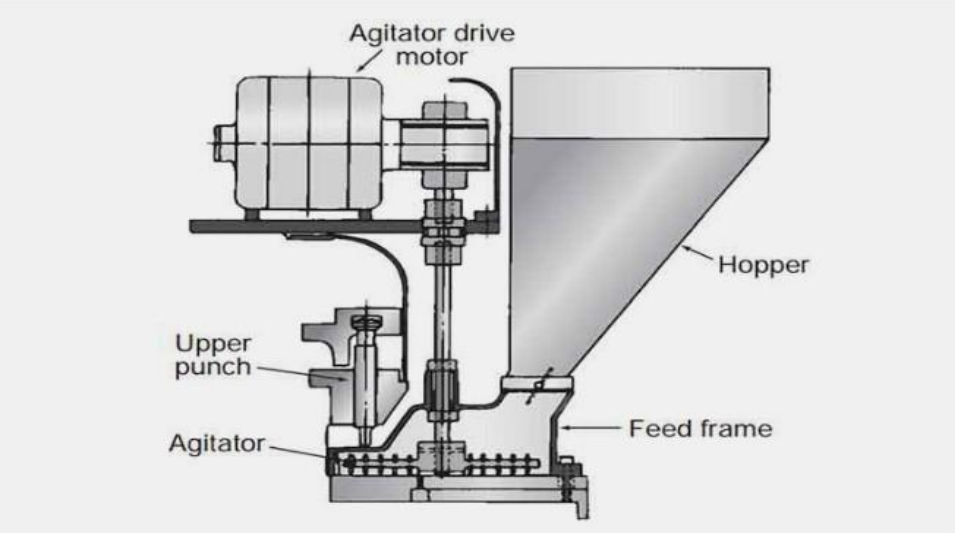

Fig.7 Direct compression machine

Cotton Candy Process:

Another technology for manufacturing fast dissolving tablets is the cotton candy process, also known as candy floss process, which involves centrifugation to produce a floss-like crystalline structure. In this technology, the matrix is formed from saccharides or polysaccharides processed into an amorphous floss through a shear foam process. The matrix is cured and milled to make flowable, compactible, and highly soluble filler. Because of the formation of the formation of porous three dimensional structures with the active ingredients encased in the pores, the resulting surface area is high. Therefore, dispersion and dissolution occur quickly when the product is placed in the mouth. This technology is patented as FlashDose® by Fuisz Technology (Chantilly, Virgina, U.S.A.)

Sprays-Drying:

Allen et al., have used spray-drying for the production of MDTs. The formulations contained hydrolyzed and non hydrolyzed gelatin as a supporting agent for the matrix, mannitol as a bulking agent and sodium starch glycolate or croscarmellose as a disintegrant. By adding an acid (e.g., citric acid) or an alkali (e.g., sodium bicarbonate)

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

disintegration and dissolution were further enhanced. The porous powder was obtained by spray drying the above suspension which was compressed into tablets. Tablets manufactured by this method shows disintegration time < 20 sec in an aqueous medium .

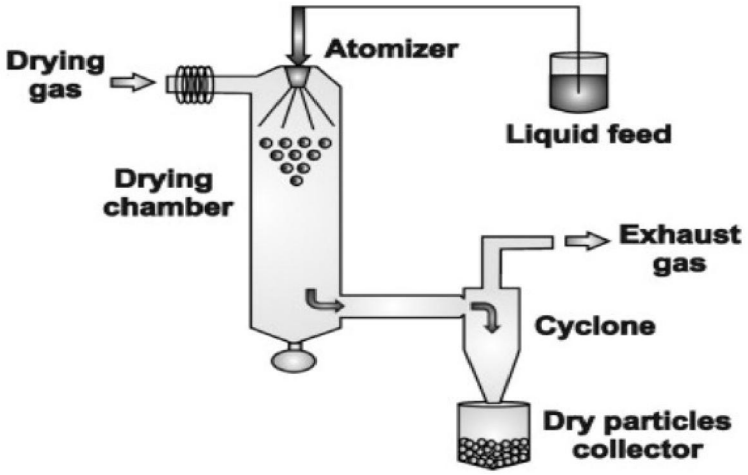

Fig.8 Equipment & process of conventional spray –drying

Sublimation:

In this method a subliming material like camphor, is removed by sublimation from compressed tablets and high porosity is achieved due to the formation of many pores where camphor particles previously existed in the compressed tablets prior to sublimation of the camphor. A high porosity was achieved due to the formation of many pores where camphor particles previously existed in the compressed mannitol tablets prior to sublimation of the camphor. These compressed tablets which have high porosity (approximately 30%) rapidly dissolved within 15 seconds in saliva . Granules containing nimusulide, camphor, crospovidone, and lactose were prepared by wet granulation technique. Camphor was sublimed from the dried granules by vacuum exposure . Conventional methods like dry granulation, wet granulation and direct compression with highly soluble excipients, super disintegrants and/or effervescent systems can also be used.

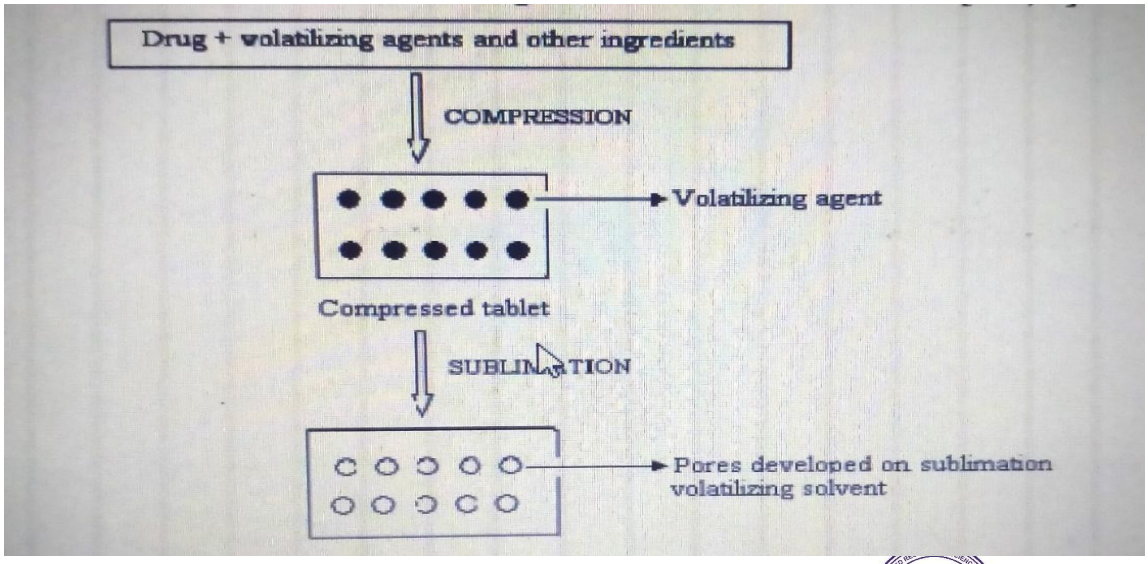

Fig. 9 Sublimation Technique for Preparation of MDT

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

Mass Extrusion:
This technology involves 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 get a cylinder of the product into even segments using heated blade to form tablets. The dried cylinder can also be used to coat granules of bitter tasting drugs and thereby masking their bitter taste 18

