IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Review On Buccal Disintegrating Tablet As Novel Approaches In Drug Delivery System

[1]Yogita S. Mahajan[*] , [2] Dr Surajj Sarode , [3] Mr. M.M. Bari , [4] Dr. S.D. Barhate

[1]Research scholar , [2] Vice Principal , [3]Assistant Professor, [4] Principal

[1]Department of Pharmaceutics,

[1]Shree Sureshdada Jain Institute of Pharmaceutical Education and Research,Jamner dist. -Jalgaon , Maharashtra , India

Abstract: The buccal drug delivery technique is generally used Because it's a inexpensive, safe, and convenient way to provide medication, buccal and oral routes (also known as the buccal drug delivery system) are the most popular for administering different drugs since they are seen to be the most convenient, safest, and affordable routes. A buccal disintegrating tablet that improves patient compliance was recently produced by researchers. and convenience, motion sickness, mental disorders, elderly and pediatric patients with dysphasia (difficulty swallowing), moderate to severe pain, and troubleshooting such issues with a novel dose form called buccal disintegrating tablet / pill dissolving .In order to facilitate easy swallowing without the need for water, a tablet known as a buccal disintegrating tablet has been designed. These tablets can be prepared by It has been possible to create buccal disintegrating tablets that dissolve quickly in saliva and can be swallowed without the need for water. These tablets can be made using a variety of technologies, including mold-making, wet granulation, and lyophilization., Flash dose technologies .This review also briefly describes the benefits and limitations of the buccal drug delivery system and the theories surrounding bioadhesion, as well as the preparation process, the bioadhesion polymer, and the classification of the buccal system.

Index Terms **- Buccal disintegrating Tablet , Superdisintegrant , Bioadhesive polymer , Buccal Drug Delivery system.**

I. INTRODUCTION

Buccal disintegrating tablets are helpful for patients with dysphagia, the elderly, and children who struggle with swallowing. Without the need for water, these dosage forms quickly dissolve or disintegrate in the oral cavity in a matter of seconds. Drugs that are absorbed through the "oral cavity" go straight into the jugular vein and into the systemic circulation, which guarantees a quick start of action, prevents first pass metabolism, and causes drug breakdown in the gastric area and enzymatic hydrolysis in the intestine. (1)Oral dispersible tablets, also referred to as rapid dissolving tablets or buccal disintegrating tablets, are a widely established formulation that takes use of the "oral cavity."(2) One option for administering medications other than orally is by buccal distribution, especially for medications that have a first-pass effect Many years ago, the stratified squamous epithelium of the buccal mucosa, which is supported by a connective tissue lamina propria, was chosen as the site for drug delivery.(3) The medicine can be administered via the buccal route to address issues associated with the oral route of administration, such as substantial metabolism by the liver, drug degradation in the gastrointestinal tract due to a harsh environment. obstacle to medication absorption.(4) Numerous strategies have been implemented to enhance buccal absorption.(5)By altering the medication's physicochemical characteristics, it was possible to increase drug penetration across the buccal membrane and stop enzyme degradation of the drug on the other hand, increasing the buccal delivery devices' bioadhesion and release properties makes more medication available for absorption One intriguing strategy is to add absorption enhancers to the buccal formulation(6).Because the buccal route avoids first pass metabolism and may be accessed for regulated release it has a high acceptance rate (7).

1.1. BUCCAL DRUG DELIVERY SYSTEM:

Drugs that undergo first-pass effect are particularly well-suited for buccal delivery, which involves administering the desired medication through the buccal mucosal membrane lining the oral cavity. The buccal drug delivery system interacts with the mucus layer covering the mucosal epithelial surface and mucin molecules, increasing the residence time of the dosage form at the site of absorption. As a result, buccal dosage forms are advantageous, increasing both the drug's therapeutic activity and plasma concentration (6,9).

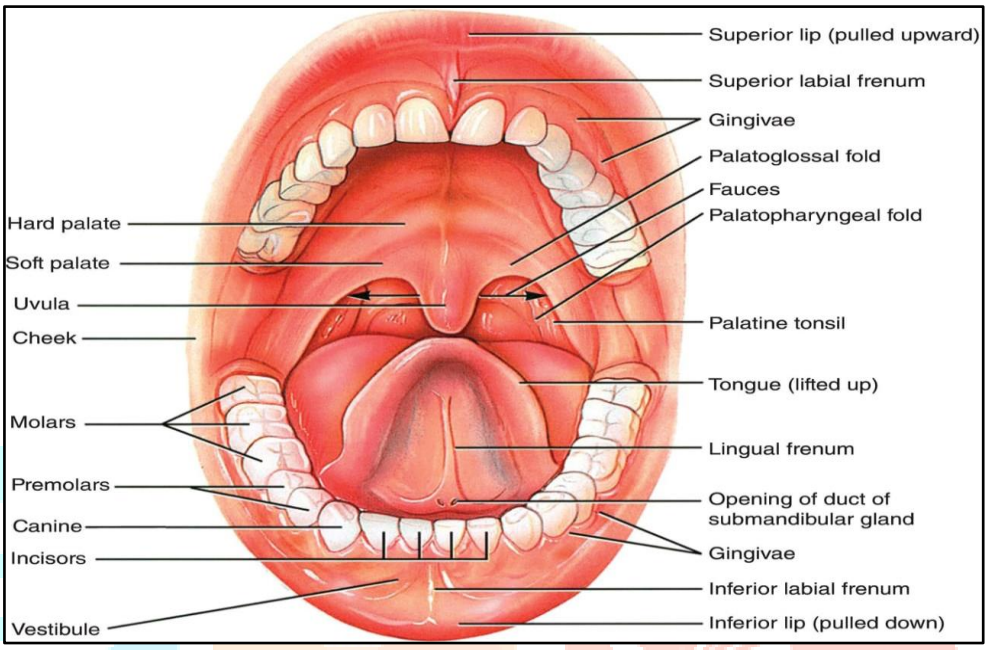


Figure 1: Conceptual diagram of Buccal Drug Delivery System

1.2 Defination

Buccal Disintegrating Tablet :

Buccal disintegrating tablet take place between cheek and gum which disintegrate and dissolve in saliva within second and then easily swallowed without need of water or additional liquid .Buccal tablets have an oval, flat, and tiny diameter that ranges from 5 to 8 mm. While wet granulation is another technique that can be used, direct compression is the method most frequently used to prepare buccal tablets. When saliva is present, these tablets adhere to the buccal mucosa. They are made to deliver the medication in two ways: one way targets the buccal mucosa, while the other way targets the saliva (8,12)

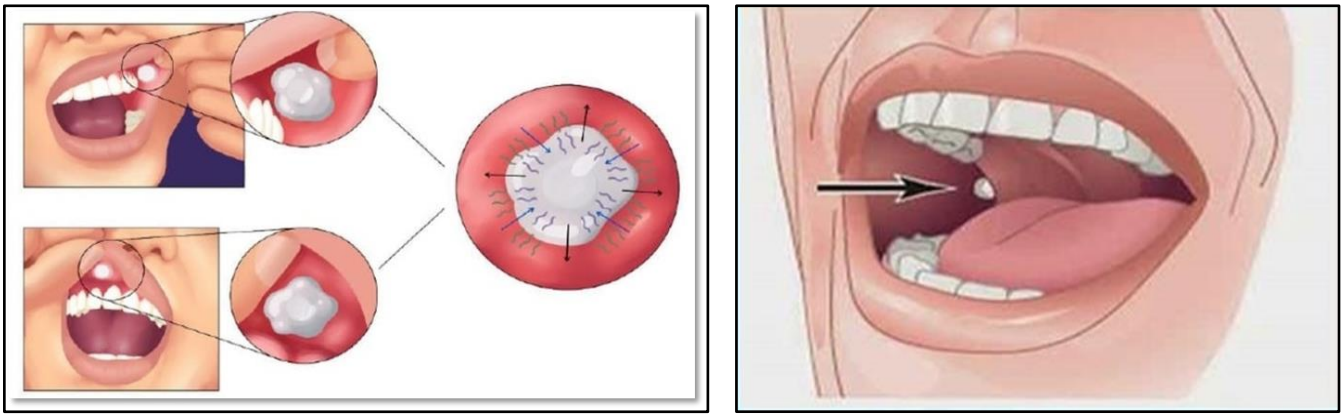


Figure 2: Conceptual diagram of Buccal Disintegrating Tablet

1.3 Criteria for Buccal Disintegrating Tablet :

- Water shouldn't be needed to administer it it quickly dissolve and crumbles in the mouth in a matter of second (5) .
- It should have a pleasant mouth feel and taste disguising ability because it dissolve in the mouth
- It must possess enough hardness to withstand the action involved in post –manufacturing .
- It ought to be more bioavailable .
- Temperature and humidity levels in the environment shouldn't have an impact on it (7).
- It shouldn't t need to be packaged specifically.
- Medicine ought to be no more than 20 mg (5).

1.4. Advantages of Buccal Disintegrating Tablet :

- These tablet can be easily administered the patient like elders who are having the difficulty in swallowing , by children who are unable to swallow and by the psychiatric patient who refuse to swallow the tablet (14).
- Buccal disintegrating tablet are having improved patient compliance because these tablet can be taken by the bed ridden patient and the people who are busy in travelling without need of water .
- Buccal disintegrating tablet have good mouth feel qualities because of these qualities , making it easy for kids to take this medication as well (17).
- Its fast onset of action is attributed to its pregastric absorption features which involve absorption through the mouth , pharynx , and oesophagus (14).
- Because of its pregastric absorption activity it , has enhanced bioavailability .
- These tablet work best in situation where a diseases calls for a quick start to treatment , such as an acute allergic reaction or a cough (17).

