Available online at www.abhipublications.org
Review Article
International Journal of Pharmacy and Engineering (IJPE)
ISSN 2320-849X

FAST DISSOLVING TABLETS FOR PEDIATRIC AND GERIATRIC PATIENTS

Piyali Khamkat[1], Abhishek Ghosh[2]

[1]*Department of Pharmaceutical Technology, Brainware University, 398, Ramkrishnapur Road, Barasat, Kolkata -125, India*
[2]*Bengal College of Pharmaceutical Sciences & Research, Basu Sarani Burdwan, Bidhannagar, Durgapur, West Bengal -713212, India*

Abstract

Oral drug delivery system is the most favourable route of drug delivery over last few decades despite few disadvantages. To overcome these disadvantages this drug delivery system is designed in many ways to make it better patient compliance and convenient in the time of administration. Fast disintegrating tablets (FDTs) are the type of tablets which are rapidly disintegrate in mouth within 5 seconds without chewing and need of water which is the most advantageous thing for both paediatric and geriatric patients because for both paediatric and geriatric patients swallowing is a main problem and also in case of geriatrics patients they may have dry mouth syndrome which does not allow to produce much amount of saliva. Thus FDT shows their ability to overcome those problems very easily. Day by day many pharmaceutical companies are patenting various approaches in developing more suitable fast disintegrating tablets and these increasing the demand of FDT during last few years. Various methods of manufacturing of FDT are direct compression, spray drying, freeze drying, sublimation, and tablet molding. Many latest technologies are under process to be developed.

Keywords: Fast Disintegrating Tablet, drug delivery system, paediatric, geriatric.

Received: June 13th , 2020, Accepted: 25th June, 2020,

Corresponding Author: * Piyali Khamkat[1], M. Pharm, *Department of Pharmaceutical Technology, Brainware University, 398, Ramkrishnapur Road, Barasat, Kolkata -125, India.*
Email: piyalikhamkat95@gmail.com

Introduction

Between various routes of drug delivery oral route is more preferred route for administration for the agents used as therapeutics because it has several advantages like dosage accuracy, cost of therapy is less, self applicability, non invasive and also it is highly patient compliance as it can be easily administered. Beside those advantages oral route may have some sorts of limitations in case of Paediatric patients who may face difficulty in ingestion as a result of underdeveloped muscular and nervous control. More than these Patients having little or no access to water struggle to use orally administered conventional tablets or capsules [1, 2, 3].

Nowadays a lot of pharmaceutical research is carried out by the pharmaceutical companies around the world to introduce new dosage forms those can eliminate the difficulties faced by patients. Most of them selected their ways by either formulating novel drug delivery systems or increasing the patient compliance. Fast dissolving tablet (FDT) is one of the widely preferred commercial dosage forms. Oral route is the most preferred and accepted way of application of drugs by the patients. Despite being most popular dosage form tablets and capsules, have some limitations and one of these limitation is the difficulty faced by geriatric patients also to swallow. Patients with medical conditions including Parkinson's disease, stroke, head and neck radiation therapy, AIDS, and other neurological disorders including cerebral palsy may face dysphasia. Fast dissolving tablet is one of the most important ways that can overcome this problem along with many advantages. These advantages are there is no need of water for administration, eliminates risk of suffocation, rapid onset of action, avoid hepatic first pass metabolism etc. One of the highlighted issues with fast dissolving tablets is the bitterness of the drug that can be unmasked in the oral cavity in time the disintegration of the tablets within the oral cavity. Proficient taste cavity masking technique is required to conceal this bitterness by formation of inclusion complex, polymer coating, and resin complex [4].

Keeping in mind the advantages of the "oral cavity", an Oral Dispersible Tablet, commonly known as the Fast Dissolving Tablets are a widely accepted formulations. According to European pharmacopoeia "ODT (Oral Dispersible Tablet) should disperse or disintegrate in less than 3 minute when placed on tongue". Fast dissolving drug delivery system (FDDDS) is an advance concept which is applicable for both solid and liquid formulations and also shows their advantages over the traditional dosage forms [5, 6, 7].

Fast dissolving tablets get popularity among the different dosage in the market as they have improved rapid onset of action, patient compliance, better stability, and increased bioavailability which enhances the popularity of FDTs as a dosage form in the market [8].

***Table 1*: Ideal characteristics of fast dissolving tablet** [9]

Properties	**Response**
Suitable for conventional tablet processing and packaging	Yes
Water required for swallowing	No

Economic	Yes
Easily dissolved in mouth	Yes
Good mouth feel	Yes
Compatible with taste masking	Yes
Fragility concern	No
Portable	Yes
Sensitive to environmental factors	No
Grittiness	No
Patient compliance	Yes

Advantages of FDT [10, 11]

1. It is dissolved into mouth easily without water.
2. No chewing is required.
3. It is under safest drug delivery system.
4. It is easily consumed by paediatric patients, geriatric patients and mentally disabled patients.
5. It helps to improve stability and gives a fresh feel.
6. Inexpensive and patient compliance.
7. Many drugs show improved bioavailability by going to stomach after its absorption through mouth, pharynx and oesophagus.
8. It is applicable for both controlled and sustained release drugs.
9. Due to better dissolution and absorption properties, it shows rapid onset of action.
10. Have high drug loading capacity and high dose frequency.