Melt Granulation:
Melt granulation technique is a process by which pharmaceutical powders are efficiently agglomerated by a meltable binder. The advantage of this technique compared to a conventional granulation is that no water or organic solvents is needed. Because there 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 dissolution rate of poorly water soluble drugs, such as griseofulvin This approach to prepare MDT with sufficient mechanical integrity, involves the use of a hydrophilic waxy binder (Superpolystate©, PEG-6-stearate). So it will not only act as a binder and increase the physical resistance of tablets but will also help the disintegration of the tablets as it melts in the mouth and solubilizes rapidly leaving no residues.

Nanonization: A recently developed Nanomelt technology involves reduction in the particle size of drug to nano size by wet-milling technique. Surface adsorption of the nano crystals of the drug is done on selected stabilizers for stabilizing them against agglomeration, which are then incorporated into MDTs. This technique is mainly advantageous for poor water soluble drugs and also for a wide range of doses (up to 200 mg of drug per unit).

Fast Dissolving Films:
It is a newer developing front that provides a very convenient means of taking medications and supplements. In this technique, water soluble film forming polymer (pullulan, CMC, HPMC, HEC, HPC, PVP, PVA etc.), drug and other taste masking ingredients are dissolved in non-aqueous solvent to prepare non-aqueous solution, which on evaporation of solvent forms a film. Resin adsorbate or coated micro particles of the drug can be incorporated into the film if the drug is bitter. This film when placed in mouth melts or dissolves rapidly and releases the drug in solution or suspension form. This system forms the thin films of size less than 2x2 inches which dissolves within 5 sec with instant drug delivery and flavored taste.

Phase Transition Process:
Kuno et. al., investigated processes for the disintegration of MDTs by phase transition of sugar alcohols using erythritol (m. pt. 122°C), xylitol (m.pt. 93-95°C), trehalose (97°C), and mannitol (166°C). Tablets were produced by compressing a powder containing two sugar alcohols with high and low melting points and subsequent heating at a temperature between their melting points. Before heating process, the tablets do not have sufficient hardness because of low compatibility. The tablet hardness was increased after heating process, due to the increase of inter particle bonds or the bonding surface area in tablets induced by phase transition of lower melting point sugar alcohol .

Three-dimensional Printing (3DP):
Three-dimensional printing (3DP) is a rapid prototyping (RP) technology. Prototyping involves constructing specific layers that uses powder processing and liquid binding materials. A novel fast dissolving drug delivery device (DDD) with loose powders in it was fabricated using the three dimensional printing (3DP) process. Based on computer-aided design models, the DDD containing the drug acetaminophen were prepared automatically by 3DP system . It was found that rapidly disintegrating oral tablets with proper hardness can be prepared using TAG. The rapid disintegration of the TAG tablets seemed due to the rapid water penetration into the tablet resulting from the large pore size and large overall pore volume.[7]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

PATENTED TECHNOLOGIES FOR MOUTH DISSOLVING TABLETS

1. 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 disintegrates instantaneously and does not require water to aid swallowing. The zydis matrix is composed of many materials to achieve a number of objectives. To impart strength and resilience during handling, polymers such as gelatin, dextran or alginates 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 while various gums are used to prevent sedimentation of dispersed drug particles in the manufacturing process. Collapse protectants such as glycine prevent the shrinkage of zydis units during freeze drying process or longterm storage. Zydis products are packed in blister packs to protect the formulation from moisture in the environment.

2. Durasolv Technology:

Durasolv is the patented technology of CIMA labs. The tablets made by this technology consist of drug, filler and a lubricant. Tablets are prepared by using conventional tabletting equipment and have goodrigidity. These can be packaged into conventional packaging system like blisters. Durasolv is an appropriate technology for product requiring low amounts of active ingredients.

3. Orasolv Technology:

CIMA labs have developed Orasolv Technology. In this system active medicament is taste masked. It also contains effervescent disintegrating agent. Tablets are made by direct compression technique at low compression force in order to minimize oral dissolution time. Conventional blenders and tablet machine is used to produce the tablets. The tablets produced are soft and friable.

4. Flash Dose Technology:

Flash dose technology has been patented by fuisz. Nurofen meltlet, a new form of ibuprofen as melt in mouth tablets prepared using flash dose technology is the first commercial product launched by Biovail Corporation. Flash dose tablets consist of selfbinding shear form matrix termed as “floss”.Shear form matrices are prepared byWOW means “Without Water”. In this process, combination of low mouldability saccharides and high mouldability saccharides is used to obtain a rapidly melting strong tablet. The active ingredient is mixed with a low mouldability saccharide (e.g. lactose, glucose, and mannitol) and granulated with a high mouldability saccharide (e.g. Maltose, oligosaccharides).

5. Flash tab Technology:

Prographarm laboratories have patented the Flash tab technology. Tablet prepared by this system consists of an active ingredient in the form of micro crystals. Drug micro granules may be prepared by using the conventional techniques like coacervation, micro encapsulation and extrusion spheronisation. All the processing utilized conventional tablet technology.[8]

6. Lyoc Technology:

Lyoc technology is patented by PHARMALYOC. Oil in water emulsion is prepared and placed directly into blister cavities followed by freeze-drying. Non-homogeneity during freeze-drying is avoided by incorporating inert filler to increase the viscosity finally the sedimentation. High proportion of filler reduces porosity of tablets due to which disintegration is lowered.

7. Quick solv Technology :

This technology is patented by Janssen Pharmaceuticals. It utilizes two solvents in formulating a matrix, which disintegrates instantly. Methodology includes dissolving matrix components in water and the solution or dispersion is frozen. Then dry the matrix by removing water using an excess of alcohol (solvent extraction). Thus the product formed has uniform porosity and adequate strength for handling.

