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REVIEW ON SUPERDISINTEGRANTS

Prashant Giri*, Prajakta Shinde, Anuja Sawant, Varad Kale and Abhishek Gosavi

S.M.B.T. College of Pharmacy, Dhamangaon, Tal. Igatpuri, Dist. Nashik, Maharashtra-422403, India.

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***Corresponding Author**
Prashant Giri
S.M.B.T. College of Pharmacy, Dhamangaon, Tal. Igatpuri, Dist. Nashik, Maharashtra-422403, India.

ABSTRACT

Fast dissolving tablets are an emerging trend in novel drug delivery system and have increasing demand during the last few decades. Superdisintegrants are used in orally disintegrating tablet to improve the disintegration and efficacy of solid dosage forms. This is achieved by decreasing the disintegration time which in turn enhance drug dissolution rate. Disintegrates are substances which are used in formulations to promote the breakdown of the tablet (and capsule "slugs') into smaller fragments in an aqueous environment thereby increasing the available surface area and promoting a rapid release of the drug substance. Natural superdisintegrants remain an attractive role in orally disintegrating tablet because they are natural products of plants, readily available, inexpensive, biocompatible and capable of multitude of chemical modification. In recent years, some newer substances have been developed known as Superdisintegrants. Natural superdisintegrants are obtained from the natural origin and having a numbers of advantages like they are cost efficacious, nontoxic, biodegradable, eco-friendly, devoid of any side effect, renewable and also provide nutritional supplement. It is proved from variuos studies that natural polymers are more effective and safe than the synthetic polymers. The aim of the present article is to study the natural and synthetic polymers utilized and their action in fast dissolving tablet.

KEYWORLDS: Fast dissolving tablet, Disintegrants, Natural superdisintegrants, Synthetic superdisintegrants, Biodegradable, Non-toxic.

INTRODUCTION

Superdisintegrants are chemicals that help to speed up the disintegration process. Disintegrating agents are compounds that are commonly used in tablet formulations to help

break apart the compacted mass into primary particles, allowing the active components to dissolve or release more easily when the tablet is placed in a fluid environment. Oral administration of the medication is the most preferred way of administration, with acceptability ranging from 50 to 60% of total dosage forms. Solid dosage forms are popular because of their ease of use, precise dosing, self-medication, pain avoidance, and, most importantly, patient compliance. The tablet is the most popular oral dosage form due to its ease of preparation, ease of administration, accurate dosing, and stability compared to oral liquids, as well as being more tamper proof than capsules. An adequate pharmaceutically acceptable diluent or carrier may be used to enable immediate release, as long as the diluent or carrier does not significantly slow down the rate of drug release and/or absorption. When held on the tongue, mouth dissolving, oro-dispersible, or rapid dissolving tablets are defined as a solid dose form containing a therapeutic ingredient that instantly disperses into the saliva within seconds. Fast-acting drug delivery devices for juvenile and geriatric patients were originally developed in the late 1970s as an alternative to traditional dose forms. Fast dissolving tablet (FDT) is described by the US Food and Drug Administration (FDA) as "a solid dosage form containing a medicinal element or active component that disintegrates or dissolves rapidly within seconds when put upon the tongue."[1,2,3]

"MDT intended to be diffused in water within few seconds before delivery, giving a homogenous dispersion," according to the WHO. Some of the benefits of mouth dissolving tablets (MDT) include: no need for water to swallow the dosage form, good mouth feel produced by the use of flavours and sweeteners, especially in paediatric patients, it gives fast action when it comes into contact with saliva, and superdisintegrants are the key ingredient that gives a drug in the form of MDT faster disintegration and/or dissolution. Both are used to make MDTs.

They are added in a lower concentration of 1-10% by weight compared to the total. Units of dose weight The faster a medicine dissolves in a solution, the faster it is absorbed and begins to have a therapeutic effect. Some medications' bioavailability and therapeutic impact may be enhanced by absorption in the oral cavity or by pregastric absorption of pharmaceuticals from saliva that passes down into the stomach. Mucilage, cross linked carboxymethyl cellulose (croscarmellose), sodium starch glycolate, and poly vinyl pyrrolidone are examples of natural and synthetic superdisintegrants that are used to provide immediate disintegration of tablets and facilitate the design of delivery systems with desirable characteristics. Fast disintegration

is an important step for faster drug release and activity in mouth dissolving tablets, hence superdisintegrants are added to help with faster disintegration. Disintegrating agents are also added to solid dosage forms to help with faster disintegration. The most frequent tablets are those designed to be ingested whole and breakdown quickly in the gastrointestinal tract, releasing their medications (GIT).[4,5,6]