Limitations of FDT [12, 13]

1. Have insufficient mechanical strength of tablets.

2. There are some FDT which are hygroscopic in nature, they cannot control physical integrity from humidity under normal condition and specialized package is required for them.

3. Drugs having bad tastes are not applicable as FDT with some special precaution like sweetening and flavouring agents.

4. As FDTs are very porous, they are brittle and friable in nature which is difficult to handle.

DRUGS USED AS FDTs FORMULATION

The ideal criteria for drugs to be used for preparation of Fast Dissolving Tablets should have good stability in aqueous media, good absorption property, good dissolution property, good mechanical strength, low dose frequency and compatibility with other excipients [14, 15].

***Table 2*: Drugs can be formulated as FDT**

Drugs	Therapeutic applications
Ibuprofen, Mefenamic acid, Piroxicam	Anti-inflammatory
Ondensatron	Antiemetic
Chloroquine, Amodiaquine	Antimalarial
Acyclovir	Anticancer
Amlodipine, Nifedipine, Prazocin	Antihypertensive
Doxycycline, Erythromycin, Rifampin, Tetracycline	Antibacterial
Carbimazole	Antithyroid
Miconazole, Griseofulvin	Antifungal

EXCIPIENTS COMMONLY USED FOR FDTs PREPARATION

Excipients like diluent, disintegrant, lubricant, swelling agent, permeation enhancers, sweeteners, flavouring agents are used for formulating FDTs.

Super disintegrants [16, 17, 20]

Disintegrants are used to enhance the breaking or integration of tablets when it comes in contact with water in the GIT. For faster disintegration of tablets super-disintegrants are added in the formulations at less concentration which shows greater disintegrating efficiency. They also have good swelling property. Tablets are rapidly disintegranted in mouth because of hydrostatic pressure and volume expansion of saliva that goes into the tablets.

Examples - Gellan gum, Croscarmellose Sodium, Cross-linked alginic acid, Crospovidone,Sodium starch glycolate, Xanthan gum, Soya polysaccharide.

Diluents [18, 19]

These are basically fillers, used to fill the weight of tablets and to improve cohesion. Diluents improve the appearance of the tablets and enhance the volume of the tablet by reducing concentration of active pharmaceutical ingredients.

Examples- Manitol, Sorbitol, Sucrose, Dextrose, Starch.

Mannitol has high aqueous solubility and gives a cooling feel because of its negative heat of solution. These are mixed around 10% to about 90% by weight of the final formulations.

A diluent should have following properties-

1. They must be non toxic.

2. They must be cheap.

3. They must be physiologically inert.

4. They must be physically and chemically stable.

5. They do not alter bioavailability of drug.

Sugar based diluents are classified into two types on the basis of their moulding and dissolution rate:

Type 1 saccharides: have low moldability but high dissolution rate. Examples- Lactose and Mannitol

Type 2 saccharides: have high moldability but low dissolution rate. Examples- Maltose and Maltitol.

Binders [13]

The main aim of binder is to control the purity and stability of the tablets. The temperature of must be around 30–35ºC to achieve fast dissolving characteristics. Binders can be solid, liquid, and semi solid in nature which gives strength and smooth appearance of the tablets. For FDTs the binders must have melting and faster release properties.

Examples- Polyvinyl alcohol, Cellulosic polymer, Povidone, and acrylic polymer.

Cellulosic polymers such as ethylcellulose, hydroxypropylmethylcellulose (HPMC) and hydroxypropylcellulose (HPC) are mixed with other ingredients of FDTs.

Acrylic polymer such as polyacrylate, ammonio-methacrylate copolymer and polymethacrylate are used for formulating FDTs.

Emulsifying agents [13]

Emulsifying agents are very important for fast dissolving tablets. The benefits of these agents are rapid disintegration and drug release without water, chewing, swallowing. They form a thin layer over minute globules and reduce interfacial tension between two phases. Thus they form a stable formulation which improves the bioavailability. These are mixed with other ingredients in the formulation approximately 0.05% to 15% by weight of the final formulation.

Examples- Lecithin, Alkyl sulfates, Sucrose esters, Propylene glycol esters.

Lubricants [13]

Lubricants are used to promote flow of powder material by reducing the friction between the particles. Disintegration of tablet in mouth shows more palatability. Lubricants are used to provide gritty property that helps to transport the drug from oral to stomach.

Flavouring and sweetening agents [13]

To mask the bad smells and unpleasant taste of drugs, flavouring and sweetening agents are used in fast dissolving tablet formulations. Natural and synthetic type flavours are used to improve the morphological characteristics of the tablets.

Examples- Sugar, Dextrose and Fructose are natural sweeteners. Non-nutritive sweeteners are aspartame, sodium saccharin, sugar alcohols and sucralose.

