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BRIEF REVIEW: "ORAL TABLET USING NATURAL AND SYNTHETIC SUPERDISINTEGRANTS"

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ABSTRACT:
Dissolving tablets is a necessary step for rapid medication release. Drug formulations that include disintegrants substances or combinations of substances increase the dispersion or tablets and capsules are broken down into tiny bits to make them dissolve more quickly. Tablets that dissolve quickly and dissolve in the mouth without the need for water are known as fast dissolving, fast melting, chewable, orally dissolving, or disintegrating tablets. Due to their strong consumer appeal and higher user compliance, these items are able to endure in the marketplace. Creating tablet formulations with quick disintegration, a pleasing mouthfeel, and a strong breaking force for tablet robustness is the primary difficulty with orally dissolving tablets. The disintegration of dosage forms is dependent on a number of physical factors, including the ratio of super disintegrants to disintegrants, the hardness of the tablets, the presence of surfactants, compatibility with other excipients, many sorts of drug substances, combining, and additives. In addition to enzymatic reaction, swelling, porosity, capillary action (wicking), deformation, disintegrating particle/particle repulsion forces, heat of wetting, gas release, and combination action, other mechanisms that result in tablet disintegration include. The Super disintegrants are a group of more modern substances that have been created in recent years. To create effective mouth-dissolving tablets and get around the drawbacks of traditional tablet dosage forms, a variety of super disintegrant categories—including synthetic, semi-synthetic, natural, and co-processed blends have been used. The goal of this article is to describe the many types of super disintegrants and their functions in drug release and tablet disintegration.

KEYWORDS: Super disintegrant, Synthetic, co-processed, Oral Tablet.

INTRODUCTION:

Oral delivery of medications is more common. The great majority of medications taken orally are ingested, however some are meant to dissolve in the mouth. The oral route of medication administration is the most often used and has been effectively employed for traditional drug delivery when compared to other routes. It is regarded as the most affordable, low-tech, safe, easy, and natural way to deliver medications. It also offers more design options for dose forms and is simple to produce [1].

A range of pharmacological dose forms are used to give drugs orally. Tablets, capsules, suspensions, and different pharmaceutical solutions are the most often used. Solid dose forms are the most popular type of product among those that are taken orally. They are easy to make, store, handle, and use. They are also adaptable in terms of dosage strength, reasonably stable, and pose less formulation and packaging issues. The medicine is best protected from light, temperature, humidity, oxygen, and stress during transit when it is in a solid dosage form. Tablets are one of the most used solid oral dose forms [1]. The simplicity of administration, patient acceptance, precise dosage, economical production process, and generally longer product shelf life are the reasons for the oral route's popularity.
There are various methods of using tablets, capsules, pills, and liquids as drug carriers in conventional drug delivery systems. Solid formulations are the least expensive to produce among them because they don't need sterile conditions [2].

However, some elderly patients find that traditional tablets and capsules are inconvenient or unfeasible due to a variety of physiological and neurological conditions associated with aging, such as hand tremors, difficulty swallowing, deterioration in vision, hearing, and memory, as well as taste and smell alterations, along with an elevated risk of drowning. Patients who are children, intellectually impaired, uncooperative, nauseous, or following decreased liquid intake diets may find it challenging to swallow solid dosage forms [3,4].

Additionally, individuals who are traveling and do not have immediate access to water find that standard oral pills or capsules are not very helpful [5].

Thus, new developments in innovative drug delivery methods have led to the creation of fast dissolving tablets (FDTs), an easy way to provide a dose form and to improve patient compliance. FDT is a solid unit dosage form that contains a medication that dissolves quickly in the mouth when it comes into contact with saliva, eliminating the need for chewing or water. The absorption and commencement of therapeutic effects occur more quickly when the medicine is in solution form. As saliva travels down to the stomach, certain medications are absorbed through the mouth, throat, and esophagus. Some pregastric medication absorption may avoid the stomach's acids and enzymes as well as the digestive system [6,7].

Disintegration is essential to a tablet's dissolution before the active drug ingredient is released from the tablet's structure into the body, so the kind, concentration, and effectiveness of disintegrants have a big influence on the disintegrant properties (like the duration of disintegration [DT] and the ratio of crushing strength-friability to disintegration time [CSFR/DT]) of formulated tablets [8]. When administered, the mouth-dissolving solid dose form transforms into a soft paste or liquid. The necessary disintegrants, can be added to a dosage form to provide this kind of characteristic. When disintegrants are added to fast-dissolving tablets, the tablets dissolve more quickly and dissolve better[9].

Since these agents are readily available and the direct compression procedure is straightforward, using them instead of more complex and patented methods to prepare ODT would likely be more profitable[10]. Researchers are currently searching for innovative, safe, and efficient disintegrating agents that can break up tablets quickly, even when they weigh more than 3.5 kg. After analyzing the patterns of disintegration time in the cavity of the mouth and wetting time by surfaces free energy, we discovered that a molecule should have a large polar component of surface free energy for a quicker wetting. Super disintegrants are agents that meet these particular parameters [11].