1.5 Disadvantages of Buccal Disintegrating Tablet :

- Limited absorption area of the 170cm ^{2}of the oral cavity membrane that is available foe medication absorption 50 cm ^{2} are non-keratinized tissues including the buccal membrane (8)
- Mucosa barrier characteristics
- Constantly suppressing saliva (0.5-2 I /day) causes the medication to be diluted over time .
- There is a risk of choking if the delivery device is inadvertently swallowed(14)
- Saliva swallowing may also result in the medicine becoming suspended or dissolved , which could cause the dose form to be inadvertently removed (8).

1.6 Limitation of Buccal Disintegrating Tablet :

- Because tablet typically lack sufficient mechanical strength handling them carefully is necessary .
- An unpleasant aftertaste may result from tablet that are not designed to hide the bitter taste of the medication .
- Patient with sjogren's syndrome or low saliva production syndrome are , not able to take these dissolving tablet
- buccal disintegrating tablet are hygroscopic sensitive to moisture we must only store them in dry environment (7,9).

1.7 Criteria for Drug selection of buccal Disintegrating Tablet :

- Excellent soluble in both water and Saliva (5).
- Does not irritate to mucosa
- A medication can penetrate the mucosa of the mouth
- The dosage need to be under 20 mg
- A medication with a biological half –life of two to eight hours
- A drug shouldn't taste bitter (7).
- Baccal dissolving tablet composition: 80% of the medicine dissolves in vitro in about 30 minutes, whereas about 50% dissolves invitro in about 15 minutes, which is better
- Disintegration time is less than 30 seconds (14).

1.8 Buccal Disintegrating Tablet's Significance :

- Precise dosing is made possible by the unit solid dosage form, which offers the advantages of precise dosing, easy mobility and manufacture, strong physical and chemical stability, and a great substitute for elderly and paediatric patients.(17)
- Increased bioavailability: The drug's increased bioavailability is a result of its absorption through the mouth, throat, and oesophagus.(18)
- Quick response, Rapid disintegration and absorption of the tablet into the oral cavity cause a fast commencement of therapeutic effect.
- Patient compliance: The dosage form can be swallowed without the requirement for water. Therefore, it is practical for patients who are on the go and do not always have access to water (17).

1.9 Ideal characteristic of Buccal Drug Delivery System :

- Prompt adherence with enough mechanical strength to the buccal mucosa.
- The controlled release of drugs.
- facilitate the rate and degree of drug absorption
- The patient's compliance should be high.
- Shouldn't impede daily activities including speaking, eating, and drinking.
- Must be able to withstand saliva's flushing effect well (10,12)

1.10 Need:

- Non-invasive drug delivery technologies will remain necessary due to low patient acceptability and compliance with invasive drug administration methods, a limited market range for pharma firms and medication application, and the high expense of illnesscare.
- The elderly who suffer from tremors and dysphagia, along with youngsters who find it uncomfortable to take the standard dosage form.
- A traveller experiencing motion sickness and diarrhoea.
- A person with constipation who is unable to swallow medicine,For instance. e.g. For instance, cancer patients who become quite ill after undergoing chemotherapy.
- A mentally challenged, immobile, and psychotic patient.
- Action must be taken immediately.
- A faster therapeutic effect would be attained if the tablet is designed to dissolve or disintegrate quickly.
- For improved patient compliance as a result of the medication's quick absorption and simple administration.
- Feel good in the mouth (19,22)

1) Patient factor :

- Buccal disintegrating dosage forms are especially appropriate for patients who, for whatever reason,find it more convenient to consume traditional tablets and capsules with a glass of water.
- Patients who refuse to swallow solid food because they worry about choking.
- An really old patient who might be able to take one daily dose by mouth.
- An individual with persistent dyspepsia who may be on the go or who has limited or no access to water.
- Older adult and children who have trouble digesting or swallowing solid dose forms (19).

2) The Efficacy factor :

One of the main claims of these formulations is a speedier start of action and increased bioavailability. In certain circumstances where the drug dissolves quickly, pregastric absorption occurs via the formulation's dispersion in saliva in the oral cavity. Several medications are absorbed in the pharyngeal, stomach, and buccal regions. Pregastric absorption can be very advantageous for drugs that experience a lot of hepatic metabolism since it prevents first pass metabolism (22).

1.11 Objective :

- To improve bioavailability
- To boost adherence rates among patients.
- To improve the dosage form's mechanism of action, safety, and efficacy.
- To create a buccal dissolving tablet, the medication will enter the systemic circulation through the buccal mucosa and start working right away.
- Using polymer to lower dosage frequency by avoiding the first pass metabolism.
- Patients with dysphagia or those who are elderly and have trouble swallowing can benefit from buccal dissolving tablets.
- Ideal for travel in areas without access to water.
- To demonstrate improved patient convenience and adaptability.
- Patients who have difficulty swallowing large amounts of water, such as those with dysphagia, motion sickness, repeated emesis, and mental disorders, prefer this type of preparation.
- Quick absorption of medication via pregastric absorption from the mouth, throat, and oesophagus as saliva travels down.
- Oral administration of the drug of the buccal drug delivery system can prevent problems regarding presystemic metabolism and drug depletion in the diagestive tract.
- The buccal medication delivery mechanism ensures a quick start of action by entering the systemic circulation straight through the jugular vein after being absorbed through the oral cavity (18,19,23).

2. Bioadhesion Theory :

There are six general ideas about adhesion, and they are modified in order to assess mucoadhesion (9,10).

2.1. Wetting theory :

This theory analyses adhesive and contact behavior in terms of a liquid or paste spreading over a biological system. It is mostly applicable to liquid bioadhesive systems. The energy released per square centimetre during the formation of an interface is known as the work of adhesion, which is represented in terms of surface and interfacial tension (ɣ) (9).

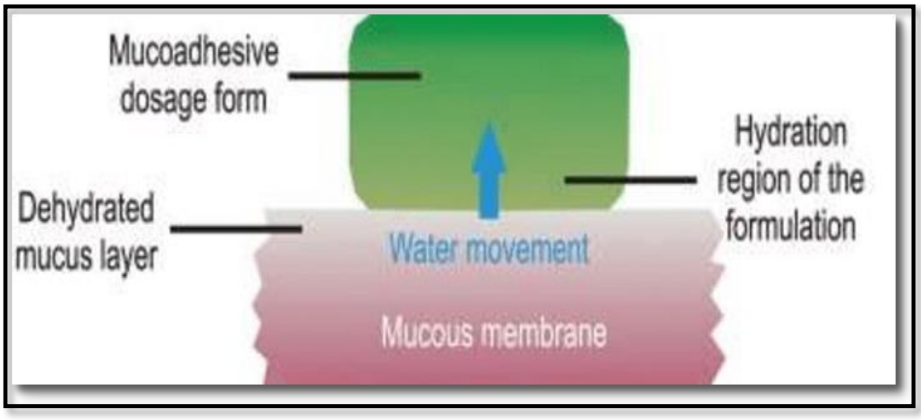


Figure 2.1 Wetting theory

2.2 Adsorption theory :

This theory states that material adheres to two surfaces following their initial contact because of surface forces between the atoms on both surfaces. The adsorption process involves two different kinds of chemical bonds: primary covalent (permanent) and secondary chemical bonds (which include electrostatic forces, hydrogen bonds, and hydrophobic interactions) (10).

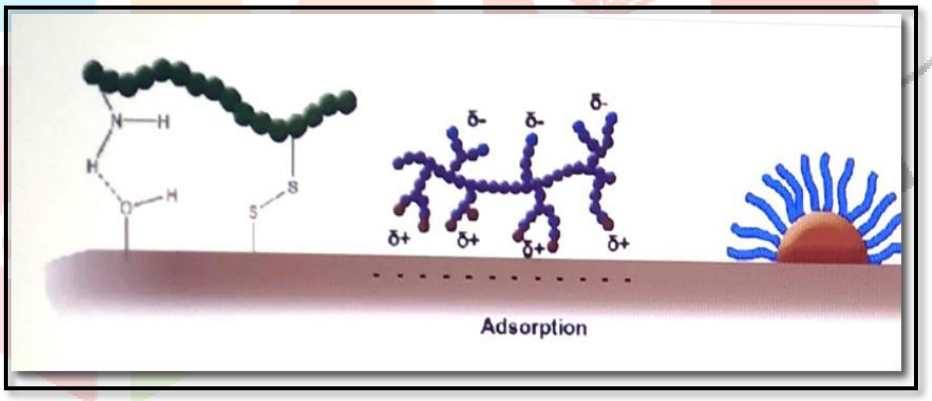


Figure 2.2. Adsorption theory

2.3 Electronic theory :

This theory states that because of differences in their electronic structures, electronic relocation happens when an adhesive polymer and the mucus glycoprotein network come into contact. At the interface, adhesion happens because of attractive forces across the double layer, which leads to the formation of an electrical double layer .(10)

2.4. Diffusion theory :

This hypothesis state that mucus and polymer chains combine deeply enough to form a semi-permeable sticky bond the time of contact and the diffusion coefficient determine how deeply the polymer chains pierce the mucus . As the cross linking density falls , this coefficient also reduce and is dependent on the molecular weight value among the cross links (9).