***Table 3*: Different excipients used in FDT preparation** [21]

Excipients	**Percentage used**
Disintegrants	1- 15%
Diluents	0-85%
Binder	5-10%
Emulsifying agents	0.5-15%
Sweetening and flavouring agents	1-2%

Techniques for Preparing Fast dissolving Tablets

There are various techniques used for formulating Fast dissolving tablets. But mostly used techniques are:

1. Spray Drying:

Dry powders can be formulated from a slurry or liquid by quick drying process through hot gas. In this process, supporting agent or matrix like gelatin, diluents like mannitol, and superdisintegrants such as crosspovidone, crosscarmellose, and sodium starch glycolate can be used in the formulation. These ingredients are compressed together by direct compression method and will be dissolved within 20 seconds in aqueous medium [22].

In sublimation process, volatile substances such as ammonium bicarbonate, camphor, benzoic acid, urea, ammonium carbonate, naphthalene, urethane, and phthalic anhydride, are added in the formulation to make the tablets porous. Here, various solvents such as cyclohexane, benzene are used as pore forming agents [23].

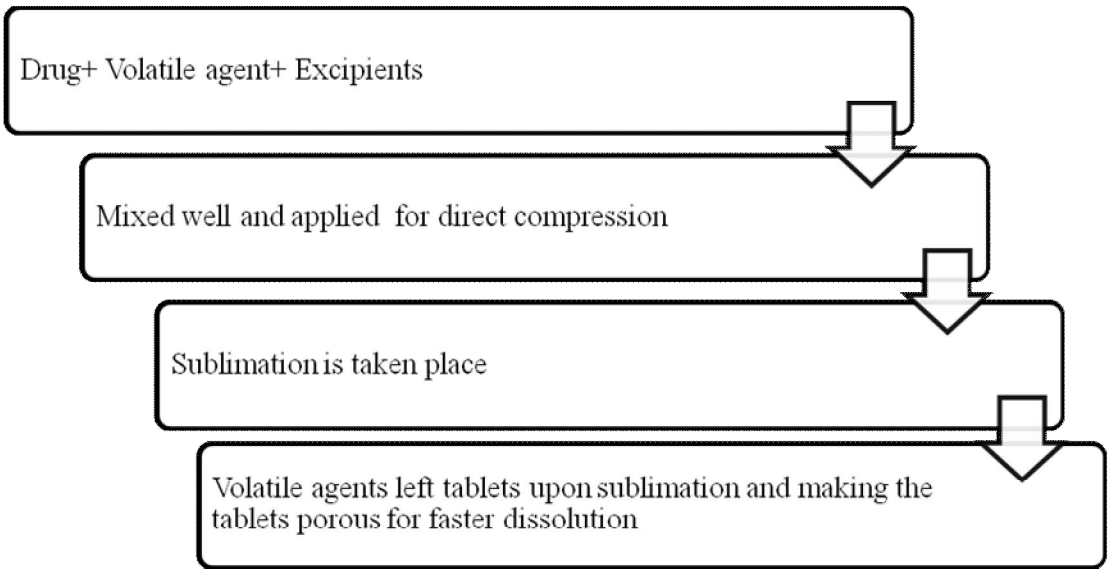

***Figure 1*: Preparation of FDTs by sublimation**

2. Direct Compression

The most simplest and inexpensive tablet formulating process is direct compression. It is also known as direct compaction by which process powdered excipients and active pharmaceutical ingredients will compress together There are various excipients used to prepare fast dissolving tablets [24].

3. Tablet Molding

There are two types Molding proceses -. heat method and solvent method which are utilized to formulate fast dissolving tablets. These methods can prepare porous tablet because compaction is less than direct compression method [25].