1. **Salient features of ODTs [3,12-15]:**
   In addition to offering additional benefits over both standard dosage forms, Oral Disintegration Tablet combine the benefits of both liquid and regular tablet formulations. It consists of:

SALIENT FEATURES OF ODTs	DISCREPTION
Fast action:	The tablet dissolves and absorbs in the oral cavity quickly, resulting in a speedy start to the therapeutic effect. As a result, it helps with things like motion sickness, unexpected allergic reactions, and coughing.
Precise dosage	For patients of all ages, this unit solid dosage form is an excellent alternative since it allows for maximum medication loading and provides the luxury of exact dosing.
Increased bioavailability	Drugs that are absorbed pregastrically have higher bioavailability and, as a result of lower dosages, better clinical outcomes.
Patient adherence	It is possible to consume the dose form without water. It is therefore useful for patients who are constantly on the road and for people who are busy and do not have immediate access to water.
Administration ease	Especially for elderly, pediatric, mentally challenged, and obstinate individuals who have trouble swallowing, this medication is easy to deliver.
Obstruction-free	This improves safety and compliance As there is little possibility that physical restriction during swallowing may produce hypoxia in the airways.
Better palatability	The taste masking approach is utilized to prevent the bitter taste of the medicine, and it leaves little to no residue in the tongue, resulting in a pleasant mouthfeel.
Strong stability	Less sensitivity to environmental factors contributes to its strong stability.

Easy packaging	Push-through blisters are one option for packaging. Therefore, special packaging is not required.
Versatile technology	Because of its versatility, this technology can be used to create improved veterinary, over-the-counter, and prescription medication goods.

table no. 1: salient features of odts

2. THE NECESSITY OF DEVELOPING FDTS:

2.1 Patient factors [16,17]: Patients who are unable to swallow conventional tablets and capsules with an 8-ounce glass of water, especially those who are young or elderly, can benefit from fast-dissolving dose forms. These consist of the following:

- those who have trouble chewing or swallowing solid medication forms.
- patients' refusal to comply because they are afraid of choking.
- severe depression in elderly people who might not be able to stomach the solid dose forms.
- A patient with allergies who is eight years old wants a dosage form that is easier to use than antihistamine syrup.
- An older patient having radiation treatment for breast cancer may have nausea and be unable to take their H2-blocker.
- A patient with schizophrenia may try to hide an ordinary pill under their tongue to avoid taking their prescribed dosage of an atypical antipsychotic.

2.2 Efficiency factor: The dissolved medicine is absorbed in the stomach, throat, and buccal regions, but it can also be absorbed in the oral cavity by dispersion in saliva.

Pre-gastric absorption increases bioavailability by avoiding first-pass hepatic metabolism. Additionally, medications with a high percentage of absorption in the oral cavity and pre-gastric regions of the GIT, as well as those that generate large amounts of toxic metabolites during first-pass liver metabolism along with stomach metabolism, might have enhanced safety profiles.

2.3 Manufacturing and marketing factors: Pharmaceutical producers frequently create a new and enhanced dosage form of a medicine after its patent expires. A novel dosage form gives a company the opportunity to enhance market exclusivity, unique product differentiation, value-added product line expansion, and patent protection in addition to providing a more pleasant dosage form for its patient base. This target underrepresented and undertreated patient populations while simultaneously increasing revenue. For instance, Eisai Inc. introduced Aricept FDT.

3. Formulation Processes for Making Fast-Dissolving Tablets[18,19]:

Orally disintegrating tablets can be developed using a variety of techniques and methods, and the resulting ODTs have a range of characteristics, including:

1. The tablets' mechanical strength
2. Mouthfeel and taste
3. The capacity to swallow
4. Salivary drug dissolution
5. Bioavailability
6. Consistency/ Stability

ODTs are created using a variety of processes, including freeze-drying, direct compression, the cotton candy process, molding, spray drying, sublimation, mass extrusion, nanonization, compaction, and fast-dissolving films. Direct compression is the simplest and most cost-effective way of making tabletsThis method may currently be used to create ODT due to the availability of better excipients, particularly superdisintegrants and sugar-based excipients.

4. Superdisintegrants:

When placed in a fluid environment, disintegrating agents—substances commonly employed in tablet formulations—help break apart the compacted mass into the main particles, enabling the active ingredients to dissolve or release. They support the tablet matrix's dispersion and penetration of moisture. Disintegrants' primary purpose is to counteract the tablet binder's effectiveness and the physical forces that give the tablet structure when it is compressed. To enhance the disintegration processes, new substances known as "superdisintegrants" have recently been produced [20,21].
A superdisintegrant is another form of super-absorbing chemical that has specific swelling properties. These materials are designed to swell fast, rather than absorb significant amounts of water or aqueous fluids. They are physically distributed throughout the dosage form's matrix and will enlarge upon exposure to a moist environment [22].

4.1 Superdisintegrants Mechanism of Action:

Mechanisms for tablet disintegration are as follows:

4.1.1 Swelling:

When disintegrating chemicals like starch produce tablet disintegration, swelling is the general mechanism of action. Dosage formulations quickly bloat and disintegrate when they come into touch with water. For instance, sodium starch glycolate Because they don't have enough swelling power, tablets with high porosity disintegrate poorly, whereas tablets with low porosity exert enough swelling force. A very high packing fraction slows down the disintegration of the pill by preventing liquids from penetrating [23-26].

4.1.2 Porosity and Capillary Action (Wicking):

The initial step is disintegration by capillary action. Tablet porosity allows fluid to enter tablets and replaces air that has been adsorbed on the particles, weakening the intermolecular link and causing the tablet to shatter into tiny pieces. Maintaining a porous structure and low interfacial tension towards aqueous fluid are essential for these kinds of disintegrants because they aid in disintegration by forming a hydrophilic network surrounding the drug particles. For instance, crospovidone and croscarmellose sodium [24-26].