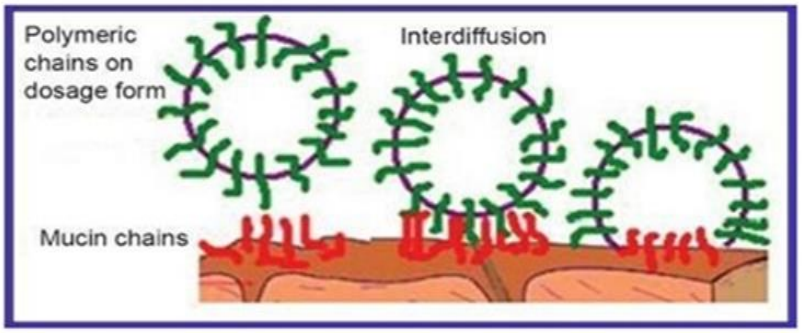


Figure 2.4 Diffusion theory

2.5 Fracture theory :

This theory asserts that adhesion is associated with the separation of two surfaces following adhesion. Adhesive strength and fracture strength are interchangeable (10)
Adhesive strength and fracture strength are interchangeable.
G is equal to (Eε./L)½.
Whereas: E represents Young's elasticity module.
ε represents the fracture energy.
When two surfaces separate,
L= Critical Crack Length.

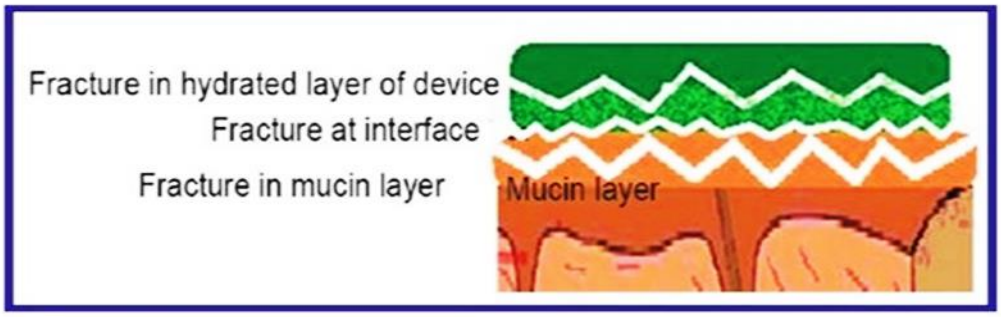


Figure 2.5 Fracture theory

3. Bioadhesive polymer :

3.1 Bioadhesive polymer :

- It ought to establish a robust, non-covalent connection with the mucin/epithelial surface (8).
- It needs to have a restricted dispersion and a high molecular weight.
- The material ought to be compatible with the biological barrier (12).
- Polymers that are frequently utilised in medicinal applications as bioadhesives.
- The bioadhesive force increases up to 10,000 times the molecular weight of the polymer, beyond which it becomes negligible (14) .

3.2 The ideal bioadhesive polymer attributes :

- It must be environmentally compatible and inert.
- Both the polymer and the result of its breakdown must to be non-toxic and able to be absorbed from the mucosal layer.
- It should have some site specificity and stick readily to the surface of moist tissue.
- Neither during storage nor during the dosage form's shelf life may the polymer break down.
- The polymer must to be reasonably priced and readily accessible in the market.
- It ought to firmly stick to the mucous membrane (6,8,12).

3.3. Polymer classification: (5,7)

Natural polymer	Sodium alginate , pectin , tragacanth , gelatin , carrageenan, cyclodextrin , collagen , chitosan dextran , Banana powder ,agarose , cellulose , Gellan Gum , Guar gum , magnifera indica Gum , Soy polysaccharide .
Synthetic polymer	PVA, polyamide ,polycarbonate, polyalkylene , polyvinyl ether , methacryclic acid , ethycellulose , carboxymethyl cellulose .
i) Bio-degradable polymer	Polylactic acid , polyhydroxyl butyrate , polyglycolic acid , polycarprolactone , polyadipic acid , ethylene glycol .
ii) Non-Biodegradable polymer	Carboxymethylcellulose, ethylcellulose , polydimethyl siloxanes ,cellulose acetate , HPMC, Colloidal silica, polymethacrylates, poloxamines .

Table No. 1 Polymer classification

3.4. Factor related to polymers :

a) Molecular weight:

The bioadhesive forces work with the polymer's molecular weight up to 10,000; after that, there is little influence that permits chain interpretation Therefore, the polymer's molecules must be of sufficient length (13).

b) Active polymer concentration:

The coiled molecules become poor in solvent in concentrated solution, and there are few chains available for interpretation possess a sufficient length (26).

c) Polymer chain flexibility:

Polymer chain flexibility is essential to interpretation and expansion. The mobility of each polymer chain decreases when a water-soluble polymer becomes cross-linked. Mucoadhesive strength decreases and the effective length of the chain that can pass through the mucus layer decreases further as the cross-linking density rises (13) .

3.5 Physiological Factor :

a) pH :

The charges on the surface of the polymer and mucus are influenced by pH .Because of variations in the dissociation of functional groups on the carbohydrate moiety and amino acid of the polypeptide backbone, mucus will have a varied charge density depending (13)

b) Swelling :

The presence of water and the concentration of the polymer both affect swelling.Bioadhesion is reduced in cases of excessive edoema (26)

c) Initial contact time : First contact time increases in tandem with an increase in mucoadhesive strength (13).

d) Charge : Nonionic polymers seem to experience less adhesion than anionic polymers, according to some earlier generation on the charges of bioadhesive polymer (28) .

4. Superdisintegrants :

The combination of swelling and water absorption by the formulation causes superdisintegrants to dissolve quickly. Superdisintegrant swelling causes the carrier's wetted surface to increase, which enhances the system's wettability and dispersibility and speeds up the process of disintegration and dissolution. Care should be taken when choosing the superdisintegrant concentration; these are chosen based on the critical disintegrant concentration (5,7,8).

4.1 Selection of Superdisintegrant :

- Able to stay hydrated.
- The flow and moulding properties are superb
- Good tableting consistency .
- Ineffective gel formation
- A wonderful mouth feel.
- Provide a quick disintegration .
- Due to combined effect of swelling and water absorption by the formulation .
- Superdisintegrant intense action and more porous in nature .
- Major function of superdisintegrant to oppose the efficacy of the tablet binder and the physical forces that act under compression to form the tablet .
- Superdisintegrant good hydration capacity , poor gel formation capacity , good molding and flow properties as well as non- tendancy to form complexes with the drug (5,8,18).

4.2. Meachanism of Superdisintegrant :

The disintegrant particles with low cohesiveness & compressibility themselves act to enhance porosity and provide these pathway into the tablet.Liquid drawn up or wicked into these pathway through capillary action and rupture the interparticulate bonds causing the tablet to break apart (3,6).

a) Swelling
b) Porosity and capillary action (wicking)
c) Due to disintegrating particles / particles repulsive forces .
d) Because of heat of wetting (air expansion)

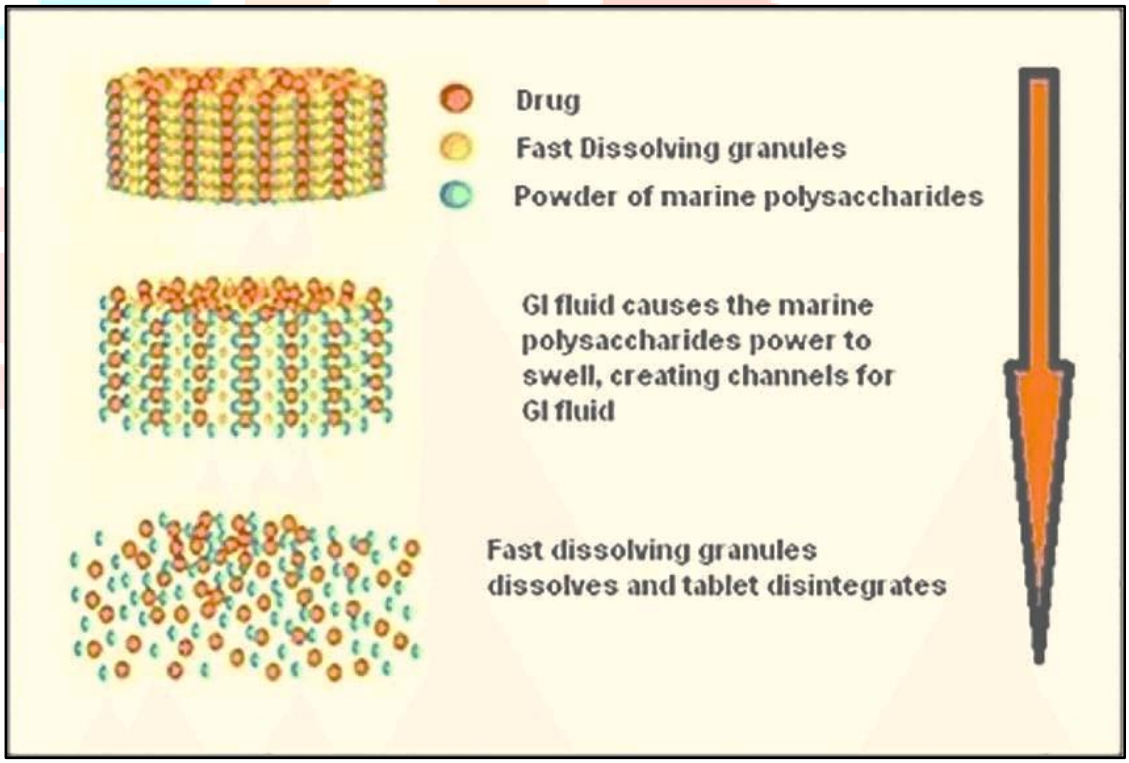


Figure 4.2 Meachanism of superdisintegrant

4.3 Superdisintegrant Classification :

A) Synthetic superdisintegrant :
B) Natural / Organic superdisintegrant :

A) Synthetic superdisintegrant :

In tablet formulation, synthetic superdisintegrants are mainly used to accelerate the rate of medication disintegration. Some of the most often used synthetic superdisintegrants are crospovidone, crosslinked cellulose, soy polysaccharide chitin, chitosan, and sodium starch glycolate. These superdisintegrants speed up the disintegration process improve the dissolution and solubility (3) .