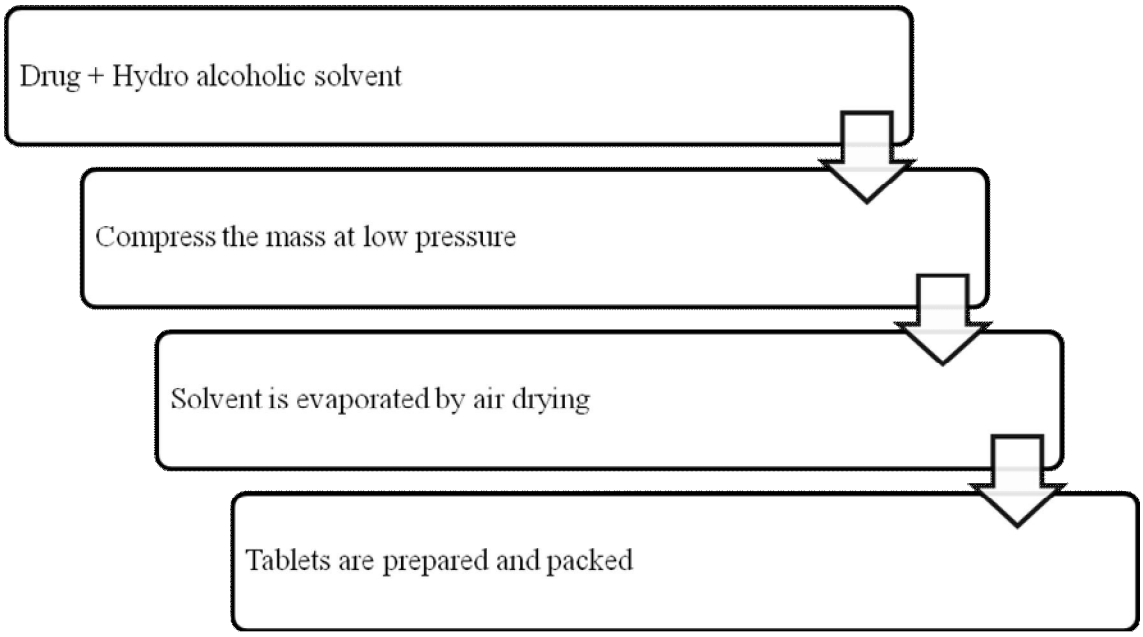

***Figure 2*: Preparation of FDTs by Solvent Tablets molding**

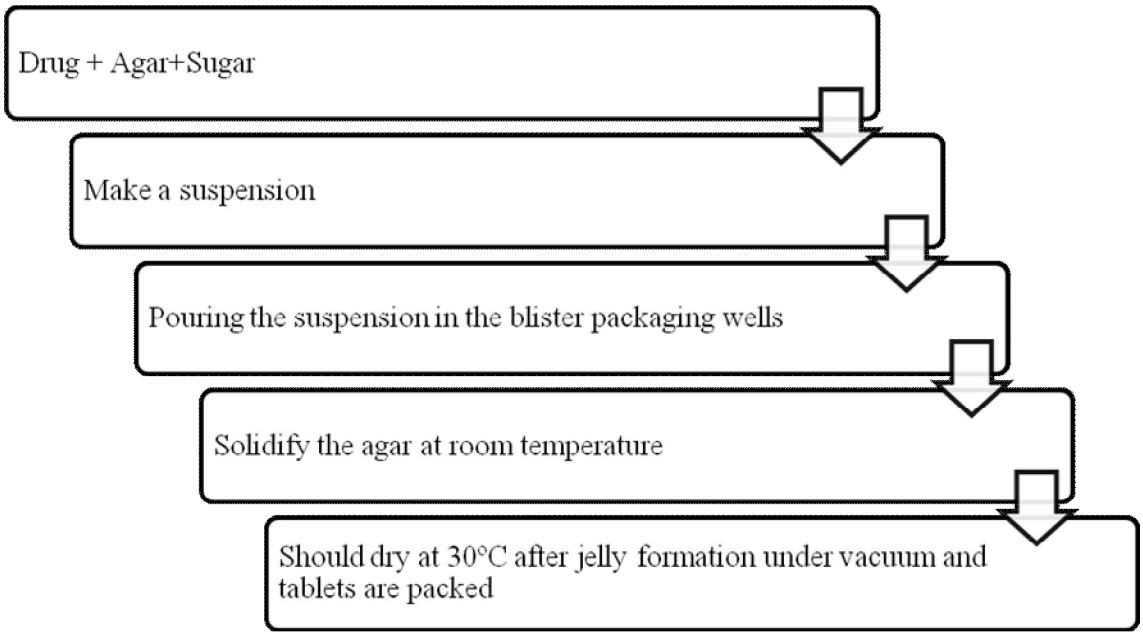

***Figure 3*: Preparation of FDTs by Heat Tablets molding**

4. Freeze-Drying or Lyophilisation

Freeze drying is a low temperature dehydration process in which ice is removed by sublimation at low pressure and temperature. This method is used for rapid dissolving amorphous porous structure. Here, when the formulation is frozen, water is sublimed from the product. Though the process is expensive, not applicable for poorly stable drugs but is used to enhance absorption and bioavailability. [26, 27]