The choice of disintegrant and its consistency of performance are crucial in the development of such tablets' formulations. In recent years, increased emphasis has been placed on developing not just swallowable fast dissolving and/or disintegrating tablets, but also orally disintegrating tablets that dissolve and/or disintegrate swiftly in the mouth. The majority of previous research has been on the function-related aspects of superdisintegrants, with a particular focus on the relationship between these functional properties and disintegrant efficiency and drug release rate. In nonsoluble matrices, water penetration rate and rate of disintegration force formation are both positively related to disintegrant efficiency. superdisintegrants that are used to provide immediate tablet disintegration and facilitate the design of delivery systems with desirable characteristics.[7,8,9]

For emergency medicines, these formulations are usually suggested. Disintegrants are substances or mixtures of substances added to medicine formulations to aid in the dispersion or breakdown of tablets and capsule contents into smaller particles for faster dissolve when exposed to water. At low concentrations, superdisintegrants are more effective than disintegrants with higher disintegration efficiency and mechanical strength. It is used in small amounts in tablets, usually 1-10% by weight of the total weight of the dosage unit. 10-40 gm of water or aqueous media is absorbed by one gramme of superdisintegrants. It causes tension after absorption, causing the entire tablet structure to disintegrate. Disintegrant function requires the ability to interact aggressively with water. The mechanisms of disintegrant activity are a combination of swelling, wicking, and distortion. A disintegrant used in granulated formulation procedures can be more successful if it is employed both "intragranularly" and "extragranularly," breaking the tablet into granules and then dissolving the granules to release the medication component into solution. However, the amount of disintegrant applied intragranularly (in wet granulation processes) is usually less effective than the amount added extragranularly since it is subject to wetting and drying (as part of the granulation process), which lowers the disintegrant's activity. Because the disintegrant utilised intragranularly is not exposed to wetting and drying during the compaction process, it

retains good disintegration activity. Incorporating disintegrating agents into the tablet can be done in three stages: A. Internal Subtraction (Intragranular) B.Addition from the Outside (Extragranular) C. Internal and external in nature. In a direct compression procedure, the medicine is mixed with a variety of excipients, lubricated, then compressed straight into a tablet. In this sort of formulation, the disintegrant merely breaks the tablet apart to expose the medication component for dissolving. FDTs of pravastatin were prepared using the direct compression method in this study because it is a straightforward, convenient, and cost-effective way for preparing FDTs. The direct compression method has proven to be rational in the pharmaceutical area due to its ease of use, adaptability, faster manufacturing, and capacity to avoid hydrolytic or oxidative reactions that occur during dosage form processing.[10,11]

➢ ADVANTAGES OF SUPERDISINTEGRANTS[12,13,14]

- It's suitable to use with common therapeutic agents and excipients.
- It is biodegradable and does not stick to punches or dyes.
- It is effective at lower concentration.
- It is less effective on compressibility and flow ability.
- It is more effective intergranular.

➢ DISADVANTAGES OF SUPERDISINTEGRANTS[15]

- It can be used with a wide range of medicinal drugs and excipients.
- It degrades quickly and does not cling to punches or dyes.
- It works at lower concentrations.
- It has a lower compressibility and flow ability.
- Intergranular communication is more effective.

➢ IDEAL PROPERTIES OF SUPERDISITGRANTS[14,15]

- It should disintegrate quickly.
- It should be water insoluble.
- It should have good moulding and flow properties.
- It should have a good particle size, hydration capacity, and compressibility index.
- It should produce compactable, less friable tablets.
- It should be nontoxic and have a pleasant mouth feel.