B) Natural / Organic Superdisintegrant :

Natural superdisintegrants, which facilitate tablet disintegration, are frequently utilised in tablet formulations and have biological origins.These superdisintegrants are primarily used to counteract some of the drawbacks of synthetic superdisintegrants. Examples of these include guargum, plantago ovata husk, ocimum tenuiflorum, Aloevera, hibiscus rosa sinensis, lipidium sativum, and magifera indica pectin. Natural superdisintegrant comparatively cheaper , non-toxic , and non-irritating in nature . there are several gums mucilage available which have superdisintegrating activity (6).

4.4. Benefits of Superdisintegrants :

- Accessible
- Financial
- Biodegradability and biocompatibility
- Boost adherence from patients
- Non-toxic and non-irritating
- Boost adherence from patients
- Non-toxic and non-irritating
- Provide patients with a safe and efficient medication administration method.
- Compatible with excipients and medicinal agents that are often utilised.
- Wetting has an uncommon propensity to result in quick disintegration (6).

4.5 Drawbacks of Superdisintegrant :

- Unstable for medications that are sensitive to moisture
- Generally hygroscopic .
- Unsuitable for medications that are sensitive to water.
- Certain superdisintegrants are poisonous and irritating (18).

4.6 Classification of Natural and Synthetic Superdisintegrant :

Natural superdisintegrant	Synthetic superdisintegrant
Banana powder	Crospovidone , sodium starch glycolate ,
Soy polysacharide , pectin	Croscarmellose sodium , polyvinyl pyrrolidone ,
Chitin ,Guar gum , mucilage	Crosslinked alginic acid , crosslink cellulose ,
Gum karaya , Isapghula husk .	Methyl cellulose , polyvinyl alcohol ,poloxamer.

Table No. 2 Classification of Natural and Synthetic Superdisintegrant

4.7 Comparative study of Natural Superdisintegrant and synthetic superdisintegrant :

Comparison between natural and synthetic superdisintegrant ,Comparison between both use in formulation maximum quantity apply high hardness so obtain accurate disintegration time ,and Dissolution and superdisintegrant 1st meachanism swelling are perform successfully . but when we use natural superdisintegrant in a large quantity and apply less hardness so obtain accurate and less disintegration time and high dissolution rate as compare to synthetic superdisintegrant so natural superdisintegrant , safe, economical convienient to patient low cost and give better therapeutic effect as compare to synthetic superdisintegrant there is no side effect and disintegrant tablet within seconds. So comparison both natural and synthetic superdisintegrant, natural superdisintegrant is better than synthetic superdisintegrant (3,22).

4.8 Application of Superdisintegrant :

Various kinds of recently identified superdisintegrant excipients are essential to the disintegration mechanism. Many superdisintegrants are on the market, and there is a constant search for additional disintegrating agents. The goal of advancements in the field of rapid disintegrating pill formulation is to improve the performance of dosage forms while also reducing the disintegration time. superdisintegrant like starch 1500,kollidone CL-f, polyplasdone, and superdry, among others superdisintegrant (3).

4.9 Difference between Natural and Synthetic superdisintegrant :

Natural superdisintegrant	Synthetic superdisintegrant
These superdisintegrant agent are natural in origin and are preferred over synthetic substances because they are comparatively cheaper abundantly available nontoxic in nature .	Synthetic superdisintegrant frequently used intablet formulation to improve the rate and extent of tablet disintegration there by increasing the rate of drug dissolution .
Easy availability and cost effectiveness	Effective in lower concentration than starch
Eco-friendly and non –irritant nature	Less -effect on compressibility and flow ability .
Compatible of multitude of chemical modification and biocompatible –compatible due to natural origin	More effective intragranularly.
Example : Gellan Gum ,guar gum , mango peel pectin locust bean gum .	Example :- Croscarmellose sodium , sodium starch glycolate , crosspovidone.

Table No. 3 Difference between Natural and Synthetic superdisintegrant

Example :- Banana powder preparation Technique as a natural superdisintegrant : (30)

Fully mature & Ripe Banana Bunches

↓

Steamed for 10-15 minutes

↓

Peeled and sliced into ½ cubes

↓

Treated with citric acid (2%) and KMS (potassium metabisulfate)

↓

Dried for 10 hour at 60 ^{0}c

↓

Pulverized & sieved through 50 # mesh size

↓

Packed in LDPE bags and stored

↓

Banana powder.

4.10 Method of addition of superdisintegrant :

Sr. no.	Method	Inferences
1.	Extragranular/External addition	Before compression superdisintegrant are added to already prepared granules.
2.	Intragranular/Internal addition	Superdisintegrant are added during granulation
3.	Partially internal and external	A portion of the superdisinegrant is added during the granulation process (internally) and rest is added there after .

Table No. 4 Method of addition of superdisintegrant

5. Technologies Employed in BDT Manufacturing :

Figure 5.1 Conventional Technique

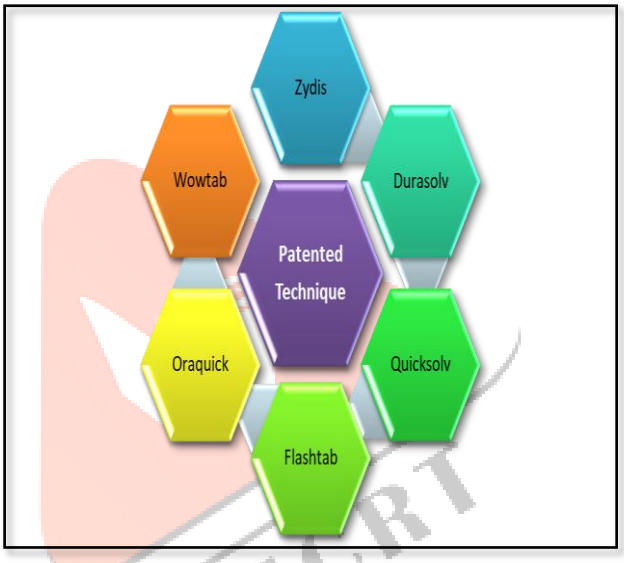


Figure 5.2 Patented Techanique

5.1 Conventional Technique :

5.1.1 Freeze –Drying / Lyophilisation :

Freeze drying is the process in which water is sublimed from the product after it is sublimed from the product after it is frozen . This technique creates an amorphous porous structure that can dissolve rapidly atypical procedure involved in the manufacturing of BDTs using this technique. The freeze drying technique has demonstrated improved absorption and increase bioavailability(13).

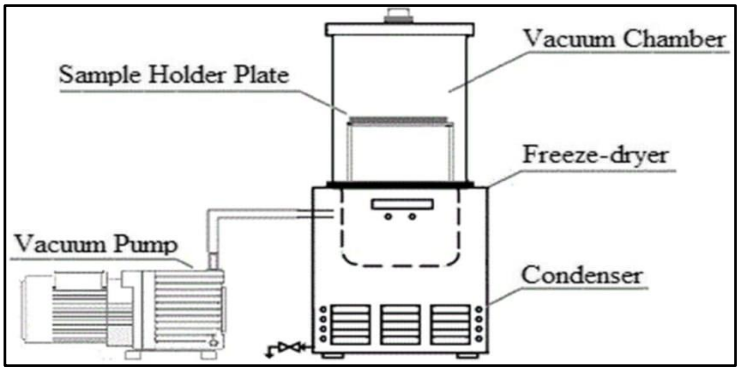


Figure 5.1.1 Freeze Drying / Lyophilisation

5.1.2 Mass Extrusion Technique :

In this technology the active blend is soften using the solvent mixture of water soluble methanol and polyethylene glycol and subsequent expulsion of softened mass through the extruder or syringe to get a cylinder product and is divided into even segment using heated blade to form tablet . The dried cylinder can also be used to coat granules for bitter drugs and can also be used to coat granules for bitter drugs and thereby achieve taste masking (2).

5.1.3 Tablet Moulding Techanique :

Moulding process is of two type i.e. solvent method and heat method . The tablet manufacturing by solvent method are less compact than compressed tablet and passes a porous structure that hasten dissolution (2).
The mechanical strength of moulded tablet is a matter of great concern. Binding agent which improve the mechanical strength of the tablet , need to be incorporated .