4.1.3 Deformation:

Disintegrated particles undergo deformation during tablet compression, and when coming into touch with aqueous fluid, these distorted particles return to their original shape. The elasticity of the disintegrant is distorted to plasticity with energy-rich potential due to high compaction force. Tablet disintegration will result from the energy potential of the deformed starch grain being activated after exposure to an aqueous environment. The swelling capacity of starch was improved when granules were substantially distorted during compression [24-25].

4.1.4 Through an Enzymatic Process:

The body's own enzymes also function as disintegrants, reducing the binder's binding activity and promoting disintegration. Swelling causes pressure to be exerted externally, which breaks the tablet or causes water to be absorbed, increasing the number of granules and encouraging disintegration [27].

4.1.5 Repulsive Forces of Particles

To explain why tablet carrying non-swellable disintegrants swell, this disintegration mechanism has also been postulated. The particle-particle repulsion hypothesis of Guyot-Hermann states that water enters the tablet through hydrophilic pores, creating a continuous network of starch that may carry water from one particle to another, leading to significant hydrostatic pressure. Due to its affinity to starch surfaces, water then seeps between the grains of starch, breaking hydrogen bonds and other components that hold the tablet together. Water is necessary for the disintegration mechanism, which is based on electric repulsive interactions between particles.

4.1.6 Heat from the wetness:

Tablet disintegration results from localized tension created by capillary air expansion when exothermic disintegrants are wetted. It is unable to explain the mechanism of more recent disintegrating agents and only discusses a small number of disintegrant kinds.

4.1.7 As a result of Gas releases:

Carbon dioxide is produced when tablets are moistened because bicarbonate and carbonate react with tartaric or citric acids. The pressure within the tablet causes it to dissolve. The composition of fast-dissolving or fast-disintegrating tablets uses this volatile combination. Strict environmental control is crucial during tablet manufacturing since these disintegrants are particularly sensitive

to even little changes in temperature and humidity. Either the effervescent mixture is injected right before compression, or it may be administered in two separate formulation portions [28].

4.1.8 Combination Action:

In this type of mechanism of action, the combination of both wicking and swelling action facilitate disintegration. E.g. Crospovidone

4.2 Superdisintegrants Selection :

At large dosages, superdisintegrants can significantly alter the hardness, friability, and mouthfeel of tablets in addition to their primary effect on the rate of disintegration. As a result, a variety of parameters must be addressed when selecting superdisintegrants for a certain formulation [22,29]. It should:

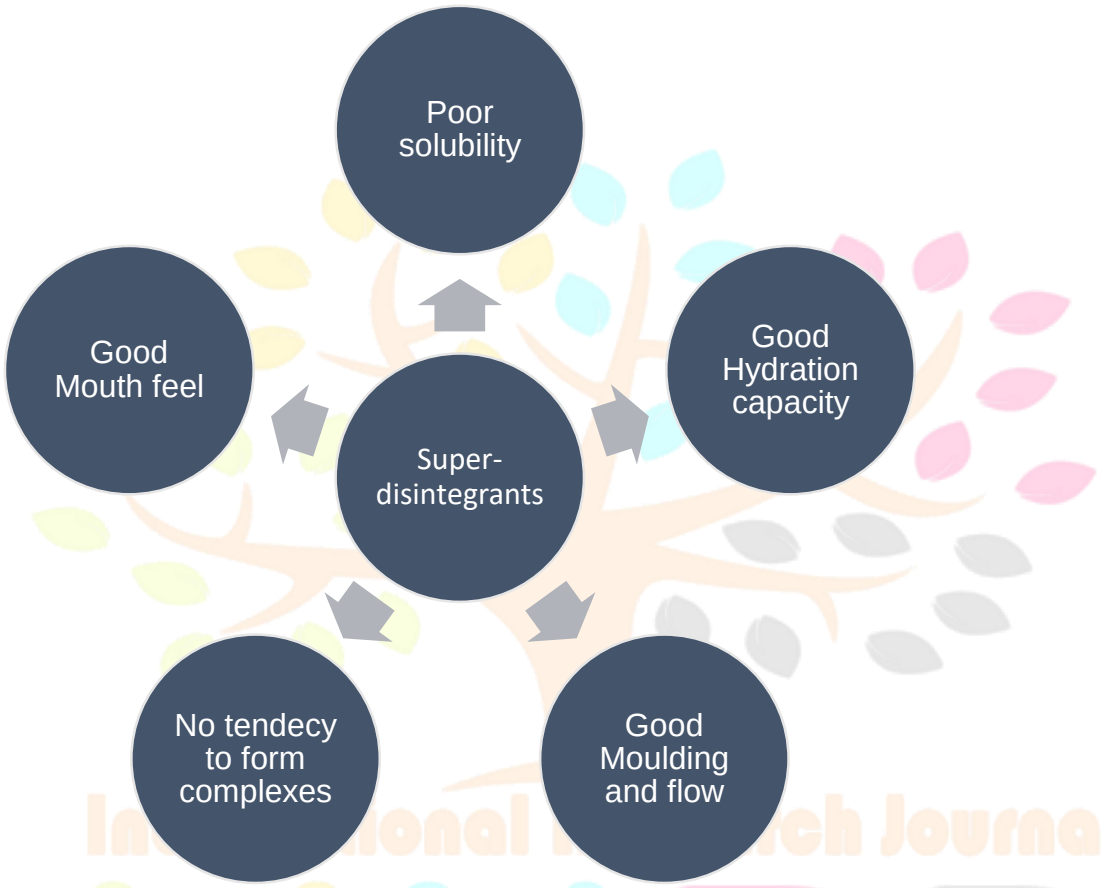

fig: superdisintegrants selection

4.3 Different Types of Superdisintegrants:

The Superdisintegrants are classified into following two categories:

1. Natural Superdisintegrants

2. Synthetic Superdisintegrants.

3. Co proceesed

4.3.1 Natural Superdisintegrants:

Many studies have looked at the suitability of some of the plant-based substances as pharmaceutical superdisintegrants. Today, there are many different types of plant-based pharmaceutical excipients [30]. Because they are readily available, affordable, environmentally friendly, emollient, non-irritating, non-toxic, robust against a variety of chemical changes, degradable, and compatible due to their natural origin, natural materials like gums and mucilages have been used in drug delivery systems. A number of mucilages and gums have good superdisintegrating properties[31].