8. Nanocrystal Technology :

This is patented by Elan, King of Prussia. Nanocrystal technology includes lyophilization of colloidal dispersions of drug substance and water-soluble ingredients filled in to blister pockets. This method avoids manufacturing process such as granulation, blending, and tabletting, which is more advantageous for highly potent and hazardous drugs. As manufacturing losses are negligible, this process is useful for small quantities of drug.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

9. Wow tab Technology :

Yamanouchi patented this technology. WOW means with out water. This technology utilizes conventional granulation and tableting methods to produce MDTs employing low- and high-moldability saccharides. Low moldability saccharides are lactose, mannitol, glucose, sucrose, and xylitol. High moldability saccharides are maltose, maltitol, sorbitol, and oligosaccharides. When these lowand high-moldable saccharides are used alone tablets obtained do not have desired properties of rapid disintegration and hardness, so combinations are used. This technology involves granulation of low-moldable saccharides with high-moldable saccharides as a binder and compressing into tablets followed by moisture treatment. Thus tablets obtained showed adequate hardness and rapid disintegration.

10. Dispersible tablet Technology :

Lek, Yugoslavia patents this technology. It offers development of MDTs with improved dissolution rate by incorporating 8-10% of organic acids and disintegrating agents. Disintegrating agent facilitates rapid swelling and good wetting capabilities to the tablets that results in quick disintegration. Disintegrants include starch, modified starches, microcrystalline cellulose, alginic acid, cross-linked sodium carboxy methyl cellulose and cyclodextrins. Combination of disintegrants improves disintegration of tablets usually less than 1 min.

11. Pharmaburst Technology :

SPI Pharma, New Castle, patents this technology. It utilizes the coprocessed excipients to develop MDTs, which dissolves within 30-40 s. This technology involves dry blending of drug, flavour, and lubricant followed by compression into tablets. Tablets obtained have sufficient strength so they can be packed in blister packs and bottles.

12. Frosta Technology :

This technology patents by Akina. It utilizes the concept of formulating plastic granules and compressing at low pressure to produce strong tablets with high porosity.

Plastic granules composed of:

- Porous and plastic material,
- Water penetration enhancer, and
- Binder

The process involves usually mixing the porous plastic material with water penetration enhancer and followed by granulating with binder. The tablets obtained have excellent hardness and rapid disintegration time ranging from 15 to 30 s depending on size of tablet.

13. Oraquick Technology :

This technology is patented by K.V.S. Pharmaceuticals . It utilizes taste masking microsphere technology called as micromask, which provides superior mouth feel, significant mechanical strength, and quick disintegration/dissolution of product. This process involves preparation of microparticles in the form of matrix that protects drug, which can be compressed with sufficient mechanical strength. Low heat of production in this process makes it appropriate for heat sensitive drugs. Oraquick product dissolves within few seconds.[9]

PREFORMULATION STUDIES BULK DENSITY

Apparent bulk density was determined by pouring the 5 gram of powder **V = Vb – Vp** into a 100 ml granulated cylinder. The bulk volume (V) poured drug was determined. The bulk density was calculated using the formula**.**

$$\rho b = M / V$$

Where:

qb - bulk density,

M- is the weight of powder,

V- is the volume of powder.

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

Tapped Density

Weight 5 g. of powder and placed in a measuring cylinder. Measuring cylinder containing known mass (5 gm) of powder was tapped for 100 times or fixed time. The minimum volume (Vt) occupied was measured. The tapped density was calculated using following formula.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

$$\rho t = M / Vt$$

Compressibility Index

The simplest way for measurement of free flow of powder is compressibility, a indication of the ease with which a material can be induced to flow is given by Compressibility Index. The value below 15% indicates a powder with give rice to good flow properties, whereas above 25% indicate poor flowability. Which is calculated follows.

$$\% \text{ C.I.} = \rho t - \rho b \; \rho t \times 100$$

Hausner ratio

Hausner ratio is an indirect index of ease of powder flow. Hosner ratio is the ratio of tapped density to bulk density. Lower the value of Housner ratio better is the flow property. Powder with Housner ratio less than 1.18, 1.19, 1.25, 1.3-1.5 and greater the 1.5 indicate excellent, good, passable, and very poor, respectively. It is calculated by following formula.

$$\text{Hausner ratio} = \rho t \; \rho t$$

Porosity

Percent relative porosity (ε) was obtained using the relationship between apparent density (ρapp) and true density (ρtrue) which is calculated by following formula.

$$\varepsilon = (1 - \rho app / \rho true) \times 100$$

Voide Volume

Voide volume (V) was obtained by difference between bulk volume (Vb) and tapped volume (Vp). Voide volume can be calculated by following formula.

Angle of repose

The angle of repose was determined using funnel method. Funnel that can be fit vertically with stand at 6.3 cm. height. The opening end of funnel is closed with thumb until drugs are poured. The 5 gm of powder was poured into funnel that can be raised vertically until a maximum cone hight (h) was obtained. Radius of the heap (r) was measured and the angle of repose (Θ) was calculated using the formula.[10]

Patients Counseling Points for FDDTs:

Pharmacists are in the ideal position to become familiar with the different technologies, and educate their patients on what to expect upon taking their first dose.

- Patients may be surprised when tablets begin to dissolve in the mouth.
- They might expect a faster onset of therapeutic action.
- Patients who concurrently take anticholinergic medications may not be the best candidates for these drugs.
- Similarly, patients with Sjögren's syndrome or dryness of the mouth due to decreased saliva production may not be good candidates for these tablet formulations.
- Although no water is needed to allow the drug to disperse quickly and efficiently, most technologies utilize the body's own salivation.
- Decreased volume of saliva may slow the rate of dissolution/disintegration and decrease the bioavailability of the product.
- Chewable tablets are not the same as the new FDDTs. Patients for whom chewing is difficult or painful can use these new tablets easily. FDDTs can be used easily in children who have lost their primary teeth, but do not have full use of their permanent teeth.
- Patients may mistake fast-dissolving/disintegrating for effervescent tablets. Pharmacists may wish to stress the difference between the use of quick-dissolving and effervescent tablets.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

• Pharmacists have been alerted to exercise additional care when dispensing new prescriptions for FDDT formulations. Most such products are available in the same strengths as traditional dosage forms.
• Verification with the prescribing practitioner may be necessary in some cases and can clear up any confusion.
• Pharmacists may wish to consider compounding as a unique way to treat the unmet needs of individual patients.
• A pharmacist's intervention and assistance, all of these patients could be more properly treated with greater convenience.