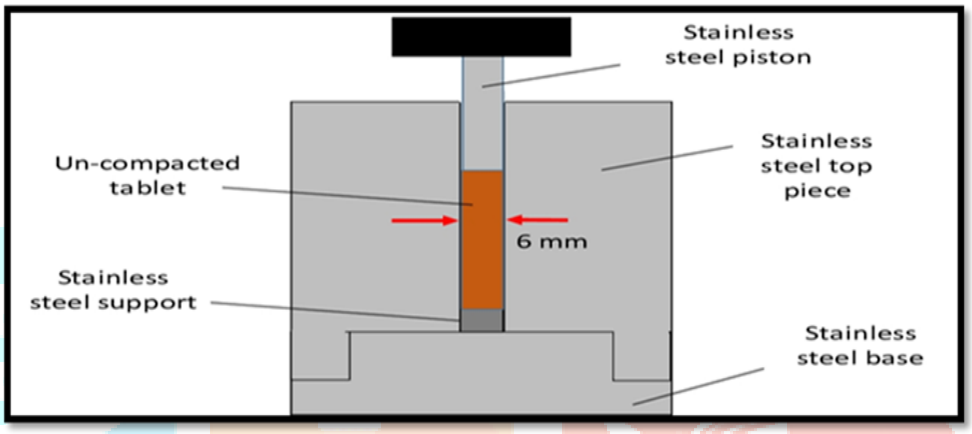
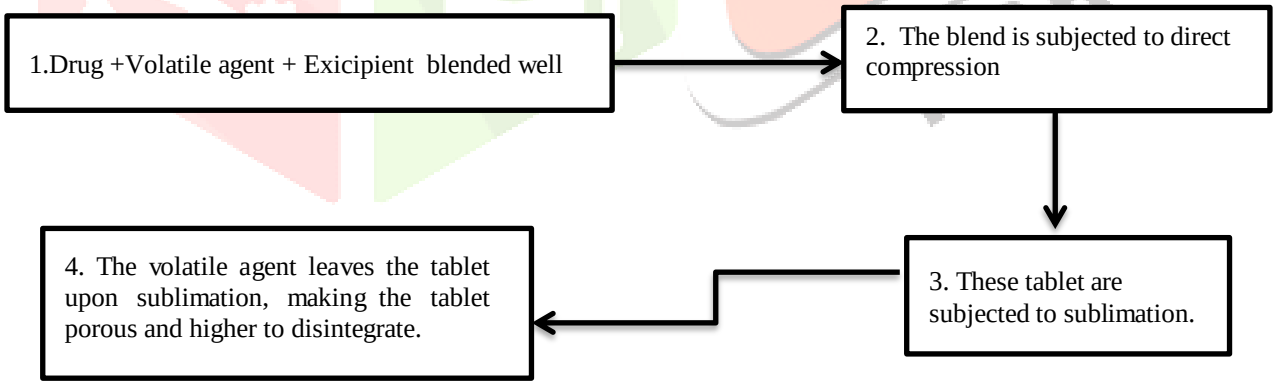


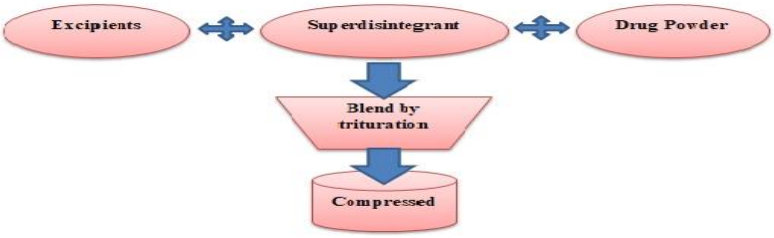
Figure 5.1.3 Tablet Moulding Technique

5.1.4 Sublimation Technique :



5.1.5 Direct Compression Technique :

Direct compression represent the most cost effective and simplest tablet manufacturing technique , Because of the accessibility of improved excipient especially superdisintegrants and sugar based excipient , this technique can now be utilized for preparation of buccal disintegrating tablet (14).



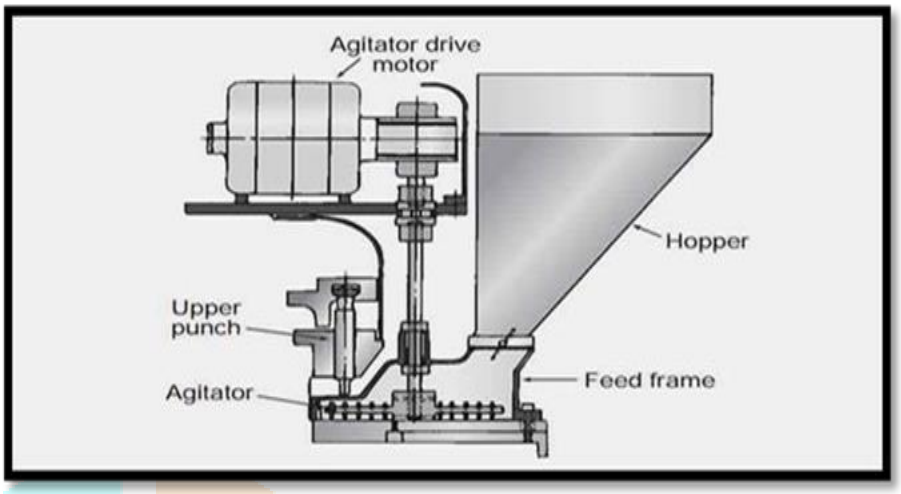


Figure 5.1.5 Direct compression Technique

5.1.6 Melt Granulation Technique :

In this method buccal Disintegrating Tablet prepared by incorporating the drug into hydrophilic waxy binder like PEG-6-stearate , Hydrophilic waxy binder helps as binding and disintegrating agent (13)

5.1.7 Cotton candy process :

Cotton candy process involves the formation of matrix of polyssacharide by simultaneous action of flash melting and spinning .this candy floss matrix is then milled and blended with active ingredient and excipient after recrystallization and subsequently compressed to mouth dissolving tablet (14).

Figure 5.1.7 . Cotton Candy process

5.1.8 Wet granulation Method :

Wet granulation method in which the powder particles mix can be done by the use of granulating liquid .Volatile solvent is used as granulating liquid.
Ex:- ethanol , isopropanol , Gellan Gum ,(used individually or in the combination.)

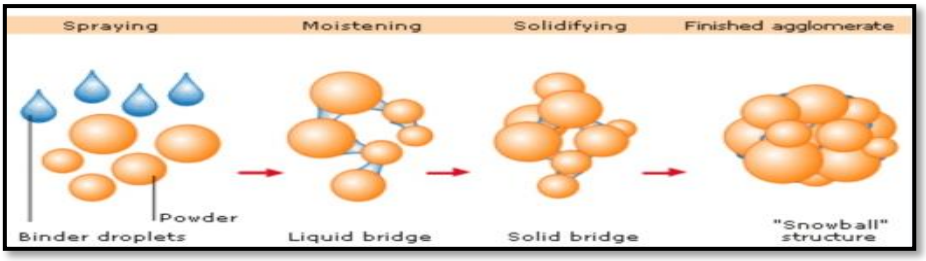


Figure 5.1.8. Wet granulation Method

5.1 Patented Technique :

5.2.1 Zydis Technique :

R.P. Scherer Corporation launched Zydis in 1986. The Zydis method calls for dissolving or suspending the active ingredient in an aqueous solution containing water-soluble additives that create double structures. The liquid is then poured into laminate film blister pockets and freeze-dried in a matter of seconds. Gelatin and mannitol are the two most often utilised structural additions, while other substances, such as starches or gums, may also be utilised based on the characteristics of the active component (2).

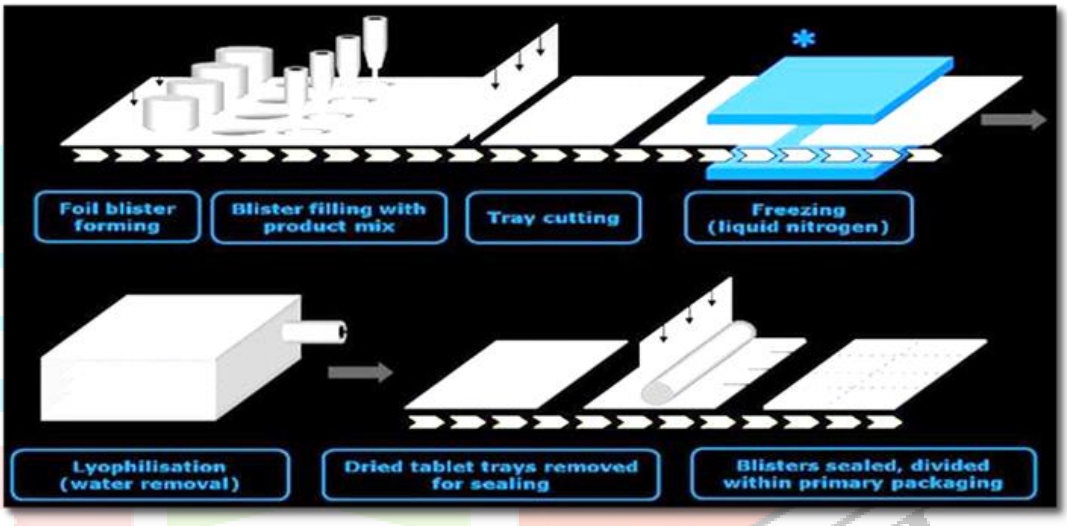


Figure . 5.2.1 Zydis technique

5.2.2 Durosolv Technique :

The second-generation fast dissolving tablet formulation from Cima is called Durasolv. Made similarly to Orasolv, Durasolv is made with a higher compaction pressure during tabletting, which gives it a far stronger mechanical strength than Orasolv. Durasolv tablets have strong stiffness (friability less than 2%), and they are made with standard tableting equipment.As a result, the Durasolv product is made more quickly and affordably (11).