- **Benefits:**
  - •Affordable in comparison to synthetic and renewable sources.
  - •Eco-friendly and bio-acceptable.
  - • Locally accessible.

a. Cress Mucilage (Lepidium sativum) :

Lepidium sativum (family: Cruciferae) is also known as asaliyo and is a popular medicinal plant in India. Its components include leaves, roots, oil, and seeds. Mucilage is prevalent in seeds, which also include two new monomeric imidazole alkaloids, lepidinoside A and B, and the dimeric imidazole alkaloids, lepidine B, C, D, E, and F. Mucilage from this plant exhibits swelling qualities such as binding, dissolving, and gelling efficiency [32]. Mucilage is identified as a brownish white powder that decomposes beyond 200oC and emits a distinct odor. After examining its different physicochemical features, the values of swelling index, angle of repose, bulk density, and tapped density are calculated to be 18, 32oC, 0.58g/cc, and 0.69g/cc correspondingly. [33].

b. Hibiscus rosa-sinensis Linn. Mucilage:

The shoe flower plant, China rose, or Chinese hibiscus are other names for Hibiscus Rosa-Sinensis Linn (Malvaceae). Its mucilage has good superdisintegrating properties. Cyclopropanoids, methyl sterculate, methyl-2-hydroxysterculate, 2-hydroxysterculate malvate, and β-rosasterol are all found in the plant. L-rhamnose, D-galactose, D-galactouronic acid, and D-glucuronic acid are all found in Hibiscus rosa-sinensis mucilage. Approximately 17% of the output is mucilage.

c. Gum Karaya (Sterculia Urens):

Karaya contains natural gum exudates from Sterculiaurens, a member of the sterculiacea family. It has chemical constituent like13% D-galactose and 15 percent L-rhamnose. It absorbs water and swells to 60-100 times their original volume. The high viscosity nature of gum limits its uses as binder and disintegrant in the development of conventional dosage form [34,35].

d. Locust Bean gum (Ceretonia siliqua):

The endosperm of the carob tree Ceretonia siliqua's (Fabaceae) seeds is used to make locust bean gum. It contains polysaccharides like as starch and cellulose, The mannose to galactose ratio of locust bean gum is greater than in guar gum, and its qualities differ from those of guar gum. um. It binds and disintegrates at varied concentrations and is employed in a variety of new medication delivery methods. It is used in the food industry as a gelling and thickening agent, with bioadhesive and solubility-enhancing effects. Reports indicated that the locust bean gum may be utilized for pharmacological and biotechnological purposes [36,37].

e. Fenugreek Seed Mucilage:

Fenugreek, also known as Trigonella Foenum graceum (family Leguminosae), is a herbaceous plant belonging to the leguminous family. It is used as a culinary ingredient, as well as a traditional medicinal. Colic, flatulence, diarrhea, dyspepsia with lack of appetite, persistent cough, dropsy, splenic and hepatic enlargement, rickets, gout, diabetes, gastroprotection, anti-urolithiatic, diuretic, antidandruff, anti-inflammatory, and antioxidant are among the conditions that fenugreek is used to treat. It can be used as a disintegrant in formulations for mouth-dissolving tablets due to its high mucilage concentration. The off-white to cream-yellow amorphous powder known as mucilage quickly dissolves in warm water to form a viscous colloidal solution.

f. Isapghula Husk Mucilage (Plantago ovata):

The dried seeds of the plantago ovata are used to make isapghula husk. The epidermis of the plant's seeds contains mucilage. It possesses binding, dissolving, and sustaining characteristics. Mucilage has a higher swelling index (89±2.2%v/v) than other superdisintegrating agents, making it suitable for quick dissolving tablets. [38].

g. Guar Gum:

A naturally occurring extract from guar seeds, guar gum contains roughly 80% galactomannan (guaran), 10% moisture, 5-7% protein, and trace levels of ash and heavy metals. It is a neutral, free-flowing polymer that is totally soluble and authorized for use in food. It is insensitive to changes in pH, moisture content, or tablet matrix solubility. In alkaline tablets, it is not usually pure white and can occasionally range in hue from off-white to tan. It also has a tendency to discolor with time. Guar gum has been discovered to be a better disintegrant than certain common ones, including magnesium aluminum silicate, celluloses, alginates, and maize starch.