➢ TYPES OF SUPERDISINTEGRANTS

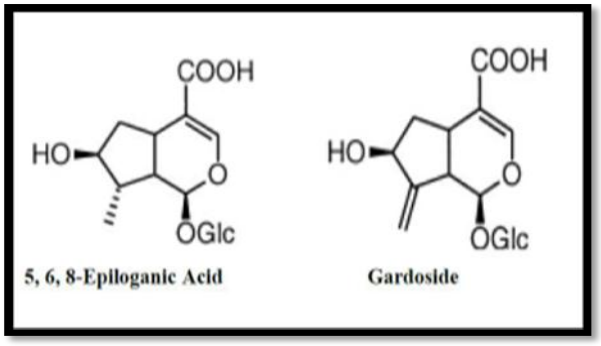
A. Natural superdisintegrants

B. Synthetic superdisintegrants

Natural superdisintegrants

❖ Ispaghula Husk Mucilage (Plantago Ovata)

Ispaghula husk is composed of dried seeds from the Plantago ovata plant, and it contains mucilage, which is found in the epidermis of the seeds. Plantago ovata seeds were steeped in distilled water for 48 hours before even being boiled for a few minutes to release all of the mucilage into the water. Plantago ovata mucilage possesses a variety of characteristics, including binding, dissolving, and maintaining qualities. Mucilage is a superdisintegrating agent that is used to make fast-dissolving tablets because it has a very high swelling index (approximately 89±2.2 percent v/v) when compared to other superdisintegrants. To filter and separate the marc, the substance was squeezed through muslin fabric.[17,18,19] The seeds and psyllium husk are valuable sources of fibers and mucilage of this plant. Psyllium husk is used as a laxative, to lower the glycemic index, and for the development of controlled-release formulations in the pharmaceutical industry. Psyllium husk increase its weight of increases up to 10 times due to quick water absorption. Hydrocolloids make up 10–30% of psyllium husk; these are water soluble polysaccharides that form mucilage layers when exposed to water. During hydrolysis, mucilage splits and the variuos polysaccharides, including xylose, arabinose, galacturonic acid, rhamnose, and galactose, are obtained. These compounds are responsible for the disintegrative properties of psyllium husk and could be applied as natural disintegrants in drug manufacturing.[33] An equal volume of acetone was added to the filtrate so as to precipitate the mucilage. The separated mucilage was dried in an oven at temperature less than 60°C. The mucilage of *Plantago ovata* is a recent innovation for its super disintegration property when compared with crospovidone. It shows faster disintegration time than the crospovidone.[17,18,19]



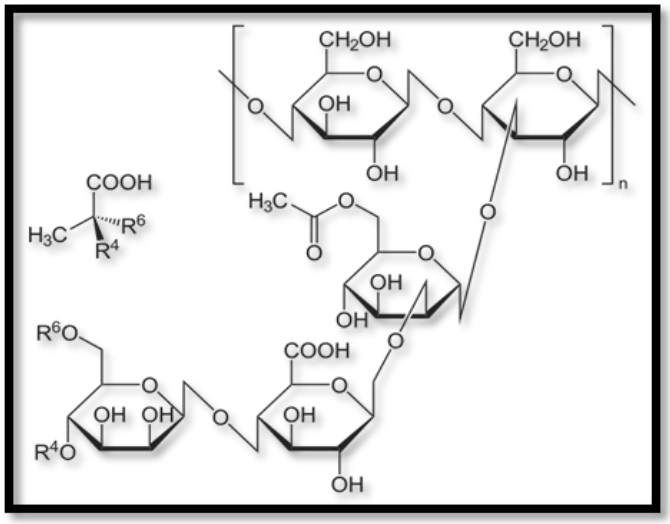
5, 6, 8-Epiloganic Acid Gardoside

Prajapati et al. concern dispersible tablet of Nimesulide with wet granulation technique and found that the mucilage was effective at low concentration as superdisintegrant.[34]

Asist, the results revealed that disintegrant property of isabgol mucilage was equivalent to Ac-Di-Sol and superior to sodium starch glycolate.