5.2.3 Quicksolv Technique :

Orasolv technology is a product of CIMA labs. The active medication in this method is taste-masked. Additionally, it contains an effervescent disintegrant. To reduce oral dissolution time, tablets are produced using a low compression force direct compression approach. To make the tablet, traditional blenders and tablet presses are employed. The resulting tablets are friable and soft.(2)

5.2.4. Oraquick Technique :

KV Pharmaceutical asserts that its Micro Mask, a taste-masking product, has a better mouthfeel than other products thanks to its microsphere technology. Since the taste masking method uses no solvent of any type, production can be completed more quickly and effectively. Moreover, OraQuick is suitable for medications that are sensitive to heat because its production heat is lower than that of other fast-dissolving or disintegrating technologies (8)

5.2.5 Flashtab Technique :

In this Technique First drug is coated with a eudragit polymer and microencapsulation with an effervescent couple to produce flash dispersal tablet . this technology used both method like , Wet granulation and dry granulation method for the formulation of granules and these granules are compressed into tablet (2).

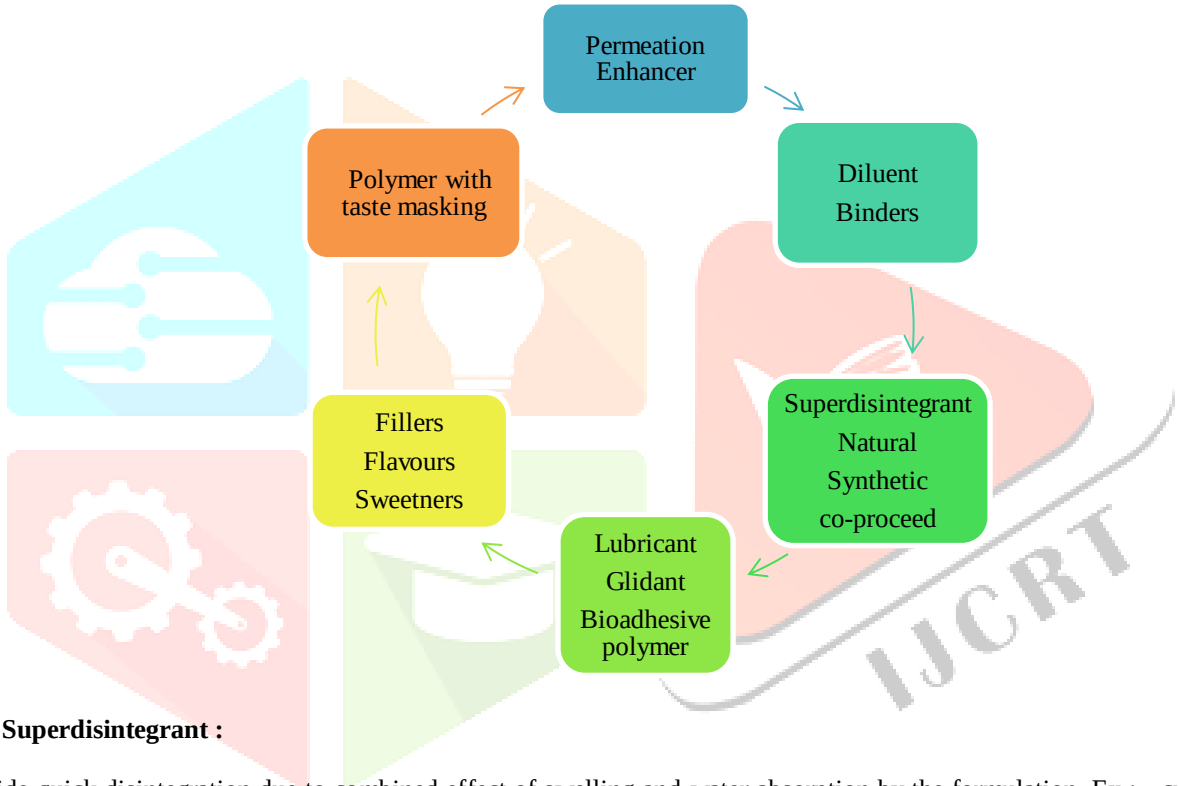
5.2.6 Wowtab Technique :

"Wow , means without water,In this technique two types saccharide are going to be used.In them high mouldability saccharide , and second one is low mouldability saccharide (11).

5.2.7 Quick-Dis Techanique :

Lavipharm labaratories Inc. has invented an ideal intraoral fast –dissolving drug delivery system , which satisfies the unmet needs of the market. The novel intraoral drug delivery system trademarked Quick-Dis is Lavipharm,s proprietary patented technology and is a thin , flexible and quick dissolving film, The film is placed on the top or the floor of the tongue .

6. Ingredient :



6.1 Superdisintegrant :

Provide quick disintegration due to combined effect of swelling and water absorption by the formulation .Ex :- crospovidone , sodium starch glycolate , polyvinypyrrolidone , crosscarmellose sodium , alginic acid , banana powder , guar gum (6)

6.2 Bio-adhesive polymer :

stick to the mucus membrane and dissolve in saliva, and gives rapid absorption and good bioavailability. Ex :- carbopol , gellan gum , HPMC , sodium carboxy methylcellulose , Tragacanth , carrageenam , chitosan , ethylcellulose ,sodium alginate (18).

6.3 Permeation Enhancer :

permeation enhancers are molecules that interact with the constituents of skin's outermost and rate limiting layer stratum corneum increase its permeability .Ex :- Azones , dimethylsulphoxide , pyrrolidones, polyoxyethylene glycols, caprylic acid .

6.4. Lubricant :

It help to reduce friction between surface in mutual contact , which ultimately reduces the heat generated When surfaces Is move . Ex :- Zinc stearate , calcium stearate , talc , Magnesium stearate , liquid paraffin , stearic acid , colloidal silicon dioxide (6)

6.5 Glidant :

Glidants are additive substances that are used to enhance the flowability of a powder by reducing the interparticle friction, surface charge, and cohesion, which in turn decreases the angle of repose. Ex :- Talc, starch, magnesium carbonate, silicon dioxide, calcium silicate, and magnesium oxide (9).

6.6 Diluent :

Diluents are fillers used to increase the bulk of tablets when the drug dosage alone is not enough to providethe necessary tablet bulk. Diluents are typically utilised to facilitate direct compression production, improve cohesiveness, or encourage flow. For instance: Ex : - starch, lactitol, sorbitol, calcium sulphate, mannitol, and calcium carbonate (18).

6.7 Flavours :

It help in masking unpleasant tastes (e.g., bitter or pungent taste) of drugs/excipients and instead improve the quality of their taste. Peppermint flavour, cooling flavour, flavour oils and flavouring aromatic oil, peppermint oil, clove oil, bay oil, anise oil, eucalyptus soil thyme oil, oil of bitter almonds. Flavouring agents include, vanilla, citrus oils, fruit essences (10).

6.8 Sweetners :

To make the tablets more palatable, flavours and sweeteners might be added to conceal their unpleasant taste. In addition to sugar, dextrose, and fructose, non-nutritive sweeteners such sucralose, aspartame, and sodium saccharin are also utilised The formula gains heft and a pleasing taste from the addition of sweets. the addition of sweetners contribute a pleasant taste as well as bulk to the composition(16).

Sr. No	Natural sweetener	Artificial sweetener
1.	Honey, stevia, Molasses, Monk fruit , Maple syrup.	Saccharin , xylitol, sucralose ,aspartame.

Table No. 5 Sweetening agent

6.9 Binders :

It preserves the dose form's integrity. Binders are a substance used to provide the granules cohesion. Ex:-Hydroxypropyl methylcellulose (HPMC),polyvinylpyrrolidone (PVP), and polyvinyl alcohol (PVA)(6).

7. Challenges of Buccal Disintegrating Tablet :

7.1 Hygroscopicity :

Several fast-dissolving dosage form are Hygroscopic and cannot maintain physical integrity under normal condition from humidity which call for specialized product packing(16).

7.2 Friability :

In order to allow fast dissolving tablet to dissolve in mouth , they are made of either very porous soft moulded matrices or compressed into tablet with very low compression force which makes the tablet friable and or brittle which are difficult to handle , often requiring specialized peel off blister packaging , to overcome this problem , some companies introduced more robust forms of buccal disintegrating tablet (8).

7.3 Mouth feel :

Mouth feel is critical and patient should receive a product that feels pleasant. any large particles from disintegrating tablet that are insoluble or slowly soluble in saliva would lead to an unpleasant gritty feeling. This can be overcome by keeping the majority of the particles below the detectable size limit (16).

7.4 Mechanical strength :

In order to allow BDTs to disintegrate in the oral cavity , they are made of either very porous and compressed into tablet with very compression force which makes the tablet friable and / or brittle difficult to handle ,and often requiring specialized peel

off blister packing that may add to the cost. only few technologies can produce tablet that are sufficient hard and durable to allow them to be packed in multi dose bottles , such as Wowtab by, yamanouchi – Shaklee and Durasolv by CIMA labs(28).

7.5 Size of Tablet :

The degree of ease when taking a tablet depend on its size ,it has been reported that the easiest size of tablet to swallow is 5-8 mm while the easiest size to handle was one large than 8mm, Therefore the tablet size that is both easy to take and easy to handle is difficult to achieve (16).