Disintegration can be influenced by particle size; finer particles are better at disintegrating. Under the trade name Jaguar, it is sold in the market[39,40].

h. Chitin and Chitosan:

Crab and shrimp shells include chitin (β-(1→4)-N-acetyl-D-glucosamine), a naturally occurring polymer. Deacetylation of chitin yields the natural polymer chitosan. Because of its good superdisintegrant properties, chitosan is utilized to make tablets that dissolve quickly in the mouth. When chitosan comes into contact with aqueous fluids, it absorbs water and bursts because of the pressure from capillary action. This causes the dosage form to disintegrate quickly, forming a uniform dispersion[42].

i. Agar:

Gelidium amansii (Gelidanceae) and many other red algae species, such as Gracilaria (Gracilariaceae) and Pterocadia (Gelidaceae), are the sources of agar, a dried gelatinous substance. It is yellowish gray or white to nearly colorless, odorless, and has a mucilaginous taste. Agarose gives agar solutions their gel strength, while agaropectin gives them their viscosity. Because of its high gel strength, agar is a potential disintegrant [41].

j. Indian laburnum / Cassia Fistula Gum:

The seeds of the Cassia fistula tree (family: Caesalpiniaceae) are used to make Cassia fistula gum. With a random distribution of α (1 6) connected d-galactopyranose units as a side chain and a mannose:galactose ratio of 3, it is composed of β-(1 4) linked d-mannopyranose units. Compared to native gum, cassia fistula gum that has undergone carboxymethylation and carbamoylethylation is said to have improved viscosity, microbiological resistance, and cold water solubility. The use of calcium or sodium salts of carbamoylethylated or carboxymethylated cassia fistula gum as a superdisintegrant in the formulation of rapidly dissolving tablets has been documented in a number of investigations [43].

k. Alginates:

Alginates are hydrophilic colloidal compounds that are either chemically modified from natural sources, such as alginic acid or salt of alginic acid, or isolated from species of kelp. They have a good dissolving action and a stronger propensity for absorbing water. They are utilized in the formulation of multivitamins and ascorbic acid.

l. Soy Polysaccharide (Dolichos soja):

Soy beans include a class of high molecular mass polysaccharides called soy polysaccharides. It can be utilized in nutritious products because it is a natural superdisintegrant and doesn't include sugar or starch. It is rated as a disintegrant in tablets that are manufactured by direct compression with lactose and dicalcium phosphate dihydrate as fillers. [40] In direct compression formulations, soy polysaccharide functions well as a disintegrating agent and produces outcomes comparable to those of cross-linked carboxymethyl cellulose [44].

m. Gum Xanthan:

Xanthan gum, a USP with a low inclination to gel and a high hydrophilicity, is derived from Xanthomonas campestris. Its poor water solubility and high swelling properties cause it to dissolve rapidly.

n. Cucurbita maxima Pulp Powder:

After washing the fruits of Cucurbita maxima with water to remove dust, the skin was taken off. After removing the seeds, the pulp was combined with a very viscous liquid, lyophilized to create a solid, porous mass that had shrunk in size, then filtered through an 80# filter and stored. According to the study, cucurbita maxima pulp powder functions as a disintegrant and shows similar dissolving, hardness, and friability behavior to sodium starch glycolate, enabling the creation of possible rapidly disintegrating tablets possible [45].

o. Mango Peel Pectin:

Dried mango peel powder is used to extract pectin. Because of its high swelling index and potent solubility in biological fluids, mango peel pectin can be used to make rapidly dissolving tablets.

4.3.2 Synthetic Superdisintegrants

Synthetic super-disintegrants are widely employed in formulation of tablets to increase the pace and extent of tablet disintegration, resulting in faster medication dispersion. The most common synthetic superdisintegrants are depicted here.

- **Benefits of synthetic superdisintegrants** :
  - More effective at low concentrations than starch.
  - Have little impact on flow ability and compressibility.
  - Greater intragranular efficacy.

➢ **Limitations:**

- More hygroscopic (perhaps a concern with moisture-sensitive drugs)
- Some are anionic and may cause minor in vitro interaction with cationic drugs (not a concern in vivo) [56].
- An acidic medium considerably lowers the liquid absorption rate and capacity of sodium starch glycolate, croscarmellose sodium, but not crospovidone [57,58].
- The swelling of Primojel1 (sodium starch glycolate) and Polyplasdone XL101 (crospovidone) is reduced after wet granulation formulation. Finally, the medium ionic strength was discovered to have a negative influence on the swelling ability of croscarmellose [59,60].

a. Microcrystalline Cellulose (Avicel):

At concentrations less than 10%, Avicel disintegrates rapidly. This method relies on the introduction of water molecules into the tablet matrix via capillary holes, which weakens the hydrogen bonding between neighboring bundles of cellulose microcrystals. Because to quick capillary absorption and tablet surface drying, higher doses may make it stick to the tongue. When paired with starch, microcrystalline cellulose's rapid water wicking rate might make it an effective and fast disintegrant [46,47].

b. Cross-linked polyvinyl Pyrrolidone (Crospovidone):

Crospovidone employs both swelling and wicking to disintegrate, in contrast to other superdisintegrants that mostly rely on swelling. Crospovidone's high crosslink density allows it to expand quickly in water without gelling. It is found that crospovidone particles are granular and very porous, which allows fluids to seep into the tablet and accelerate breakdown [48]. Crospovidone also used as solubility enhancer and it is available in two particle sizes in the form of Polyplasdone XL and Polyplasdone XL-10.

c. Sodium Starch Glycolate:

These are modified starches made by cross-linking potato starch, and they have good disintegration capabilities. The degree of cross-linking and substitution is critical for the superdisintegrating effect [49,50].

Cross linking reduces both the polymer's water soluble fraction as well as the viscosity of dispersion into water. Pre-dried natural starches swell 10–20% in water, but modified starches increase in volume by 200–300%. This action occurs by quick water absorption, which causes a significant rise in the volume of granules, resulting in rapid as well as uniform disintegration. Explotab and Primogel are low-substituted carboxymethyl starches [42].

d. Croscarmellose Sodium:

It is a sodium carboxymethyl cellulose polymer with internal crosslinks [48].