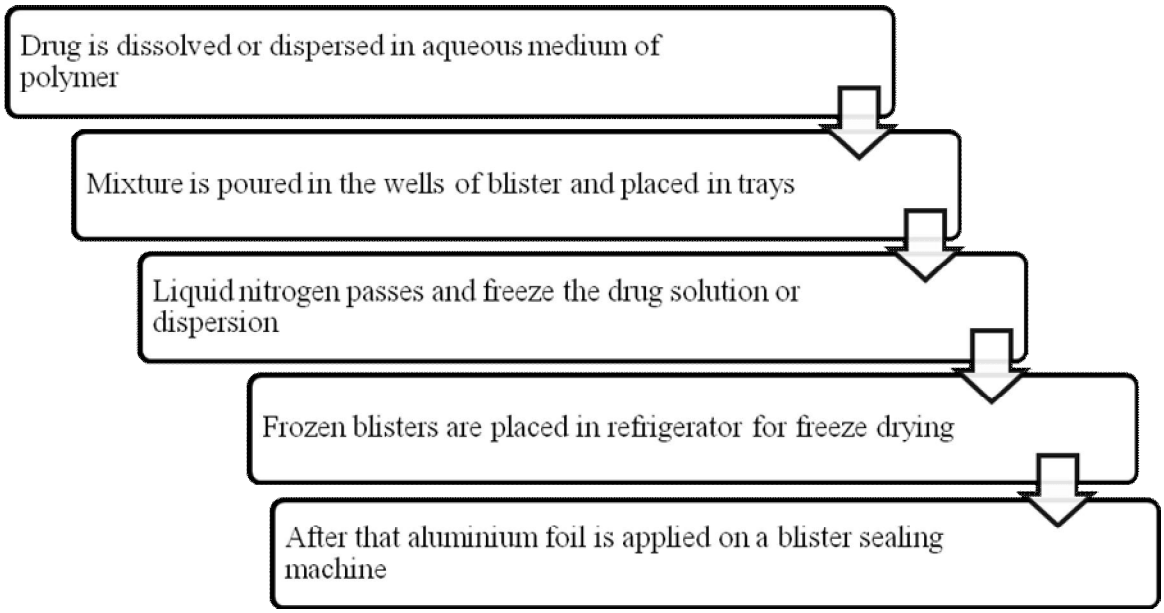

Figure 4: **Preparation of FDTs by Freeze drying**

5. Mass-Extrusion

In this process, water-soluble polyethylene glycol and methanol are used to form a soft mass. The mass is extruded by an extruder or syringe to make cylinder products. They are separated into tablets by using heated blade [28].

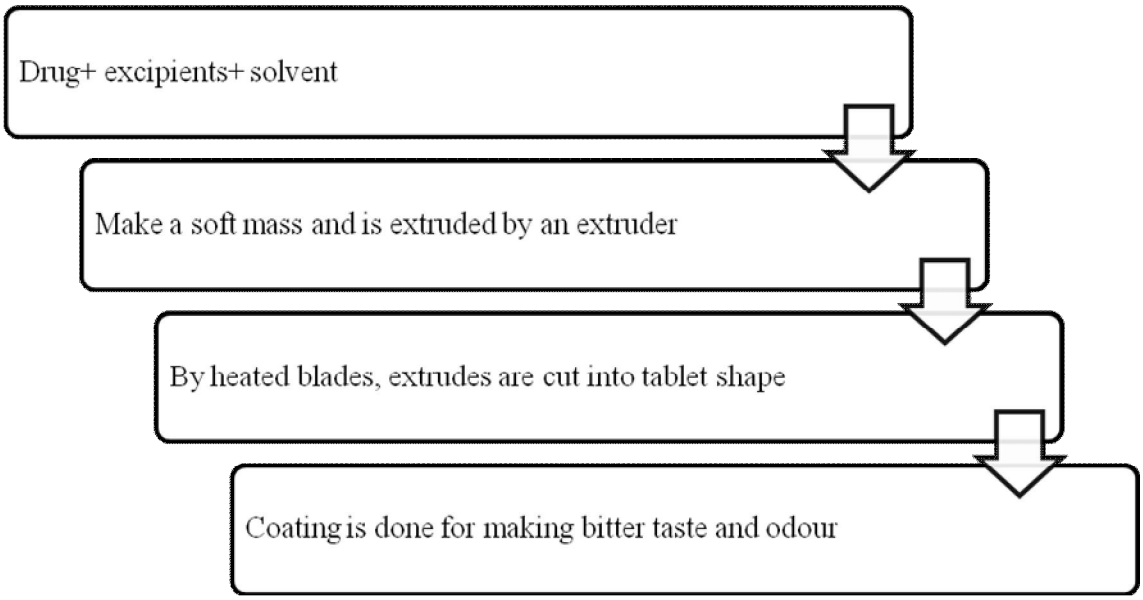

Figure 5**: Preparation of FDTs by Mass extrusion**

Table 4: **Major challenges in formulation of FDTs** [29, 30, 31]

Challenges	**Explanation**
Mouth feel	Tablet must be disintegrated into small particles in the oral cavity and should leave minimal or no residue in mouth.
Sensitivity to environment	Tablet must be dissolved in minimum quantity of water and should not be sensitive to environmental factors like temperature and humidity.
Aqueous solubility	Tablet should have maximum solubility as they are fast dissolving tablet. There are many water soluble drugs that may form eutectic mixtures, which may help in structural degradation during the sublimation.
Fast Disintegration	FDTs must be disintegrated in the mouth without water or small amount (1–2 mL) of water.
Size of tablet	Size of the tablet must be 7-8 mm which is easy to handle.
Hygroscopic property	There are some drugs which are hygroscopic in nature and must need protection from humidity.
Palatability	Tablets are bitter in taste and must have taste masking agent in the formulation to mask the taste.
Mechanical strength	Tablets must be porous and should have very low compression force. The specialized peel-off blister packing is needed as tablets are brittle.
Mechanical strength and disintegration time	As FDTs will dissolve within few seconds, may be fragile in nature. To protect FDTs during transportation, mechanical strength must be optimum so that it will not delay disintegration time.