8. Evaluation parameter of Buccal Disintegrating Tablet :

8.1 Physical appearance :

The general appearance and elegance of tablet was identified visually, which include tablet size, shape, color, presence or absence of an odor, taste surface texture and sticking of tablet etc (10).

8.2 Tablet Dimension / Thickness :

The thickness of the tablet was determined by using vernier calipers. Randomly 10 tablet selected were used for determination of thickness that expressed in mean **±SD** and unit is mm (2).

8.3 Hardness :

The hardness of a tablet determine its resistance to shipping , breakage , storage , transportation and handling before use . For each formulation, the hardness of 20 tablets was determined using the Monsanto hardness tester. The tablet was held along its oblong axis in between the two jaws of tester. At this point reading should be Zero kg/cm ^{2} .Then constant force was applied by rotating the knob untilthe tablet fractured. The valued at this point was noted in kg/cm^2 (7).

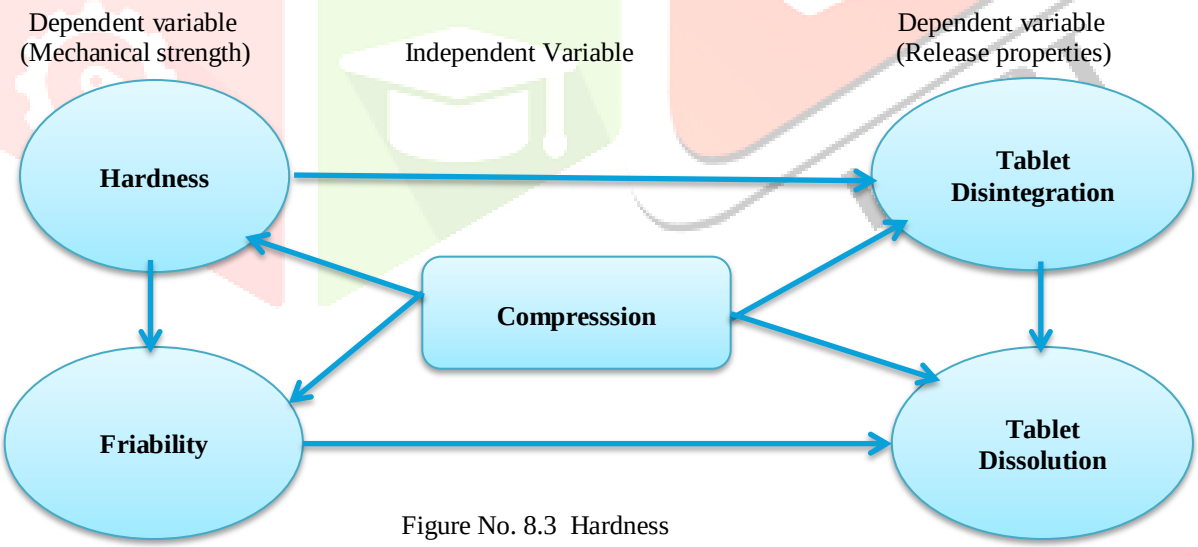


Figure No. 8.3 Hardness

8.4. Friability :

Friability is the loss of weight of tablet in the container due to removal of fine particles from the surface during transportation or handling . Roche friabilator was employed for finding the friability of the tablet. For tablet with an average weight 0.65g or less take a sample of whole tablet corresponding about 6.5 g for tablet with average weight of more than 0.65 g take a sample of 10 whole tablets. Roche friabilator was rotated at 25 rpm for 4 minutes for 100 rounds. A loss of less than 1% weight is generally considered acceptable. percent friability was calculated as follows, (% friability of tablet less than 1% is considered acceptable.) (3,4).

Percent friability % F = Initial weight – Final weight / Initial weight × 100

8.5. Weight variation :

To determine weight variation, 20 tablet of each formulation were individually weighed using an electronic balance, the average weight calculated, and the individual tablet weight was then compared to the average value (2,10,6).

Specification for Tablet as per IP

Average weight of tablet	% deviation
80 mg or less	± 10
More than 80 mg or less than 250 mg	± 7.5
250 or more	± 5

8.6 Drug content :

The tablet from each batch were precisely weighed and powdered. The powdered was weighed and shaken in 100ml of phosphate buffer pH 6.8 in a volumetric flask , and 1ml was pipetted out and diluted up to 10 ml . The resulting solution was filtered and measured at λ max and content was calculated (10).

It was calculated by using formula,

Drug Content = Test Absorbance / Standard Absorbance × 100

8.7 Disintegration Time :

The process of breakdown of a tablet into smaller particles is called as disintegration. The in-vitro disintegration time of a tablet was determined using disintegration test apparatus as per I.P. specifications: It was carried out using an Electrolab disintegration test apparatus place one tablet in each of the 6 tubes of the basket. Add a disc to each tube and run the apparatus using distilled water maintained at 37±2^{0}c as the immersion liquid . The assembly should be raised and lowered between 30 cycles per minutes in the distilled water maintained at 37± 2 ^{0}c .The time in second taken for complete disintegration of the tablet with no palpable mass remaining in the apparatus was measured and recorded. All tablet had disintegrated completely (1,2,7,10).

8.8 Wetting Time & water Absorption Ration:

The wetting time of the tablet can be measure using a simple procedure . Five circular tissue papers of 10cm diameter were placed in a petridish with a 10 cm diameter . 10 ml of water containing water soluble dye was added to the petridish . Tablet was carefully placed on the surface of tissue per in the petridish at room temperature. The time required for water to reach the upper surface of the tablet and completely wet them was noted as the wetting time (13,16,17).

R = Wb -Wa / Wa × 100

Where ,

Wb = weight of a tablet after absorption

Wa = weight of a tablet before absorption

8.9 In – vitro Dissolution studies :

The USP dissolution test apparatus (apparatus II paddle type) was used to study the drug release from the tablet. The dissolution medium was 900ml of phosphate buffer pH 6.8. The release was performed at 37 ±0.5 ^{0}c , with rotation speed 50 rpm . 5ml of sample was withdraw at predetermined time interval and replaced with fresh medium .The samples were analyzed after appropriate dilution by UV spectrophotometer 1800 at λmax (nm) and drug release was determined by following formula (1,2,4,7).

% Drug Release = (Test Abs./ Std. Abs .) × Std . Dilution / Test Dilution × Purity / Label claim

8.10 Stability studies :

Buccal disintegration as instructed by ICH guidelines, tablets are packed appropriately and stored under the following conditions throughout the duration of an expedited study. 40 ± 1℃; 50 ± 1℃; 37 ± 1℃; and relative humidity 75% ± 5% The pills were taken out after 15 days, and the drug content and physical attributes (hardness, friability, disintegrations, etc.) were examined. The gathered data is fitted into first order equations to ascertain the kinetics of degradation. Using the Arrhenius equation, accelerated stability data are displayed in order to determine the shelf life at 25℃ (19).

9. Marketed Products :

Table No. 6. List of commercially available Buccal Disintegrating Tablets (26, 28,30).

Trade Name	Active drug	Manufacturer
Falden Fast melt	Piroxicam	Pfizer Inc , NY, USA
Ugesic	Piroxicam	Mayer organic Ltd
Esulide Md	Nimesulide	Doff Biotech
Kazoldil MD	Nimesulide	Kaizen Drugs
Mosid Md	Mosapride	Torrento Pharma
Valus	Valdecoxib	Glenmark
Vomidon MD	Domperidone	Olcare lab
Claritin redi Tab	Loratidine	Schering plough corp , USA
Maxalt MLT	Rizatriptan	Merck and Co, NJ,USA
Zyprexia	Olanzapine	Eli Lilly Indianapolis, USA
Pepcid RPD	Famotidine	Merck and Co., NJ , USA
Zofran ODT	Ondansetron	Glaxo Wellcome , Middlesex ,UK
Zofer MD	Ondansetron	Sun pharma
Ondem MD	Ondansetron	Alkem pharma
Zoming ZMT	Zolmitriptan	Astrazeneca , USA
Zeplar TM	Selegilline	Amarin Corp , London

Tempra Quiclets	Acetoamionphen	Bristol Mayers squibb, USA
Febrectol	Paracetamol	Prographarma , France
Nimulid MDT	Nimesulide	Panacea Biotech , India
Torrox MT	Rofecoxib	Torrent Pharmaceutical , India
Rofixx md	Rofecoxib	Cipla Itd ,Mumbai , India
Olanex Instab	Olanazapine	Ranbaxy Lab .Ltd , India
Romilast	Montelukast	Ranbaxy Lab , Ltd , India
Zontec MD	Cetrizine	Zosta pharma India
Lonazep MD	Olanazepine	Sun Pharma

CONCLUSION :

Due to insufficient muscle and nervous system development, as well as the possibility of elderly patients experiencing hand tremors or Parkinson's disease, buccal disintegrating tablets have become a popular and generally recognised dose form, particularly for paediatric and geriatric patients. There are now a few solid dose forms, such as tablets and capsules, that have issues with dysphagia (difficulty swallowing), mental disorders, and emesis. These issues lead to a high rate of non-compliance and unsuccessful therapy. For many medications with restrictions such as first-pass metabolism, mental patients, immobile patients, and recalcitrant patients, the oral route and dose form are the most preferable methods of administration break down or dissolve fast in saliva and don't require water. These are genuine Buccal-disintegrating pills, which are made to dissolve in saliva relatively quickly-within a few seconds, or less than (30 second) Super disintegrants are added to BDT formulations to speed up a tablet's disintegration in the buccal cavity. BDTs are a great substitute for older and younger patients because of their simple transportation, precise dosing, superior chemical and physical stability, and easy production. BDTs have a rapid rate of disintegration and absorption, which improves the in vitro drug release time and increases the dosage form's bioavailability. The benefits of both liquid dose form and traditional tablet format are included in BDT formulations. Additionally, patients, individuals with developmental disabilities, and those who are mentally ill may encounter difficulties when utilising traditional oral dosage forms. as well as uncooperative, sick, or on reduced liquid-intake programmes patients. Swallowing regular tablets may be challenging in certain situations, such as motion sickness, abrupt episodes of allergy attack or coughing, and a lack of water, swallowing conventional tablet is my be difficult, so buccal disintegrating tablet is convenience for the paediatric , geriatric and bedridden patient .