Croscarmellose particles have wicking properties due to their fibrous structure [51]. It is possible to use both wet granulation and direct compression techniques to include croscarmellose sodium into tablet formulations. When used in wet-granulation, the croscarmellose sodium has to be added during both the wet and dry phases of fermentation, in order to effectively use the disintegrant's wicking and swelling capacity [51,52].

e. Resins:

Despite being insoluble, resins function as disintegrants because of their strong affinity for water. Furthermore, because their particles are tiny, they swell quickly, making them superdisintegrant. They, like traditional disintegrants, do not lump and provide robustness to the pills. Ion exchange resins' physicochemical stability, benign nature, uniform size, spherical shape that facilitates coating, and equilibrium-driven reproducible drug release in an ionic environment have all contributed to their increased application in drug delivery systems. Insoluble polymers having basic or acidic functional groups that have the ability to exchange counter-ions with the surrounding aqueous solutions are known as ion exchange resins [53]. In the gastrointestinal system, the proper charged ions release the drug molecules that are affixed to the resins, followed by diffusion of free drug molecules out of the resins as shown below,

Resin - Drug + +X+.....> Resin -.....X+ + Drug + (a)

Resin + Drug- +X-.....> Resin +.....X- + Drug (b)

f. Ion Exchange Resins

With the functional group -COO- and the typical ionic form K+, INDION 414 is a chemically cross-linked polyacrylic. It can absorb a lot of water. It serves as a superdisintegrant for oral dissolving tablets. It is a dry powder made of a weak acid cation exchange resin. It gives the tablet with the required hardness and chemical stability, as well as an effective disintegration action. When dosage forms come into touch with water or gastrointestinal fluids, they expand dramatically and disintegrate quickly without forming lumps [54,55].

g. Calcium Silicate

It's a very porous, lightweight superdisintegrant that works by wicking moisture.

4.3.3 Co-processed superdisintegrants

In current years, drug formulation experts have discovered that single-component excipients do not always provide appropriate performance for the formulation or manufacturing of certain active pharmaceutical components. As a result, there is a need for excipients with numerous properties, such as improved flow, low/no moisture sensitivity, enhanced compressibility, and quick disintegration. Co-processing two or more excipients is one method for increasing their functioning. The novel idea that two or more excipients might interact at the sub-particle level is the foundation of co-processing, with the goal of providing a synergy of functionality increase while disguising the unwanted features of each. Co-processing excipients produces excipient granules with higher characteristics as compared to physical combinations of components or separate components [61].

Co-processing excipients has improved properties as compared to physical mixing of separate excipient mixtures. Superdisintegrants examples which are commercially available are given in table.

Sr. No.	Co-processed superdisintegrants	Consists of
1.	Pan Excea MH300G	(Microcrystalline cellulose, hydroxyl-propyl-methyl cellulose and crospovidone)
2.	Ludipress	(Lactose monohydrate, polyvinylpyrrolidone and crospovidone)
3.	Ran-Explo-C	(Microcrystalline cellulose, silica and crospovidone)
4.	Ran-Explo-S	(Microcrystalline cellulose, silica and sodium starch glycolate)
5.	Ludiflast	(Mannitol, crospovidone and polyvinyl acetate)
6.	Starlac	Lactose and maize starch
7.	Starcap 1500	Corn starch and Pregelatinized starch)

table no. 2: co-processed superdisintegrants

CONCLUSION:

Tablets that are chewable, oral, fast-melting, and fast-dissolving are solid dosage forms that dissolve rapidly in the mouth without the need for water. The pharmaceutical business has a sizable demand for fast-dissolving tablets. Superdisintegrants use a variety of ways to cause disintegration. The primary purpose of fast dissolving tablets is their quick dissolve, quick absorption, and instantaneous action, all of which are made possible by superdisintegrants. Superdisintegrants improve the compressibility, compatibility, and mechanical strength of medications with high dosages without compromising either. The information on natural, synthetic and Co-processed superdisintegrants and their effectiveness and significance in the pharmaceutical sector is included in the current review paper.

References

1. The theory and practice of Industrial Pharmacy, Leon Lachmann, Herbert A. Lieberman, Joseph L. Kanig. Pg. 293-303, Fourth edition.
2. VermaP,Thakur AS, DeshmukhK, Jha AK,Verma S.Routes of drug administration. Int J Pharm Stud Res2010; I(I):54-59.
3. Pahwa R, Piplani M, Sharma PC, Kaushik D and Nanda S: Orally disintegrating tablets – friendly to pediatrics and geriatrics. Archives of Applied Science Research 2010; 2(2): 35-48.