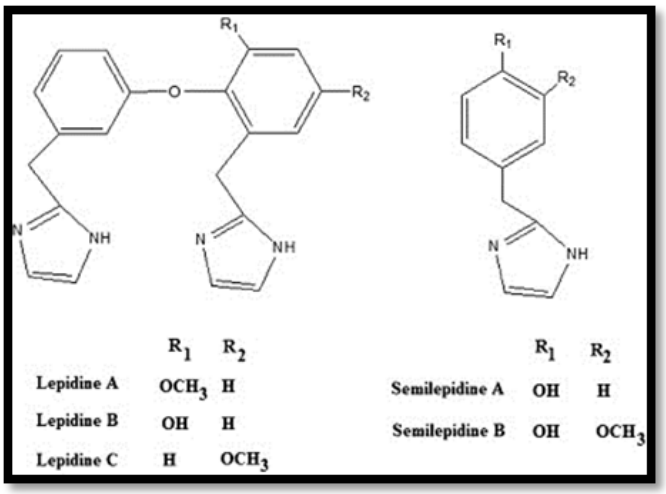
❖ **Xanthan Gum**

Xanthan gum which is derived from Xanthomonas campestris is official in USP with high hydrophilicity and low gelling tendency. It has low water solubility and extensive swelling properties for faster disintegration.[20] Xanthan Gum produced by a fermentation process using the bacteria Xanthomonas campestris it show high hydrophilicity and low gelling tendency. Xanthan gum has a **β-(1→4)-D-glucose backbone** where every second glucose unit is attached to a trisaccharide consisting of mannose, glucuronic acid, and mannose. The negatively charged carboxylates from glucuronic acid allow it to form highly viscous fluids at appropriate pH. Although it is considered a nongelling gum, it generates a viscous medium due to its tenuous associations. Although it is highly swellable, it slows drug release in sustained release formulations**.** Modified xanthan gum obtained was biodegradable, directly compressible and exhibited desirable swelling dynamics to be used as a hydrophilic excipient for rapidly disintegrating tablets. The rapidly disintegrating tablets of roxithromycin formulated with lower level of modified xanthan gum and higher level of MCC was selected as the optimized formulation that displayed nine-fold reductions in lag time, was stable for a period of 12 months and retained the rapid disintegration characteristics till the end of tested time period.[42]



❖ Mucilage of Lepidum Sativum (Asaliyo)

Lepidum sativum is commonly known as asaliyo and widely used as herbal medicine from a long time in India. it is easily available in local market and has very low cost. Parts used are leaves, root, oil, seeds etc. Seeds contain higher amount of mucilage containing dimeric imidazole alkaloids lepidine B, C, D, E and F and two new monomeric imidazole alkaloids semilepidinoside A and B. Mucilage of Lepidium Sativum has various properties like binding, disintegrating, gelling etc. Hence isolated the mucilage from seeds and it's used into develop the fast-dissolving tablet in a study.[34]

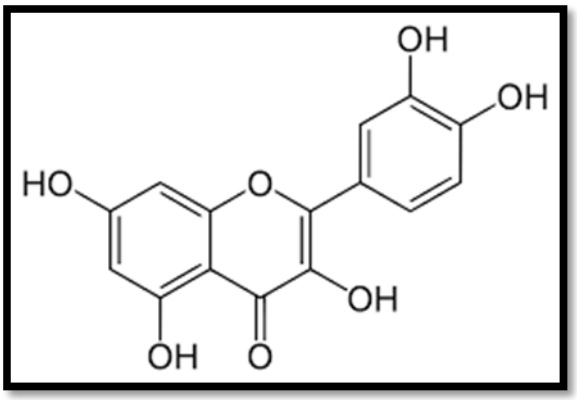


The super disintegrants obtained from mucilage of Lepidium sativum possess good physiochemical properties and Swelling index of the mucilage and Husk obtained from Lepidium sativum were found to be 27 and 25 respectively. The swelling factor is related to the disintegration of tablets rapid water uptake and rapid swelling leads to rapid disintegration of tablets. The LOD value is within prescribe limit as specified in official. The compressibility index and angle of repose value indicates that the mucilage and the husk powder have good flow characteristics with moderate compressibility. Different batches were formulated using different ratio of drug, mucilage and husk of the seeds of Lepidium sativum by direct compression technique. Other excipients such as sucrose, microcrystalline cellulose, talc and magnesium stearate were incorporated in the formulation. Coarser grade of Microcrystalline cellulose (PH102) was selected as diluent as it facilitate the flow property of the blend from the hopper.[39]

Lovleen kaur et.al. prepared a fast dissolving tablet of aceclofenac using Mucilage of Lepidum sativum and find made by the design expert software which is exhibit DT 15.5 sec., WT 18.94 sec., and invitro drug release (100%) with in 15 min.[32]

❖ **Hibiscus Rosa sinesis linn**

Leaves of Hibiscus rosa- sinensis Linn contains high proportion of mucilage which can be used as additives in pharmaceutical formulations. The formulated tablets were evaluated for their pre and post compression parameters like tablet hardness, thickness, % friability, wetting time which was found to be in permissible limits. The in vitro disintegration time of tablet formulations containing 6% of mucilage was found to be 24 sec and that of tablet containing 4% of crosspovidone was 42secs. Based upon in vitro disintegration time in vitro drug release studies were carried out in phosphate buffer p H 6.8 which showed 100% drug release in 12 minutes of F3 formulation containing 6% of mucilage. Stability studies performed on F3 formulation indicated that the prepared tablets remain stable for the period of 90 days and showed no change in in vitro drug release pattern.[38]