Table 2: Some of Promising Drug Candidates for Mouth Dissolving Tablets [11]

Sr No.	Category	Example
1	Antibaterial agent	Ciprofloxacin, tetracycline, erythromycin, rifampicin, penicillin, doxycyclin, nalidixic acid,
2	Anthelmintics	Albendazole, mebendazole, thiabendazole, livermectin, praziquantel, pyrantel embonate,
3	Antidepressant	Trimipramine maleate, nortriptyline HCl, trazodone HCl, amoxapine, mianserin HCl, etc.
4	Antidiabetics	Glibenclamide, glipizide, tolbutamide, tolazamide, gliclazide, chlorpropamide etc.
5	Analgesic /antiinflammatory	Diclofenac sodium, ibuprofen, ketoprofen, mefenamic acid, naproxen, oxyphenbutazone,
6	Antihypertensiv	Amlodipine, carvedilol, diltiazem, felodipine, minoxidil, nifedipine, prazosin HCl, nimodipine,
7	Antiarrhythmics	Disopyramide,quinidine sulphate, amiodarone HCl, etc.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

8	Antihistamine	Acrivastine, cetrizine, cinnarizine, loratadine, fexofenadine, triprolidine, etc.
9	Anxiolytic,sedative,hypnotics	Alprazolam, diazepam, clozapine, amylobarbitone, lorazepam, haloperidol, nitrazepam ,
10	Diuretics	Acetazolamide, clorthiazide, amiloride, furosemide, spironolactone, bumetanide, ethacrynic
11	Gastro-intestinal agent	Cimetidine, ranitidine HCl, famotidine, domperidone, omeprazole, ondansetron HCl,
12	Corticosteroid	Betamethasone, beclomethasone, hydrocortisone, prednisone, prednisolone, methyl
13	Antiprotozoal agent	Metronidazole, tinidazole, omidazole, benznidazole, clioquinol, decoquinate etc.

EVALUATION OF MOUTH DISSOLVING TABLETS

Measurement of Tablet Tensile Strength

The tablet tensile strength is the force required to break a tablet by compressing it in the radial direction and is measured using a tablet hardness tester. For measuring the hardness of the tablets, the plunger of the hardness tester is driven down at a speed of 20 mm/min. Tensile strength for crushing (T) is calculated using equation

I: Eq. I. $T = 2F / \pi dt$

Where F is the crushing load, and d and t denote the diameter and thickness of the tablet, respectively.

Though, this is a widely used and accepted method for hardness testing, it is not applicable to very delicate tablets prepared by lyophilization technique wherein the liquid suspension of drug and excipients is freeze dried in the blister pocket and the dried tablets are finally sealed in the blister. Special aluminum (alu) blisters with peel off blister covers

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

are used as packaging material for these tablets. Flashdose tablets prepared by cotton candy process are also poor candidates for this test . This test is best suited for tablets prepared by direct compression and moulding methods. However, the tensile strength of these tablets is always kept low which needs to be compromised to keep the disintegration time as minimum as possible.

Friability

The pharmacopoeial limit of friability test for a tablet is not more than 1% using tablet friability apparatus, carried out at 25 rpm for 4 min (100 rotations). However, it becomes a great challenge for a formulator to achieve friability within this limit for MDT product keeping hardness at its lowest possible level in order to achieve a minimum possible disintegration time. This test is again not applicable for lyophilized and flashdose tablets, but is always recommended for tablets prepared by direct compression and moulding techniques to ensure that they have enough mechanical strength to withstand the abrasion during shipping and shelf life.

Moisture Uptake Study

MDTs usually contain high concentration of hydrophilic excipients with the minimum possible hardness which together contribute to their increased susceptibility to moisture uptake. In order to maintain their physical integrity and surface texture, special attention is required during the storage and packaging of these dosage forms. Therefore, moisture uptake studies are strongly recommended for MDTs. The test can be carried out by keeping ten tablets along with calcium chloride in a desiccator maintained at 37 °C for 24 hrs to ensure complete drying of the tablets. The tablets are then weighed and exposed to 75% RH, at room temperature for 2 weeks. The required humidity can be achieved by keeping saturated sodium chloride solution in the dessicator for 24 hrs. The tablets are reweighed and the percentage increase in weight is recorded. If the moisture uptake tendency of a product is high, it requires special dehumidified area for manufacturing and packing. The materials with high moisture resistant properties should be used for packaging for e.g. alu strip pack, alu-alu blister or polyethylene sealing on blister. The use of appropriate quantity of desiccant in HDPE bottle packs with minimum head space is highly recommended to ensure stability of the product during its shelf life.

Measurement of Tablet Porosity

The mercury penetration porosimeter can be used to measure the tablet porosity which is a relative assessment of the degree of water penetration in the formulation, responsible for its fast disintegration. This instrument is based on the capillary rise phenomenon wherein an excess pressure is required to cause a non-wetting liquid to climb up a narrow capillary. The pressure difference across the interface is given by the Washburn equation II, where the pressure drop is inversely related to the pore size (perpendicular radius).

Eq. II. $\Delta P = -(2\gamma/r) \cos \theta$

where γ is the surface tension of the liquid, r is the perpendicular radius and θ is the angle of contact between the liquid and the capillary walls. Pore radius is calculated from eq II using experimental data obtained in the form of P. In this test, the contact angle between mercury and the tablet is kept at 140° and the surface tension at the interface of mercury and the tablet is 0.486 N/m. Pore sizes in the range of 0.06–360 µm, can be efficiently measured by this technique .

Otherwise, the tablet porosity (ε) can also be calculated using equation III:

Eq. III. $\varepsilon = 1\text{-}m / (\rho t V)$

Where ρt is the true density, and m and V are the weight and volume of the tablet, respectively . Tablets prepared by spray drying, lyophilization and cotton candy process generally possess high porosity and therefore, have extremely low disintegration time.

Wetting Time and Water Absorption Ratio

A study on wetting time and water absorption ratio reported the use of a piece of double folded tissue paper placed in a petridish containing 6 ml of water. One tablet was placed on this paper and the time for complete wetting of tablet was noted as wetting time. The wetted tablet was then weighed and the water absorption ratio, R, was determined according to equation

Eq. IV. $R = 100\ (Wa - Wb)/Wb$

Where Wb and Wa are the weights of tablet before and after water absorption, respectively.