Evaluation of Fast Dissolving Tablets

Organoleptic properties:

The size and shape of the tablet are important characteristics to be taken care of. Size and shape of the tablet depends on their thickness which produces appearance. Filling equipment helps to provide the thickness to the tablets. Some filling equipment gives uniform thickness to the tablets as a counting mechanism. To measure these properties ten tablets are taken and their thickness is measured by using micrometer [32, 33, 34].

Hardness:

These tablets do not have a significant hardness because achievement of the hardness is not easy due to the processes of manufacturing and ingredients used. These tablets use to disintegrate early in the mouth, so the hardness of the tablets kept lower than usual. Conventional hardness testers are used to measure the hardness of the tablet [32, 33, 34].

Friability:

Increasing the % friability is a major problem for this kind of tablets and the process of manufacturing is responsible for this problem. Achieving % friability inside the range is a challenge for a formulator. Thus, it is necessary to evaluate this parameter and the result should be within a particular range (0.1-0.9%) [32, 34].

Wetting time:

The measurement of tablet wetting time is done by folding a piece of tissue paper (12 cm X 10.75 cm) twice and placed it in a petridish. The internal diameter of petridish is 6.5 cm which consists 6 ml of Sorenson's buffer having pH 6.8. The total wetting time is measured after dropping a tablet on a piece paper. This process is carried for three times for each and every batch and also the standard deviation was also detected [32, 33, 34].

In-Vivo Disintegration test:

6 tablets are taken for this test in the apparatus specified in I.P.-1996. Distilled water at 37°C ± 2°C is used as a disintegration media. The complete disintegration time of the tablet is determined in second without remaining palatable mass [32, 33, 34].

Dissolution test:

USP monograph contains dissolution conditions for many commonly used drugs. 0.1 N Hcl, pH 4.5 and pH 6.8 buffers can be used as other media for evaluation of these tablets exactly in the same way as the ordinary tablets. It was experienced that USP 2 paddle apparatus is adequate for dissolution test of FDTs and paddle speed (50 rpm) is to be maintained. According to the USP monograph the dissolution of these tablets are very fast using mentioned conditions. Thus slower paddle speed is recommended to obtain a comparative profile. In case of larger tablets near about or more than one gram with dense particles contained within it may build up aggregation in the dissolution vessel that can be reduced by using higher paddle speeds. Optimum stirring speed will be 25-75 rpm to disappear this situation [35].

Table 5: **Recent Patented Technologies**

Name	Description
Zydis Technology	Zydis formulation is prepared by freeze dried technology in which fast dissolving carriers entraps drug material within it. Water is not necessary for swallowing because of the freeze dried unit which disintegrates rapidly in mouth [36, 37].
Durasolv Technology	This technology was patented by CIMA LAB (US patent no.6, 024, 981). It follows direct compression in which suitable excipient with improved property are used. Especially superdisintegrants are used to accelerate the dissolution property. This technology may use effervescent agents to improve disintegration [15].
Orasolv Technology	Oralosov technology was also founded by CIMA LAB. Effervescent direct compression tablets are produced by oralosov technology that dissolves in mouth less than within a minute and leave the coated drug powder. Drug powder is coated to mask the unpleasant taste of the drug powder. Oralosov formulations have low mechanical strength [15].
Wow Technology	Patent of this technology belongs to Yamanouchi Pharmaceutical Corporation where WOW stands for “without water”. In this process High moldability sacchardies like mannitol is used together with low moldability saccharides like glucose that results in rapidly melting tablets [38].
Flashdose Technology	This technique is patented by fuisz. It uses flash heat processing to develop the matrices. Matrices are prepared by unique spinning mechanism in a form of crystalline floss structure within which the drugs are incorporated. These products are

	having high surface area thus it dissolves rapidly in tongue [15].
Ceform Technology:	Dry powder containing pure drug and excipients are placed in rapidly spinning machine named as ceform machine. Centrifugal force of this machine helps to blend the drug powder and the powder is liquefied to form a sphere [15].
Flashtab Technology	In this method tablets are prepared by wet/dry granulation followed by classical method of compression .This process target the drug to be rapidly released within the GIT. Euragit is basically used for rapid release. Tablets prepared by this process have high physical strength [15].
Nanocrystal Technology	Nanocrystal technology use to increase dissolution rate by increasing surface area and decreasing particle size. Nanocrystal drug particles can be achieved by milling the drug substances. This technology can provide wide angle of drug doses (upto 200mg). Tablets produced by the process can be highly robust but can dissolve in very less quantity of water [39].
Advantol 200	Standard rotary tablet press with standard tooling and normal tableting temperature produces robust “soft-melt”. Tablets can be achieved by directly compressible excipient without any special tooling. These are having applications in preparation of nutraceuticals [15].
Advatab	Kyowa Hakko Kogyo patented AdvaTab™ technology well lubricated tablets are produced by the help of this technology via spray which are orally dissolved. 10–30 times less hydrophobic lubricants are used to prepare these tablets. And can be 30-40% stronger than conventional tablets [40].
Ora-Quick Technology	This microsphere technology is known as Micro Mask which uses a distinctive patented taste masking technology. Tablets prepared by this