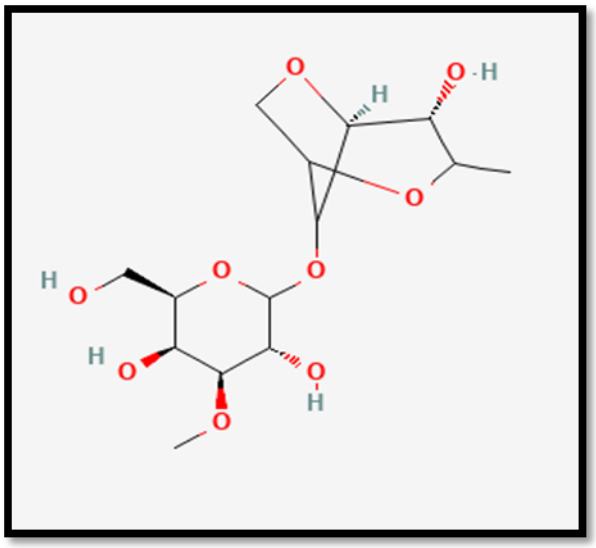


Gailute Draksiene et al. was carried out to study the disintergant property of Hibiscus rosa-sinensis mucilage using imipramine as a model drug and the work was carried out to develop fast dissolving tablet of Imipramine using natural disintegrant.

which is isolated from Hibiscus rosasinensis leaves and its efficiency was compared with synthetic superdisintegrant like crosspovidone. Hibiscus rosasinensis mucilage was isolated and characterised for its identification by chemical test and micrometric properties. Fast dissolving tablets of Imipramine were formulated by direct compression method using Hibiscus rosa-sinensis mucilage (2-8% w/w), Avicel PH 102 as diluents, mannitol to enhance mouth feel and compressibility, as sweetener.[36]

❖ **Agar and Treated Agar**

It is the dried gelatinous substance obtained from various species of family: **Gelidanceae** like ***Gelidium amansii*** and several other species of red algae like ***Gracilaria*** and ***Pterocladia.*** Agar is yellowish-gray or white to proximately colorless, inodorate with mucilaginous taste and is out there within the sort of divests, sheet flakes, or coarse powder. Agar consists of two polysaccharides, agarose and agar pectin. Agarose is responsible for gel vigor and agar pectin is responsible for the viscosity of agar solutions. High gel vigor of agar makes it a potential candidate as a disintegrants.

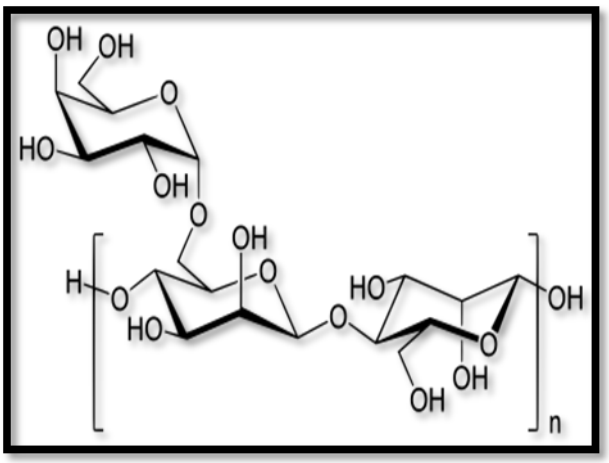


P. Bhardwaj et.al. prepare orodispersible tablets of metformin hydrochloride using agar as natural super disintegrant and the objective of the work is to improve bioavailability, disintegration time, dissolution efficacy and patient compliance.