Fineness of Dispersion This is a qualitative test specified by EP for dispersible tablets . We recommend performing this test on tablets which are not truly mouth dissolving, but are fast oral disintegrating tablets (ODTs). It is an

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

assessment of the grittiness which arises due to disintegration of the tablet into coarse particles. The test is performed by placing two tablets in 100 ml water and stirring it gently, till the tablets get completely disintegrated. The formulation is considered to form a smooth dispersion if the complete dispersion passes through a sieve screen with a nominal mesh aperture of 710 μm without leaving any residue on the mesh.

Disintegration Time

The methods for evaluation of in-vivo disintegration time had been explained in literature . However, the results from this type of test typically reveal unsatisfactory reproducibility and are not reliable as the difference in disintegration time is few seconds in most cases. In addition, the in-vivo disintegration test has its own limitation of issues related to ethics and the safety of the volunteers. At present, the disintegration time of MDTs is measured using the disintegration test for conventional tablets that is described in the Pharmacopoeias. EP has set the limit of 3 mins for disintegration time of MDTs using conventional disintegration apparatus. However, no special apparatus is mentioned in the pharmacopoeias for disintegration test of MDTs and the conventional method available seems to be inappropriate for MDTs. This is because of the extreme operating conditions in the disintegration apparatus which fails to provide a significant discrimination among the rapidly disintegrating tablets. Furthermore, the conventional test employs a relatively huge volume of test solution (900 ml) compared to the volume of saliva in human buccal cavity, which is less than 6 ml. Therefore, the results obtained from the conventional disintegration test do not reflect the actual disintegration rate in the human mouth which usually ranges from 5–30 secs . To overcome these issues, several new methods have been proposed, which are reviewed here.

Bi et al., suggested the use of a modified dissolution apparatus, instead of the disintegration apparatus as shown in Fig.1. In this experiment, 900 ml of water maintained at 37 °C as the disintegration fluid and a paddle at 100 rpm as stirring element were used. Disintegration time was noted when the tablet disintegrated and passed completely through the screen of the sinker (3–3.5 mm in height and 3.5–4 mm in width, immersed at a depth of 8.5 cm from the top with the help of a hook). This method was useful in providing discrimination among batches which was not possible with the conventional disintegration apparatus.

Disintegration Test on Wire Cloth

Motohiro et al., carried out disintegration test by placing the MDT on a wire cloth No. 10 and dropped water on it at a rate of 4 ml/min. The time required by the tablet to completely pass through the wire cloth was noted as disintegration time.

Disintegration Test using Modified Dissolution Apparatus

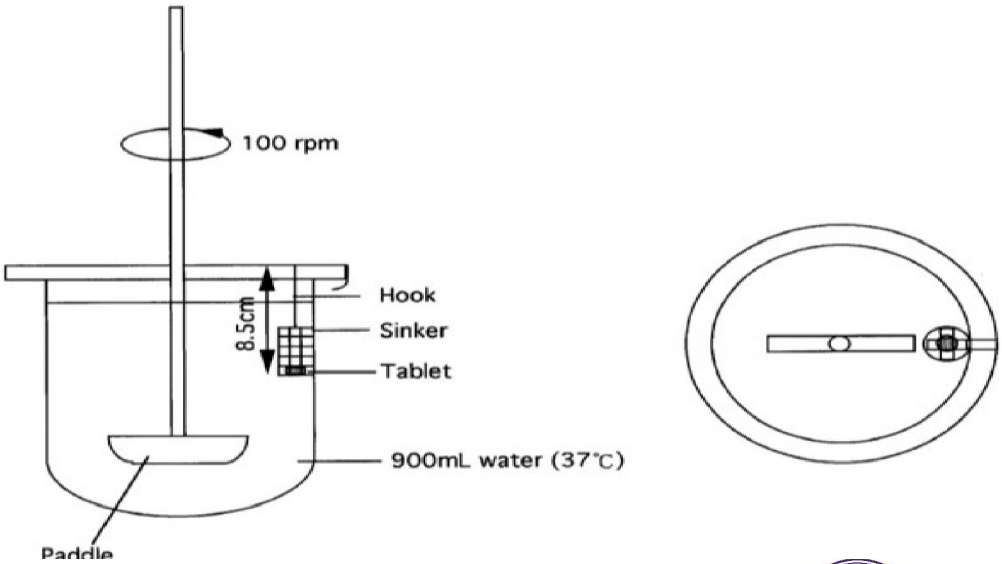

Fig.10. Schematic view of modified dissolution apparatus for disintegration test

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

Disintegration Test with CCD Camera

Morita et al., developed a sophisticated disintegrating test apparatus equipped with a CCD camera. This apparatus is divided into two distinct sections, a disintegration component and a measurement device. The mode of measurement involves the continuous monitoring and recording of disintegration time course by obtaining pictures through the CCD camera, which are simultaneously transferred into a computer and stored. The speciality of this apparatus lies in the combination of detailed pictures obtained by the CCD camera and the calculation capabilities of the computer.

The disintegration apparatus consists of a plastic cell partitioned into two parts: one component comprises of an inner tank containing the stirring bar, the grid fabricated from stainless-steel and 200 ml of distilled water as disintegration medium maintained at 37±2 °C; the second component is an outer tank, which functions as a water bath heated at 37±1 °C (Fig. 11a) via circulation of thermostated water. The grid consists of three hollow areas, equidistant from the center, in which the tablets are positioned using a support to avoid their displacement during the test (Fig. 11b).

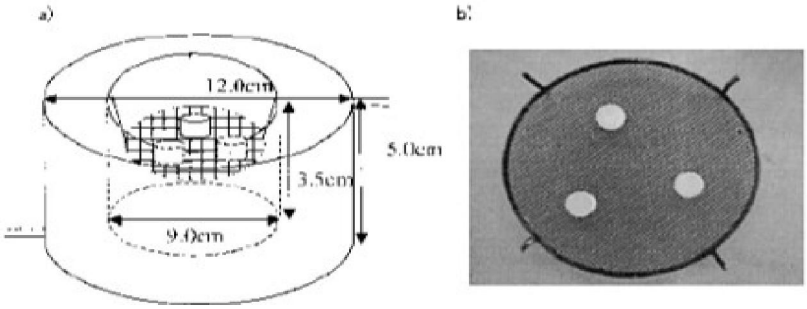

Fig.11 Plastic Disintegration Cell (a) and Tablet Support Grid with Three RDT (b)

The measurement apparatus consists of a CCD camera and a computer. The CCD camera is positioned in such a manner that the top surface of the three tablets can be seen on the camera's screen. The disintegration time course can be analyzed graphically with the data obtained using this equipment. It is especially useful for very fast dissolving tablets prepared by lyophilization which have disintegration time of less than 10 secs.