4. Kumar MV, Sethi P, Kheri R, Saraogi GK and Singhai AK: Orally disintegrating tablets: a review. International Research Journal of Pharmacy 2011; 2(4): 16-22.
5. Giri TK, Tripathi DK and Majumdar R: Formulation aspects in the development of orodispersible tablets: an overview. International Journal of Pharmacy and Pharmaceutical Sciences 2010; 2(3): 38- 42.
6. Siddiqui Md.N, Garg G and Sharma PK: Fast Dissolving Tablets: Preparation, Characterization and Evaluation: an overview. International Journal of Pharmaceutical Sciences Review and Research 2010; 4(2): 87-96.
7. Hirani JJ, Rathod DA and Vadalia RK: Orally disintegrating tablets: a review. Tropical Journal of Pharmaceutical Research 2009; 8(2): 161-172.
8. Alebiowu G and Itiola OA: The Influence of pregelatinized starch disintegrants on interacting variables that act on disintegrant properties. Pharmaceutical Technology 2003; 28-33.
9. Bhowmik D, Chiranjib B, Yadav J, Chandira RM and Kumar S: Emerging trends of disintegrants used in formulation of solid dosage form. Scholars Research Library Der Pharmacia Lettre 2010; 2 (1): 495-504.
10. Mohanachandran PS, Sindhumol PG and Kiran TS: Superdisintegrants: an overview. Journal of Pharmaceutical Sciences Review and Research 2011; 6(1): 105-109.
11. Goel H, Vora N and Rana V: A novel approach to optimize and formulate fast disintegrating tablets for nausea and vomiting. AAPS PharmSciTech 2008; 9(3): 774-781.
12. Vaibhav S, Mahaveer PK, Gupta MK, Agarwal D and Sharma N: Orally disintegrating tablet: friendly dosage form. International Journal of Research in Ayurveda and Pharmacy 2010; 1(2): 399 407.
13. Ghosh T, Ghosh A and Prasad D: A review on new generation orodispersible tablets and its future prospective. International Journal of Pharmacy and Pharmaceutical Sciences 2011; 3(1): 1-7.
14. Velmurugan S and Vinushitha S: Oral disintegrating tablets: an overview. International Journal of Chemical and Pharmaceutical Sciences 2010; 1(2): 1-12. 16. Khan T, Nazim S, Shaikh S, Shaikh A, Khairnar A and Ahmed A: An approach for rapid disintegrating tablet: a review. International Journal of Pharmaceutical Research and Development 2011; 3(3): 170-183.
15. Deshmukh KR, Vidyanand P, Shekhar V, Kumar PA and Dewangan P: A review on mouth dissolving tablet techniques. International Journal of Research in Ayurveda and Pharmacy 2011; 2(1): 66-74.
16. Slowson M, Slowson S, What to do when patients cannot swallow their medications. Pharm Times, 51, 1985, 90-96.
17. Chang RK, Guo X, Burnside BA, Couch RA. Fast dissolving tablets. Pharm Tech, 2000; 24(6):52-58.
18. Bandari S, Mittapalli RK, Gannu R and Rao YM: Orodispersible tablets: an overview. Asian Journal of Pharmaceutics 2008; 2(1): 2-11.
19. Arya A and Chandra A: Fast drug delivery systems: a review. Scholars Research Library 2010; 2(2): 350-361.
20. Konapure AS, Chaudhari PS, Oswal RJ, Kshirsagar SS, Antre RV and Chorage TV: Mouth dissolving tablets-an innovative technology. International Journal of Applied Biology and Pharmaceutical Technology 2011; 2(1): 496-503.
21. Belet MH and Derle DV: Analysis of patents pertaining to superdisintegrants used in tablet manufacturing. Journal of intellectual Property Rights 2008; 13: 601-604.
22. Omidian H and Park K: Swelling agents and devices in oral drug delivery. Journal of Drug Delivery Science and Technology 2008; 18 (2): 83-93.
23. Mangal M, Thakral S, Goswami M, Ghai P. Superdisintegrants: An Updated Review. International Journal of Pharmacy and Pharmaceutical Science Research, 2(2):26-35, 2012.
24. Swarbrick J. Encyclopedia of Pharmaceutical Technology. CRC Press, New York, 2006.
25. Rowe R C, Sheskey P J, Quinn M E. Handbook of Pharma ceutical Excipients. Pharmaceutical Press, London, 2009.
26. Chandrashekhara S, Deshmkh H, Nagesh C, Murade A, Usgaunkar S. Superdisintegrants: A Recent Investigation and Current Approach. Asian J Pharm Tech, 2(1):19-25, 2012.
27. Pahwa R, Gupta N. Superdisintegrants in the Development of Orally Disintegrating Tablets: A Review. International Journal of Pharmaceutical Science and Research, 2:2767-2780, 2011.
28. Kuchekar B S, Bhise S B, Arungam V. Design of Fast Dissolving Tablets. Indian J Pharm Edu, 35:150-55, 2005.
29. Iyad R, Mayyas AR, Eftaiha AA and Badwan A: Chitin-silicon dioxide coprecipitate as a novel superdisintegrant. Journal of Pharmaceutical Sciences 2008; 97(11): 4955-69.
30. Kumar R, Patil MB, Patil SR and Paschapur MS: Evaluation of Anacardium occidentale gum as gelling agent in aceclofenac gel. International Journal of PharmTech Research 2009; 1(3): 695-704.
31. Shirsand S, Suresh S, Para M, Swamy P, Kumar D N. Plantago ovata mucilage in the design of fast disintegrating tablets. Indian Journal of Pharmaceutical Science, 71:41-45, 2009.
32. Mehta K K, Patel H H, Patel N D, Vora C N, Patel N J. Comparative evaluation of natural and synthetic superdisintegrant for promoting Nimesulide dissolution for fast dissolving technology. International journal of pharmacy and pharmaceutical sciences, 1:102-108, 2010.
33. Divekar VB, Kalaskar MG, Chougule PD, Redasani VK and Baheti DG: Isolation and characterization of mucilage from Lepidium sativum linn seeds. International Journal of Pharmaceutical Research & Development 2010; 2(1): 1-5.