ACKNOWLEDGMENT :

The authors are grateful to the Shree Sureshdada Jain Institute of Pharmaceutical Education and Research Jamner (M.S), dist- Jalgaon for providing facilities and assisting us through the process.

REFERENCES :

1. Rani Nisha, Dev Dhruv ,Prasad D.N. A Review on Recent Trend in development superdisintegrants Journal of Drug Delivery and Therapeutics , 2022: 12 (1) 163-169.
2. Dr. Bharat .V. Jain , Miss. Kiran Jijabrao patil , Dr. Sandip .R. Pawar , Mr. Tanveer. Y. Sheikh , To Design and develop Mucoadhesive buccal tablet of vildagliptin , International Journal of creative and Innovative research , 2022 may vol.4 issue 12 , 82-90.
3. Yashkumar Rajiv, Mr. Adarsh Bhadoriya, Dr. pragnesh patani , A Review on polymer use in mouth Dissolving Formulation , Journal of pharmaceutical result , 2022 Volume 13, issue 5, 2579-2586.
4. V. T. Iswariya , Nambaaru Sailaja , CH. Vamsi Krishna, G.S. Annammadevi , Natural Super- Disintegrant Agents Used in Various Oral solid Dosage Forms , Journal of Drug Delivery and Thereapeutics , 2021, 11.(1), 110-113 .
5. Vivek Puri , Ameya Sharma , Paramjot maman , Nishant Rathore, Inderbir Singh , A Review on Overview of Mucoadhesive Biopolymers for Buccal Drug Delivery system , International journal ofapplied Pharmaceutical 2019,

vol 11, issue 6, 21-29.
6. Shailendra singh Narwariya , Suman Jain , Arvind singh Jadon , Manish Soni , A Review on Development and Evaluation of Mouth Dissolving Anti – inflammatory Tablet Containing Fenoprofen**.** American Journal of Pharmatech Research 2019, 9 (02) 248- 267.
7. R. Santosh Kumar, Sahithi Mudilli, A Review on Technologies Employed in Formulation of Mouth Dissolving Tablets **,** Indo American Journal of Pharmaceutical Sciences 2018 , 05 (02), 890-902.
8. Reena Sheoran A Review on Bauccal Drug Delivery System, International Journal of Pharmaceutical Sciences 2018, 50 (01) page .no. 40-46 .
9. Prashant Kumar Singh , Devender Singh and Rohit kumar Bijauliya , A Comprehensive Review on Buccal Drug Delivery System **,** International Journal of Research and Development in pharmacy & Life Sciences, 2018, 6 (3) , 2606 – 2618.
10. Shrutika. M. Gawas , Asish Dev, Ganesh Deshmukh , S. Rathod , A review on Current approaches in buccal drug delivery system , Pharmaceutical and Biological Evaluation **,** 2019 vol (3) , 165-177.
11. Sonia Barua , Hyeongmin Kim, Kanghee Jo , Chang Won Seo , Tae Jun Park , Kyung Bin Lee, Gyiae Yun , Kyungsoo oh , Jaehwi Lee, Drug Delivery technique for Buccal Route , Formulation Strategies and Recent advances in Dosage form design , Journal of Pharmaceutical investigation , 2019, Springer, 2093-3021.
12. Ahmed A. Hussein , Laith .H. Samein , Mowafq .M . Ghareeb , Omar s. Salih , Effect of mucoadhesive polymer combination the properties of lisinpril , Buccal Tablet Prepared By Wet Granulation Method**,** International Journal of Pharmacy and Pharmaceutical sciences , 2018 , vol5, issue 4 , 341-343.
13. Anup kumar roy , Vinod Kumar ,sayed Jalaluddin Basha, Rabiul Haque , Roopa Karki, A Review on Formulation and Evaluation of mucoadhesive Buccal Tablet of Valsartan , International journal of Drug Development and Research , 2018, 5 (4) , 145-155.
14. Surender verma , Mahima Kaul , Aruna Rawat , and Sapna saini , AN Overview on Buccal Drug Delivery System , International Journal of Pharmaceutical Science and research , 2018, vol .2. (6) 1303-1321.
15. Yagmur Akdag , Tugba Gulsun , Nihan Izat, Meltem cetin, Levent Oner, Selma Sahin , Evaluation of preparation method for orally disintegrating tablet, Medicine science international medical journal , 2020, 9, (1): 259-63.
16. Md. Sadique Hussain , Mohit , A Brief Review on Buccal Drug Delivery System Advantages,Limitation and Impact on Health care system , International Journal of Pharmaceutical Science **,** 2021, Vol 10, issue 5, 558-575.
17. Dr. Darsh Gautam, Mrs Poonam Talwan , A Review on Formulation Aspect and manufacturing technology , A Review on Fast Disintegrating Tablet, Annual peer-reviewed academic journal published by Swedish society, Vol22, 2023, (01) jan,1265-1278.
18. Y. Madhusudan Rao , A.V.Jithan, Advance in Drug Delivery ,Volume II, press Pub.Ltd, 103-207.
19. Akshay .M . Akotakar , Ashwini . A. Zanken , Ananta.B. Ghonge , " Formulation and Evaluation of Buccal Disintegrating Tablet of Anticonvulsant Drug, " Asian Journal of Review in Pharmaceutical Sciences , 2022, 12 (2) , 123-127.
20. Naveen Sahu , Shikha Singh , Dr.R. B. Goswami, " Formulation and Evaluation of Mucoadhesive Buccal Tablet Diltiazem Hydrochloride , Indo American Journal of Pharmaceutical Sciences , 2022, 09, (02) , 141-147.
21. Akshay .M . Akotakar , Ashwini . A. Zanken , Ananta.B. Ghonge , " Formulation and Evaluation of Buccal Disintegrating Tablet of Anticonvulsant Drug, " Asian Journal of Review in Pharmaceutical Sciences , 2022, 12 (2) , 123-127
22. Naveen Sahu , Shikha Singh , Dr.R. B. Goswami, " Formulation and Evaluation of Mucoadhesive Buccal Tablet Diltiazem Hydrochloride , Indo American Journal of Pharmaceutical Sciences , 2022, 09, (02) , 141-147.
23. Mais Fidel Mohammed, Zainab Ahmed Sadeq, Omar Saeb salih, Formulation and Evaluation of Mucoadhesive Buccal tablet of Anastrozole ," Journal of Advanced Pharmacy Education & Research , 2022, 12 (2) , 38-44.
24. Kumara Swamy Samanthula, Mahendra Kumar CB, Agaiah Goud Bairi, Shoba Rani Satla, Development ,In-Vitro and Ex-Vivo, Evaluation of Muco- Adhesive Buccal Tablet of Hydralazine Hydrochloride, **"** Brazilian Journal of Pharmaceutical Sciences , 2022 ;58 , 1-13.
25. Akula Ramesh, Jagadish Purale Channa basavaish, Vinay Jhawar, Proneel Das, Prajakta Patil, Srinivas Mutalik , Mraviroc Oral Disintegration Tablet Analytical Design of Experiments (DOE) For Assessment and Comparison of In Vitro Dissolution Profiles, " Current Pharmaceutical Analysis ,2022, 18, 427-436.
26. R. Joan Vijetha, K. Balamurugan ," Formulation and InVitro, In Vivo Evaluation of Mucoadhesive Buccal Tablet of Felodipine, " Asian Journal of Pharmaceutics , 2021,15 (4), 462-468.
27. Sandip R Pawar, Anil S Mahajan , Md . Usman, Tanvir Y Shaikh, Bharat .V.Jain , Development and Evalution of Oral Fast Disintegrating Tablet of Warfarin Prepared by Wet Granulation Technique, ' International Journal of Pharmaceutical Science Review ,Research . 2020, Article No 23. 156-160.
28. M. Maheshwar, " Phytochemical Screening and TLC Fingerprinting Formulation and Evaluation of Fast Disintegrating Tablet of Fenofibrate, **"** Indo American Journal of Pharmaceutical Sciences , 2018 .05, (01), 318-325.
29. Bhupendra G. Prajapati , Dipesh V. Patel , Formulation and Optimization of Domperidone Fast DissolvingTablet by Wet Granulation Techanique using Factorial design , **'** International Journal of Pharma Tech Research , 2020, Vol2, 292-299.
30. O. Esim , A. Savaser, C.K. Ozkan , Z.Bayrak , C. Tas, Y. Ozkan , " Effect of Polymer type on Chracteristicof buccal tablet using factorial design ," Saudi Pharmaceutical Journal **,** 2018 , 53-63.

IJCRT