However, this method has a limitation of absence of any mechanical stress, as the MDT placed in the oral cavity receives some mechanical stress produced by the tongue

Disintegration Test on Shaking Water Bath

Fu et al., conducted the disintegration test by placing the MDT in a glass cylinder fitted with 10 mesh at its base. This set up was further placed in a shaking water bath operated at 150 rpm. 1 ml of purified water maintained at 37 °C temperature was used as medium. The critical parameters of this method were the operational speed of shaking water bath and volume of the medium.

Disintegration Test with Rotary Shaft Method

In another study, Narazaki et al., proposed a better disintegration method for MDTs as shown in Fig. 12(a). In the experimental method, the MDT was placed on the wire gauze (D), slightly immersed in the medium, and then compressed by a rotary shaft (E) which was employed to provide mechanical stress on the tablet by means of its rotation and weight. Purified water at temperature 37 °C was used as the medium. The critical parameters of the proposed method were the rotation speed and the mechanical stress. Using this new method, it would be possible to predict a more realistic disintegration rate in human. The compression force can be easily adjusted using the weight (A). The rotary shaft crushes the MDT which disintegrates into the medium. The endpoint was measured visually using a stopwatch.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

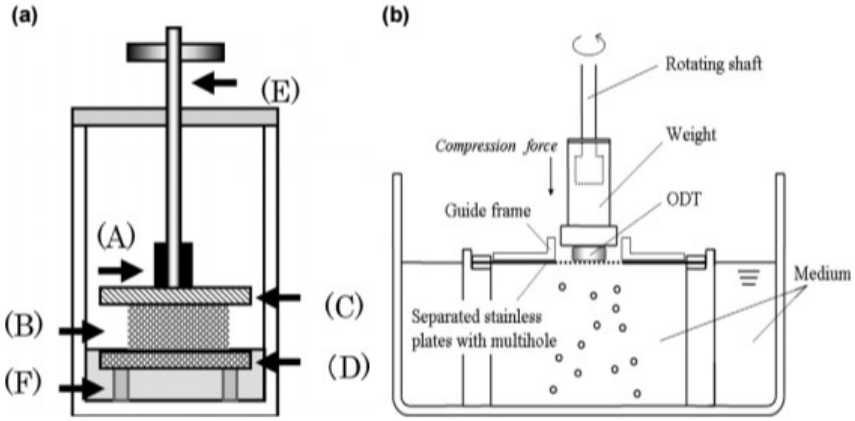

Fig.12. (a) Apparatus of rotary shaft method for MDT (A) weight, (B) MDT, (C) wetting sponge, (D) wire gauze, (E) rotary shaft, (F) medium. (b) improved rotary shaft apparatus

The above mentioned apparatus was modified by Harada et al., by placing a sponge at the surface of shaft weight to increase friction with the MDT (Fig. 12b). Therefore, the weight transmits the torque of the rotating shaft to the ODT and grinds it on the stainless steel perforated plate which is used in place of wire gauge. The electrodes are attached on each side of the plate. The rotation speed and weight were optimized to set the mechanical pressure. When the weight makes contact with separated plates, the electric sensor conveys a signal that indicates the end point of the disintegration test of the ODT.

Disintegration Test using Texture Analyzer

In another study, a texture analysis apparatus was used to measure the start and end time points of tablet disintegration. The set up is shown in Fig. 13. A constant penetration force was applied to tablets via a cylindrical flat-ended probe. The tablet, under constant force, is immersed in a defined volume of distilled water and the time is plotted against the distance, which the probe travelled into the tablet. Typical time–distance profiles, generated by the texture-analysis software, enabled the calculation of the starting and ending time of disintegration.

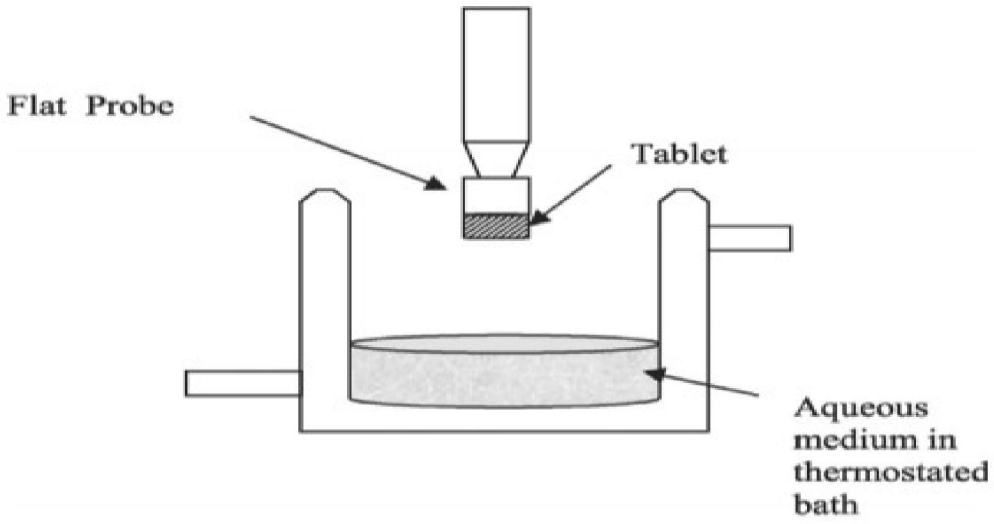

Fig. 13. Texture analyzer apparatus for disintegration test

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

Disintegration Test using ElectroForce® 3100

An instrument "ElectroForce® 3100" has recently been designed by the Bose corporation with an objective to simulate the disintegration condition of the MDTs in mouth. It is based on application of low force to measure small displacements and disintegration rate as a function of manufacturing process of a variety of MDTs (Fig.14).