Formulation of nine batches out of which batch F5 with 6% super disintegrant was found to have better results in compare to other formulations, the F5 batch was passed with friability test and found negligible loss (0.4%), Then the batch was further evaluated for disintegration test and found to have 11.03 sec and *in-vitro* dispersion was found to be 15 sec in simulated saliva fluid and percentage drug release was evaluated to be 98.5% in less than 30 min. Hence, F5 batch was found to be better as it contain 6% treated agar. It shows further potential to carry animal model.[36]

❖ **Gaur Gum**

Guar gum consists of a linear chain of **β-(1→4)-linked D-mannose** units with **D-galactose** attached by **α-(1→6)** linkages to every other mannose unit to form short side chains.[19] Though not self-gelling, guar gum has a high low-shear viscosity. Because it is nonionic, it is not affected by ionic strength or pH.[39]



Guar gum is a nonionic polysaccharide derived from the seeds of Cyam. opsis tetragonolobus, family Leguminosae. It consists of linear chains of (1?4)- â -D-man..nopyranosyl units with á-D-galactopyranosyl units attached by (16) linkages. In pharmaceuticals, guar gum is used in solid dosage forms as a binder and disintegrant. A few reports appear on the use of guar gum, as a hydrophilic matrix, for designing oral controlled release dosage forms.[39]

Sunitha HS. et al. developed Captopril tablet using gaur gum as superdisintegrant and evaluated for pre compression and post compression parameters which complied official limits.

She said that, Among all the formulations, containing guar gum 10 mg gives best disintegration and dissolution profile compared with other formulations, showed drug release of 99.86±0.54% with 12 min and disintegration time 50.16±1.32 sec.[38]

❖ **Advantages of Natural Superdisitegrants**

✓ Easily available.

✓ Economic.

✓ Biocompatibility & biodegradability.

- ✓ Increases patient compliance.
- ✓ Non-irritant and non-toxic.
- ✓ Offer secure and effective drug delivery systems in the patients.

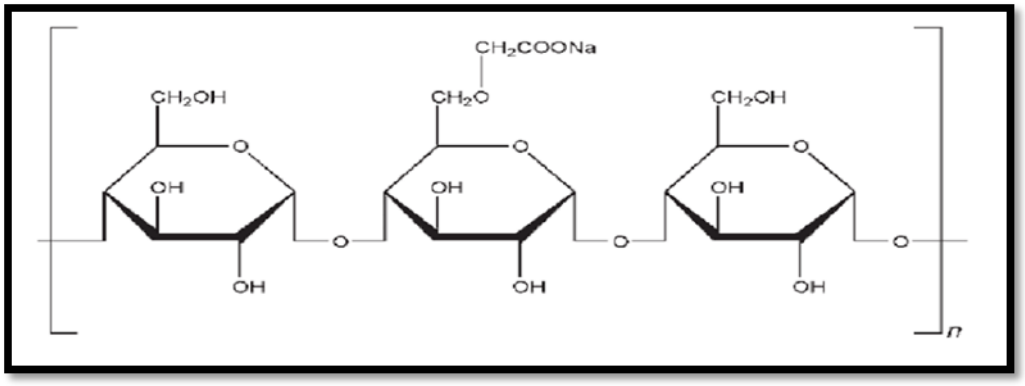
Table no. 1: List of natural superdisintegrants along with their source of mechanism of action.[45]

Sr no.	Superdisintegrants name	Source	Mechanism
1.	Musilage of Lepidus sativum	Msilage was obtain from the seeds of Lepidus sativum	Swelling
2.	Isapghula husk (Plantago Ovata)	From the seed of Plantago ovata	Swelling
3.	Hibiscus rosa sinesis linn	Mucilage of hisbiscus rosa sinesis	Swelling
4.	Xanthum gum	Derived from Xanthomonas compestris	Swelling
5.	Agar & treated agar	Dried gelatinous substance obtain from gelidium Amansii and several other species of red algae	High strength gelling property
6.	Guar gum	Isolated from endosperm seed of the guar gum, Cyamopsis tetragonloba.	

❖ **Synthetic Superdisintegrants**

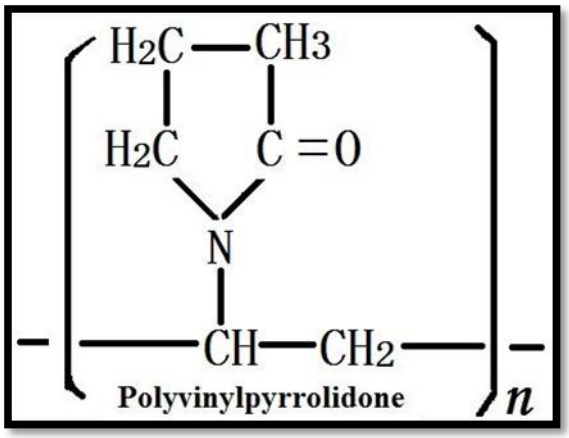
- **Modified Starch (Sodium starch glycolate, Primojel)**