34. Bhowmik D, Chiranjib B, Yadav J, Chandira RM and Kumar S: Emerging trends of disintegrants used in formulation of solid dosage form. Scholars Research Library Der Pharmacia Lettre 2010; 2 (1): 495-504.
35. Shah DP and Jani GK: A newer application of physically modified Gellan gum in tablet formulation using factorial design. ARS Pharmaceutica 2010; 51(1): 28-40.
36. Dey P, Maiti S, Sa B. Locust Bean Gum and Its Application in Pharmacy And Biotechnology: An Overview. International Journal of Current Pharmaceutical Research, 4:7-11, 2011.
37. Malik K, Arora G, Singh I. Locust bean Gum as Superdisintegrant Formulation and Evaluation of Nimesulide
38. Pratik R Amaliyar, Hitesh Patel, Sunita A Chaudhary et al. A Brief Review on Natural and Synthetic Superdisintegrants. Inventi Rapid: Novel Excipients, 2014(3):1-10, 2014.
39. Uddhav S Bagul. (2006). Current status of tablet disintegrants: a review. Retrieved March 5, 2011 from Pharmainfo.net. http://www.pharmainfo.net/reviews/current-status-tablet disintegrantsa-review.
40. Shah B: Textbook of Pharmacognosy and Phytochemistry. Elsevier Health Sciences Publishers, First Edition 2009; 164-165.
41. Setia A, Goyal N and Kansal S: Formulation and evaluation of Ciprofloxacin hydrochloride dispersible tablets using natural substances as disintegrates. Pelagia Research Library Der Pharmacia Sinica 2011; 2(1): 36-39.
42. Nagar M, Yadav A V. Cinnarizine orodispersible tablets: a Chitosan based fast mouth dissolving technology. International Journal of PharmTech Research, 1(4):1079-1091, 2009.
43. Rai P R, Tiwary A K, Rana V. Superior disintegrating properties of calcium cross-linked Cassia fistula gum derivatives for fast dissolving tablets. Carbohydrate Polymers, 87:1098–1104, 2012.
44. Antony P J, Sanghavi N M. A new Disintegrant for Pharmaceutical Dosage form. Drug Dev Ind. Pharm, 23:413 415, 1997.
45. Malviya R, Srivastava P, Bansal M, Sharma P K. Preparation and evaluation of disintegrating properties of Cucurbita maxima pulp powder. International Journal of Pharmaceutical sciences, 2(1):395-399, 2010.
46. Bi D. Rapidly Disintegrable multiparticular Tablets. Chemical & pharmaceutical Bulletin, 18(9):1308-1310, 1995.
47. Watanable Y. Preparation of rapidly disintegrating tablets using new type of MCC (PH-M-Series) and L-HPC by direct compression method. Chemical & Pharmaceutical Bulletin, 49(2):134-139, 2001.
48. Raymond CR: Handbook of Pharmaceutical Excipients. APhA Publishers, Fifth Edition 2006.
49. Superdisintegrants: an introduction to chemistry and performance [online]. 2011 April 11 [cited 2014 Apr 16]; Available from: URL:http://www.dfepharma.com/.
50. Newman A W, Mueller R L, Vitez I M, Kiesnowski C C. Starch and starch derivatives. Encycolpedia of Pharmaceutical Technology. Informa Healthcare USA, 2007.
51. Camarco W, Ray D and Druffner A: Selecting superdisintegrants for orally disintegrating tablet formulations. Pharmaceutical Technology Supplement 2006.
52. Goel H, Rai P, Rana V and Tiwary AK: Orally disintegrating systems: innovations in formulation and technology. Recent Patents on Drug Delivery & Formulation 2008; 2: 258-274.
53. Singh I, Rehni A K, Kalra R, Joshi G, Kumar M, Aboul-Enein H Y. Ion Exchange Resins: Drug Delivery and Therapeutic Applications. FABAD J Pharm Sci, 32:91-100, 2007.
54. Smallenbroek A J, Bolhguis G K, Lerk C F. The effect of particle size of disintegrants on the disintegration of tablets. Pharmaceutisch Weekblad, 3:172-175, 1981.
55. European Pharmacopeia, European Directorate for the Quality of Medicines, 5:3151, 2006.
56. John C Carter. (2002-06). The role of disintegrants in solid oral dosage form manufacturing. Carter Pharmaceutical Consulting, Inc. Retrieved March 25, 2011 from http://www.carterpharma ceutical consulting.com/articles/The-role-of-disintergrants. html.
57. Chen CR, Lin YH, Cho SL, Yen SY and Wu HL: Investigation of the dissolution difference between acidic and neutral media of Acetaminophen tablets containing a super disintegrant and a soluble excipient. Chem Pharm Bull 1997; 45: 509–512.
58. Zhao N and Augsburger LL: The influence of swelling capacity of super disintegrants in different pH media on the dissolution of Hydrochlorothiazide from directly compressed tablets. AAPS PharmSci-Tech 2005; 6: 120–126.
59. Bussemer T, Peppas NA and Bodmeier R: Evaluation of the swelling, hydration and rupturing properties of the swelling layer of a rupturable pulsatile drug delivery system. European Journal of Pharmaceutics and Biopharmaceutics 2003; 56: 261–270.
60. Zhao N and Augsburger LL: The influence of granulation on super disintegrant performance. Pharm Dev Technol 2006; 11: 47–53.
61. Nagendrakumar D, Raju SA, Shirsand SB, Para MS. Design of fast dissolving granisetron HCl Tablets using novel co-processed superdisintegrants. International journal of pharmaceutical sciences and review. 2010 March- April; 1(1):58-62.