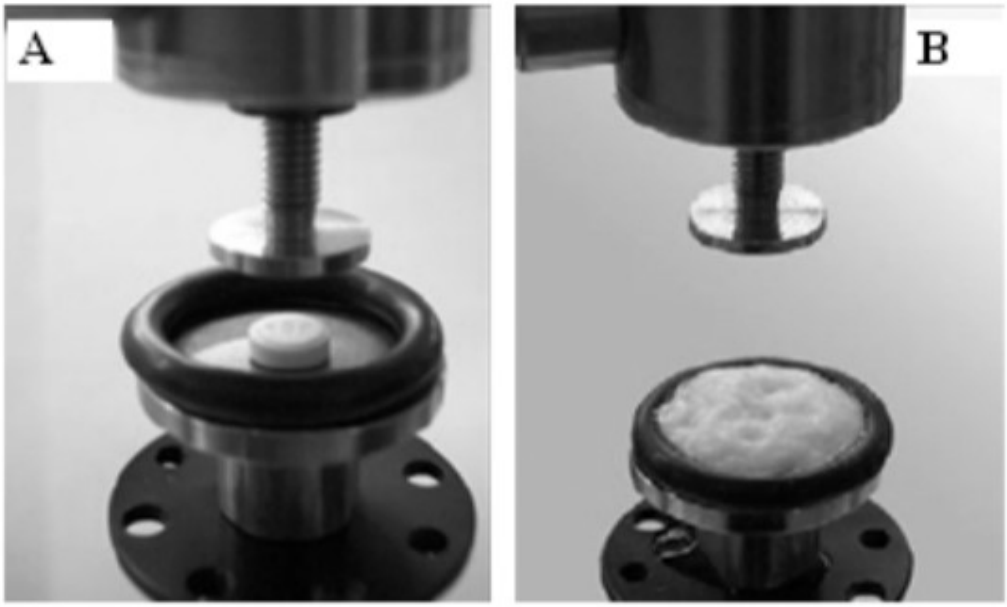

Fig.14. ElectroForce® apparatus for Disintegration test A. ODT mounted on test plate before loading. B. ODT after completion of Disintegration test

The instrument typically consists of a lower plate to hold the tablet on which a force of about 10 mN is applied followed by addition of approximately 5 ml of water maintained at 37 °C. It has the advantage of providing better resolution than those available instruments with moderate to high force test . This is the first equipment of its type which is available in the market for evaluation of ODT. This tabletop system can be used by the manufacturers and regulatory agencies to monitor and evaluate the different fabrication technologies of MDTs.

Some of these new methods have been able to produce satisfactory discrimination between tablets of different types and could perhaps be taken into consideration as an effective method for evaluation of disintegration time of MDTs.

Dissolution Testing of Mouth Dissolving Tablets

The conventional method of dissolution could be extended to in-vitro evaluation of MDT. The dissolution conditions for the reference listed drugs available in USP can be utilized for preliminary in-vitro studies to mimic better in-vivo conditions. Apart from the above, multimedia dissolution studies in various buffer solutions of different pH viz. 0.1 N HCl; pH 4.5 and 6.8 buffers should be carried out for interpretation of their in-vivo performance and pharmaceutical equivalence. USP apparatus II (paddle) with a speed of 50 rpm seems to be most suitable and common choice with appropriate dissolution media volume to maintain sink condition. Typically, the dissolution of MDTs is very fast when using USP monograph conditions and therefore, under such conditions the dosage forms behave almost equally. Hence, slower paddle speeds may be employed to obtain a profile and better discrimination among various batches prepared during the developmental stage. In case of tablets approaching or exceeding one gram weight and containing relatively dense insoluble particles, there are the chances of heap formation at the bottom of the dissolution vessel. Under such a condition, although the tablet disintegrates completely, there is a significant reduction in the apparent dissolution rate. However, this issue can be resolved by using higher paddle speed of 75 rpm . The USP I (basket) apparatus may have application for certain MDTs which disintegrate into particles with floating tendency. However, tablet fragments or disintegrated tablet masses may become trapped on the inner top side of the basket at the spindle where little or no effective stirring occurs, yielding irreproducible dissolution profiles. In that case, a higher basket rotation speed of 100

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

rpm is recommended for quality assurance purpose while the formulation should be evaluated on the basis of a separate discriminatory disintegration test as listed above.

Dissolution Test for MDTs with Taste-Masking Approaches

Drug substances with bitter or objectionable taste in any orally-administered dosage form, including suspensions and chewable tablets are required to be suitably taste masked. The taste masking of the dosage form may be carried out using multiple approaches including use of taste masking flavors and sweetners, pH dependent/independent polymer coating of drug particles or complexation using ion exchange resins or cyclodextrins. Though the use of flavors and sweetners do not require special attention, the other taste-masking approaches greatly influence dissolution method development, specifications and testing. In such cases, the pH of the dissolution media plays a vital role in either the dissolution of the pH sensitive polymer or the release of the drug from the ionic complexes. Coated drug microparticles for controlled-release purpose, where bitter taste of drug is automatically masked, can also be incorporated in MDTs. Here, the in-vitro dissolution study condition would be similar to that for a controlled release dosage form along with a discriminatory disintegration test to evaluate the disintegrating properties of the system.

The disintegration time of MDT in a dissolution vessel is generally less than thirty seconds and therefore, is not an important factor in the resulting dissolution profile in terms of discrimination. Thus, the in-vitro dissolution study is carried out to assure the complete release of the drug in the media within the stipulated time period. Based on the functionality of the dosage form, single point dissolution is sufficient for an immediate release dosage form while a multi point dissolution profile is required for the evaluation of a controlled release system. However, it is important to observe the tablet's disintegration pattern and behavior of the disintegrated particles during the dissolution test for a better understanding of the role of the excipients that are used for the purpose.

Evaluation of Effectiveness of Taste Masking

The formulation's organoleptic properties like taste, mouth-feel and appearance are of considerable importance in differentiating products in the market and can ultimately determine the success of a product. The following discussion is focused on the in-vitro and in-vivo methods for evaluation of the taste masking property.

In-vivo Method

The in-vivo taste evaluation consists of a double blind crossover study, carried out on a trained taste panel of healthy volunteers with sound organoleptic senses, with their prior consent. On placing the dosage form in the oral cavity, the disintegration time is noted after which it is further held in mouth for 60 sec by each volunteer, and the bitterness level is recorded against pure drug (control) using a numerical scale. After 60 sec, the disintegrated tablet is spitted out and the mouth is rinsed thoroughly with mineral water. The numerical scale bears the following values: 0 = tasteless, 0.5 =aftertaste, 1.0 = slight, 1.5 = slight to moderate, 2.0 = moderate, 2.5 = moderate to strong, 3 = strong and 3+ = very strong . Alongwith the taste evaluation, a simultaneous observation of mouth feel (grittiness or smoothness) should also be noted to assess the quality of the product. This pharmaceutical taste assessment typically requires a large, trained taste panel and sophisticated interpretation. The tests may require the similar health safeguards as for a clinical trial especially for potent drugs like steroids and antipsychotics. Overall, a properly conducted taste trial adds huge investment of time and money to the product development process. Therefore, a well designed in-vitro taste masking evaluation technique would be a valuable alternative.