	process are more quickly and efficiently produced because no solvents are used during the process [41].
Pharmaburst Technology	This technology is patented by SPI Pharma, New castle. Coprocessor excipients, dissolving within 30-40 seconds are used by this process. Drug, flavour, and lubricant are blended dry and compressed into tablets. These tablets have high mechanical strength. [39].
Lyoc	Farmlyoc patented this technology. This process is done by lyophilisation. A porous and solid emulsion is put into drug or drug microparticles containing blisters and then freeze tablets prepared by this process have low strength because of the porosity but have good dissolution rate [42].

Conclusion

FDTs are dosage forms disintegrate within few seconds in the saliva. Because of having more advantages such as rapid onset of action, improved efficacy, better bioavailability and patient compliance, are used for both geriatric and paediatric patients. Various ingredients and different methods are used to prepare FDTs. They are porous and have less mechanical strength. There are different techniques used to make a tablet porous and to improve mechanical strength advance technologies can be utilized. Bitter drugs can be used for FDTs by using taste making agent. FDTs can provide a success in the market. Many drugs will be formulated in the form of FDTs in future and the research is still going on [42].

References

1. Garg A. and Gupta M., Mouth dissolving tablets: a review. J Drug Deliv Ther.3 (2) 207-214 (2013).

2. Garg A. and Gupta M. Taste masking and formulation development & evaluation of mouth dissolving tablets of levocetrizine dihydrochloride. J Drug Deliv Ther.3 (3) 123-130 (2013).

3. Hardenia S. and Darwhekar G. Formulation and optimization of fast dissolving tablets of promethazine theoclate using 3^2 factorial designs. J Drug Deliv Ther.7 (7) 12-14 (2017).

4. Ratnaparkhi M.P., Jagadale S.K., Patil P.S. and Dhiwar S.B. Formulation and Development of Taste Masked Orally Disintegrating Tablets of Perindopril Erbumine by Direct Compression Method. Int J Drug Dev. & Res.3 (5) 374-394 (2012).

5. Kumari S., Visht S., Sharma P.K., and Yadav R.K. Fast dissolving Drug delivery system: Review Article. J Pharm Res.3 (6) 1444-1449 (2010).

6. Bandari S., Mittapalli R.K., Gannu R., and Rao Y.M. Orodispersible tablets: An overview. Asian J Pharm.2 (1) 2-11(2008).

7. Khanna K., Xavier G., Joshi S.K., Patel A., Khanna S., and Goel B. Fast Dissolving Tablets- A Novel Approach. Int J Pharm Res Allied Sci.5 (2) 311-322 (2016).

8. Bi Y., Sunada H., Yonezawa Y., Dayo K., Otsuka A., and Iida K. Preparation and evaluation of compressed tablet rapidly disintegrating in oral cavity. Chem Pharm Bull (Tokyo).44 (11) 2121-2127 (1996).

9. Bhowmik D., Chiranjib B., Krishnakanth, Pankaj, and Chandira R.M. Fast Dissolving Tablet: An Overview. J Chemical and Pharma Res.1 (1) 163-177 (2009).

10. Kaur T., Gill B., Kumar S., Gupta G.D. Mouth dissolving tablets: a novel approach to drug delivery. Int J Curr Pharm Res.3 (1) 1-7 (2011).

11. Patel T.S. and Sengupta M. Fast dissolving tablet technology. World J Pharm Sci.2 485-508 (2013).

12. Gupta D.K., Bajpai M., and Chatterjee D.P. Fast mouth is dissolving disintegrating tablet and patient counselling points for FDDT review. Int J Res Dev Pharm Life Sci. 3 949-958 (2014).

13. Nautiyal U., Singh S., Singh R., Gopal, and Kakar S. Fast dissolving tablets as a novel boon: a review. J Pharm Chem Biol Sci.2 (1) 05-26 (2014).

14. Mudgal V.K., Sethi P., Kheri R., Saraogi G.K., and Singhai A.K. Orally Disintegrating Tablets: A Review. Int Res J Pharm.2 (4) 16-22 (2011).

15. Fu Y., Yang S., Jeong S.H., Kimura S., and Park K. Therapeutic Drug Carrier Systems, Orally Fast Disintegrating Tablets: Developments, Technologies, Taste- Masking and Clinical Studies. Crit Rev Ther Drug Carrier Syst. 21 (6) 433–475 (2004).

16. Kuchekar B.S., Badha A.C., and Mahajan H.S. Mouth dissolving tablets: a novel drug delivery system. Pharma Times.35 7-9 (2003).

17. Liang A.C. and Chen H.L. Fast-dissolving intraoral drug delivery systems. Expert Opin Ther Patents.11 (6) 981-986 (2001).