Sodium starch glycolate is the sodium salt of a carboxymethyl ether of starch. These are modified starches made by crosslinking of potato starch as it gives the product with the best disintegrating properties. The degree of cross-linking and substitution are important factors in determining the effectiveness of these materials as superdisintegrants. The effect of the crosslinking is to reduce both the water soluble fraction of the polymer and the viscosity of dispersion in water. The natural pre dried starches swell in water to an extent of 10-20 percent and the modified starches increase in volume by 200-300 percent in water. The mechanism by which this action takes place involves rapid absorption of water leading to an enormous increase in volume of granules that result in rapid and uniform disintegration.[16,24] The tablets formulated by using these superdisintegrants may disintegrate in less than two minutes.



- **Cross-linked Polyvinyl Pyrrolidone (Crospovidone)**

Crospovidone quickly wicks saliva into the tablet to generate the volume expansion and hydrostatic pressure necessary to provide rapid disintegration in the mouth. When examined under a scanning electron microscope, crospovidone particles appears to be granular and highly porous. This unique, porous nature facilitates wicking of liquid into the dosage systems and causes rapid disintegration. In contrast to other superdisintegrants such as sodium starch glycolate and croscarmellose sodium, crospovidone exhibit virtually no tendency towards gel formation, even at a high ratio.[25]

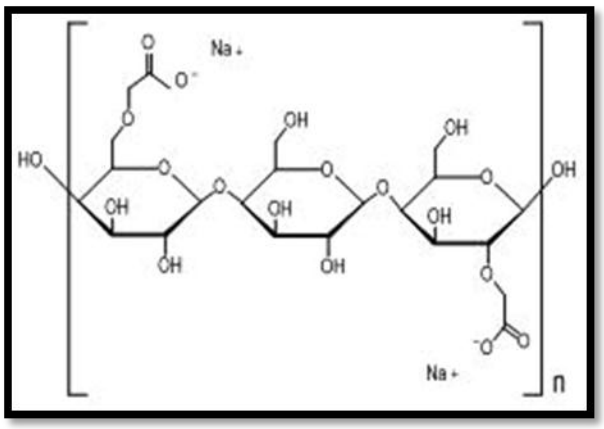


Crosspovidones are highly compressible materials as a result of their unique particle morphology. Crospovidone is used as superdisintegrant at low concentration levels (2-5%) in direct compression, wet and dry granulation processes.[26]

The polymer has a small particle size distribution that imparts a smooth mouth feel to dissolve quickly. Varieties of grades are available commercially as per their particle size in order to achieve a uniform dispersion for direct compression with the formulation.

- **Modified Celluloses (Croscarmellose Sodium)**

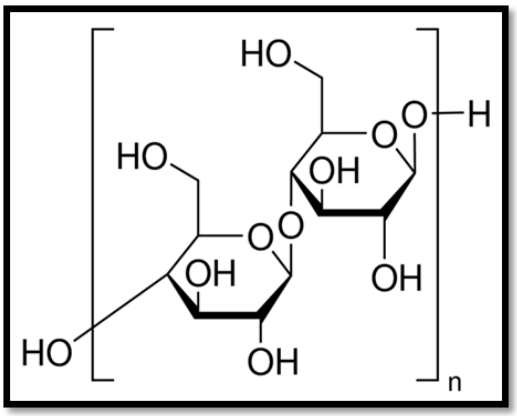
It is insoluble in water, although it rapidly swells to 4-8 times its original volume on contact with water. It specific surface area is 0.81-0.83 m2/g and swelling index is 65±1.7% v/v. Cross-linked sodium carboxymethylcellulose is a white, free flowing powder with high absorption capacity. It has a high swelling capacity and thus provides rapid disintegration and drug dissolution at lower levels. It also has an outstanding water wicking capability and its cross-linked chemical structure creates an insoluble hydrophilic, highly absorbent material resulting in excellent swelling properties. Its recommended concentration is 0.5–2.0%35. Croscarmellose sodium should be defined as a cross-linked polymer of carboxymethylcellulose. There are many differences between the starch and cellulose polymer and the important one included difference between the synthetic processes that is used to modify the polymer. In tablet formulations, croscarmellose sodium may be used in both direct compression and wet-granulation processes. When used in wet-granulation, the croscarmellose sodium should be added in both the wet and dry stages of the process (intra- and extra-granularly) so that the wicking and swelling ability of the disintegrant is best utilized.[33]