In-vitro Method

The conventional in-vitro method of dissolution study lacks relevance to simulate the behavior of an MDT in the buccal cavity, due to excessively large dissolution media volume. Therefore, a more relevant method was developed in our laboratory wherein 5 ml of pH 6.8 phosphate buffer (to simulate salivary pH and volume) was used to study the taste masking efficiency of risperidone resinate complex.

Risperidone resinate equivalent to 4mg of risperidone was placed in two 25 ml glass bottles. 5 ml of the buffer solution was then added and the bottles were allowed to stand for 60 sec and 120 sec, respectively. After the specified time, the suspensions were filtered using 0.45 µ nylon filters. The filtrates were analyzed for drug content. The test was

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

performed in triplicate. It was found that 2.5% of drug was released in 120 secs. The bitterness threshold of risperidone is 25 µg/ml , while the concentration of the drug released in our study was 20 µg/ml in 120 secs which is insufficient to impart bitterness. Moreover, the disintegration time of the prepared MDT was 20 secs which would be an added advantage in further reducing the release of drug in the oral cavity. However, a very fast drug release was observed in 500 ml of 0.1N HCl using USP dissolution apparatus II at 50 rpm (about 92% of drug released in 5 mins).

The pharmaceutical taste assessment usually demands large panels and elaborate analysis, raises safety and scheduling issues, and can be time consuming and expensive. These challenges were overcome with the invention of a breakthrough electronic sensor array technology, the "E-tongue". This is a sensor device for recognition (identification, classification, and discrimination), quantitative multicomponent analysis and artificial assessment of taste and flavor. This unique device helps to considerably reduce the developmental time and costs, subjectivity, bias and safety concerns. The E-tongue mimics the three levels of biological taste recognition: the receptor level (taste buds in humans, probe membranes in the E-tongue); the circuit level (neural transmission in humans, transducer in the E-tongue) and the perceptual level (cognition in the thalamus in humans, computer and statistical analysis in the E-tongue). At the receptor level, the Etongue uses a seven-sensor probe assembly to detect the dissolved organic and inorganic compounds. The probes consist of a silicon transistor with proprietary organic coatings, which govern the probe's sensitivity and selectivity. Measurement is done potentiometrically. Each probe is cross-selective to allow coverage of full taste profile. At the circuit level, the system samples, quantifies and records potentiometer readings. At the perceptual level, taste cognition happens in the computer, whereas the E-tongue's statistical software interprets the sensor data into taste patterns. Depending on the study design, data analysis can produce a variety of informations.This electronic sensor was employed for taste optimization of MDT prepared by lyophilization process (Zydis technology) by Cardinal Health.[12]

II. CONCLUSION

The popularity of MDTs has increased tremendously over the last decade because of better patient acceptance and compliance and may offer improved biopharmaceutical properties, For example, they require smaller amounts of active ingredient to be effective, improve absorption profiles, and offer better drug bioavailability than regular tablets and capsules improved efficacy, and better safety compared with conventional oral dosage forms. The clinical studies also showed that MDTs can improve patient compliance, provide a rapid onset time of action, and increase bioavailability. There are about 40 drugs that have been formulated into marketed MDTs using various technologies. The key to MDT formulations is fast disintegration, dissolution, or melting in the mouth and this can be achieved by producing the porous structure of the tablet matrix or adding superdisintegrant and/or effervescent excipients.

REFERENCES

[1]. Mayuri R Patil*, Nayan A Gujarathi, Bhushan R Rane. Formulation And Evaluation Of Mouth Dissolving Tablet. Impact Factor: 0.3397/Icv: 4.10

[2]. Preeti*, Vijay Agarwal, Abhinav Agarwal. An Overview On Mouth Dissolving Tablet: From Manufacturing And Patented Technique To Quality Control Test Asian J Pharm Clin Res, Vol 15, Issue 11, 2022, 7-13

[3]. Vikrant K Nikam*1,Kiran B Kotade2 , Vinayak M Gaware3 , Ramdas T Dolas1 , Kiran B Dhamak3 , Sachin B Somwanshi1 , , Atul N Khadse3 ,Vivek A. Kashid1. MOUTH DISSOLVING TABLETS : AN OVERVIEW. Pharmacologyonline 3: 562-586 (2011) Newsletter Nikam Et Al.

[4]. Prem Shankar Tyagi. A Review On Mouth Dissolving Tablets. International Journal Of Pharmacy &Life Sciences Volume 11 Issue 6: June. 2020. Review Article ISSN: 0976-7126 CODEN (USA): IJPLCP Tyagi, 11(6):6650-6654, 2020

[5]. Bhanage P. B., Dr Pawar A.R., Dr Deshmukh V.K, Raut A. R. Mouth Dissolving Tablets (Mdts)-A Review Article. 2023 Ijcrt | Volume 11, Issue 6 June 2023 | Issn: 2320-2882

[6]. Dipan Roy1*, Anjan De1 , Souvik Biswas2 , Nabanita Pramanick3 , Arijit Das2 , Sriparna Mondal1. An Overview On Mouth Dissolving Tablets. Journal Of Huazhong University Of Science And Technology Issn-1671-4512. Vol 50.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, February 2025

[7]. Arijit Gandhi *1. Mouth Dissolving Tablets: A New Venture In Modern Formulation Technology. The Pharma Innovation. Vol. 1 No. 8 2012 Www.Thepharmajournal.Com

[8]. H. K. Patil*, G. M. Patil, V. H. Jain, S. A. Tadvi, S. P. Pawar. A Review On Mouth Dissolving Tablet. Journal Of Applied Pharmaceutical Research April – June 2017 Volume 5 Issue 2.

[9]. M. Swamivelmanickam*, R. Manavalan And K. Valliappan. Mouth Dissolving Tablets: An Overview. Swamivelmanickam Et Al., Ijpsr, 2010; Vol. 1 (12): 43-55.

[10]. Uma Shankar Mishra, S. K. Prajapati, P. Bharadvaj. A Review Article On Mouth Dissolving Tablet. International Journal Of Pharma Research & Review, June 2014; 3(6):24-34 Issn: 2278-6074

[11]. Gupta Dilip Kumar1* , Bajpai Meenakshi2 , Chatterjee D.P. 3. Fast Mouth Dissolving Disintegrating Tablet And Patient Counselling Points For Fddts - A Review. Available Online At Http//Www.Ijrdpl.Com April - May, 2014, Vol. 3, No.3, Pp 949-958 Issn: 2278-0238.

[12]. Dali Shukla, Subhashis Chakraborty, Sanjay Singh, Brahmeshwar Mishra *. Mouth Dissolving Tablets Ii: An Overview Of Evaluation Techniques. Sci Pharm. 2009; 77; 327–341