18. Deshmukh V.N. Mouth dissolving drug delivery system: a review. Int J Pharm Tech Res. 4:412-21 (2012).

19. Kumaresan C. Orally disintegrating tablet-mouth dissolving, sweet taste and target release profile. Pharm Rev. 6 1 (2008).

20. Mohanachandran P.S., Sindhumol P.G., and Kiran T.S. Superdisintegrants: an overview. Int J Pharm Sci Rev Res.6 105-109 (2011).

21. Kundu S., and Sahoo P.K. Recent Trends in the Developments of Orally Disintegrating Tablet Technology. Pharma Times.40 (4) 11-15 (2008).

22. Badguja B.P., and Mundada A.S. The technologies used for developing orally disintegrating tablets: A review. Acta Pharm.61 117–139 (2011).

23. Nagar P., Singh K., Chauhan I., Verma M., Yasir M., Khan A., Sharma R., and Gupta N. Orally disintegrating tablets: Formulation, preparation techniques and evaluation. J Applied PharmaSci.1 (4) 35-45 (2011).

24. Ito A. and Sugihara M. Development of Oral Dosage forms for elderly patients: Use of agar as Base of rapidly disintegrating oral tablets. Chem Pharm Bull.44 (11) 2132-2136 (1996).

25. Goel H., Rai P., Rana V., and Tiwary A.K. Orally Disintegrating Systems: Innovations in Formulation and Technology. Recent Pat Drug Deliv Formul.2 258-274 (2008).

26. Basu B., Bagadiya A., Makwana S., Vora V., Batt D., and Dharamsi A., Formulation and evaluation of fast dissolving tablets of cinnarizine using superdisintegrant blends and subliming material. J Advanced Pharma Tech & Res.2 (4) 266-273 (2011).

27. Bircan Y., and Comoglu T. Formulation technologies of orally fast disintegrating tablets. Marmara Pharm J.16 (1) 77-81 (2012).

28. Shukla D., Chakraborty S., Singh S., and Mishra B. Mouth Dissolving Tablets I: An Overview of Formulation Technology. Sci Pharm.77 309-326 (2009).

29. Erande K. and Joshi B. Mouth Dissolving Tablet: A comprehensive Review. Int J Pharm Rev Res.2 (7) 26-28 (2013).

30. Shaikh S., Khirsagar R.V., and Quazi A. Fast Disintergating Tablets an overview of formulations and technologies. Int J Pharm Sci.2 (3) 9-11 (2010).

31. Chaudhari P.D., Chaudhari S.P., Lanke S.D., and Patel N., Formulation and in vitro evaluation of taste masked orodispersible dosage form of Levocetirizine dihydrochloride. Indian J Pharm Educ.41 (4) 319-327 (2007).

32. Mallika T., Anand D., and Harikrishna E. Isolation, characterization and investigation of starch phthalate as novel superdisintegrant in developing of acyclovir fast dissolving tablets. J Drug Deliv Ther.8 (1) 33-42 (2018).

33. Siraj S., Kausar S., Khan G., and Khan T. Formulation and evaluation of oral fast dissolving tablet of ondansetron hydrochloride by coprocess excipients. J Drug Deliv Ther.7 (5) 102-108 (2017).

34. Aher S., Saudagar R., and Chaudhari D. Formulation and evaluation of taste masked fast dissolving tablet of prazosin hydrochloride. J Drug Deliv Ther.8 (4) 263-271 (2018).

35. Keshari A., Tripathi, D.P., Srivastava A., and Vishwas R. Formulation and evaluation of effervecent floating tablets of antidiabetic drug. J Drug Deliv Ther.5 (6) 43-55 (2015).

36. Panigrahi D., Baghel S., and Mishra B. Mouth dissolving tablet: An overview of preparation techniques, evalution and patented technologies. J Pharma Research.4 (3) 33-38 (2005).

37. Deshmukh V.N. Mouth Dissolving Drug Delivery System: A Review. Int J of Pharm Tech Research.4 (1) 412-421 (2012).

38. Puttalingaiah L., Kavitha K., and Mani T.T. Fast disintegrating tablets: An Overview of Formulation, Technology and Evaluation. Res J Pharma. Biological Chem Sci.2 (2) 589-601 (2011).

39. Kumar R., Patil S., Patil S.R., and Paschapur M.S. Formulation, evaluation of mouth dissolving tablets of fenofibrate using sublimation technique. Int J Chem Tech Res.1 (4) 840-850 (2009).

40. Bi Y.X., Sunada H., Yonezawa Y., and Danjo K. Evaluation of rapidly disintegrating tablets prepared by a direct compression method. Drug Dev Ind Pharm.25, 571-581 (1999).

41. Prajapati B. and Ratnakar N. A Review on recent patents on fast dissolving drug delivery system. Int J PharmTech Res.1 (3) 790-798 (2009).

42. Gavaskar B., Kumar S.V., Sharan G., Nagaraju M., and Rao Y. M. Present investigations and future prospects of oral disintegrating tablets: A Review. Int J PharmaSci and Res.1 (8) 14-28 (2010).