- **Microcrystalline Cellulose (Avicel)**

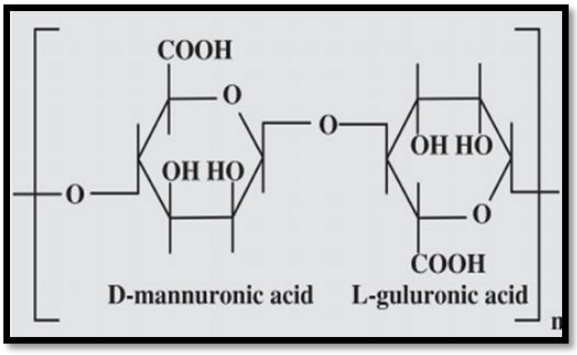
Microcrystalline cellulose is a purified, partially depolymerized cellulose that occurs as a white, odourless, tasteless, crystalline powder composed of porous particles. Avicel concentration of less than 10%, shows enhanced disintegration. This mechanism depends on entry of water in the tablet matrix through capillary pores, which disrupt or break the hydrogen bonding between nearby bundles of cellulose microcrystals. With high concentration, particularly in oral disintegrating tablet it shows an affinity to stick to the tongue due to fast capillary absorption and quicker dehydration of the tablet surface. It has a

fast wicking rate for water, hence this and starch makes an excellent combination for effective and rapid disintegration in tablet formulation. It is commercially available in different particle sizes and moisture grades that have different properties and applications.[30]



- **Alginates**

These are hydrophilic colloidal ingredients that are extracted naturally from certain types of kelp or chemically improved from natural sources like alginic acid or alginic acid salts**.** Alginic acid is a polymer derived from seaweeds comprising D-mannuronic and L-glucoronic units. Its affinity for water absorption and high sorption capacity makes it an excellent disintegrant. Alginic acid is used as disintegrant at 1-5 % concentration while sodium alginate at 2.5-10 % concentration. It can be successfully used with ascorbic acid and multivitamin formulations.[30]



- **Indion 414**

It is safe for oral consumption, economical and easily available polymer. By nature, it is ion exchange resin and if used as superdisintegrants as compared to conventional ones, swell on getting hydrated without dissolution and devoid of adhesive tendency, cause uniform tablet disintegration. They do not form lumps, do not stick to tablet press components and are

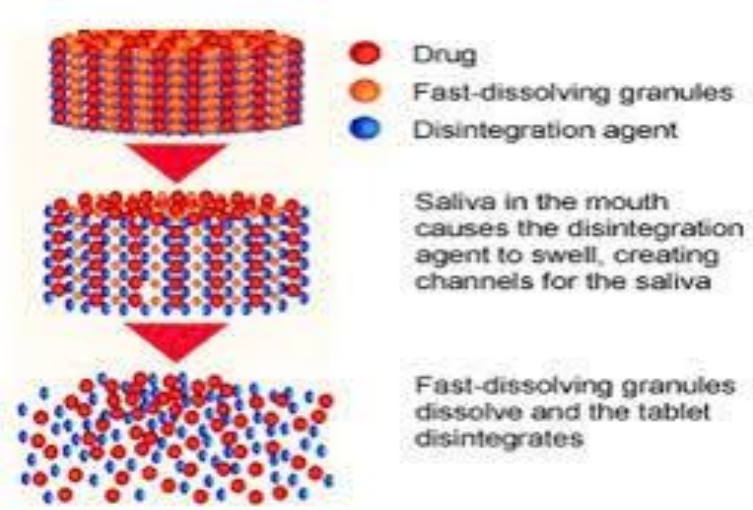
compatible with commonly used active pharmaceutical ingredients as well as other pharmaceutical necessities. They offer better hardness to the tablets on compression. Indion 414 is more effective in hydrophobic formulations, as compared to the conventional disintegrants. For effective disintegration ability in the tablets, concentration of Indion 414 is used in range from 0.5 to 2%.[27]

❖ MECHANISM ACTION OF SUPERDISINTEGRANTS

- Swelling.
- Porosity and capillary action (wicking).
- Combination action.
- Heat of wetting.
- Deformation.
- Enzymatic reaction.
- Electrostatic repulsion.
- Chemical reaction.

➢ Swelling

Swelling is widely accepted mechanism and necessarily the first step for tablet disintegration. It is a process in which certain disintegrating agents (such as starch) generate the disintegrating effect. Tablets with high porosity show poor disintegration due to lack of adequate swelling force. Particles of disintegrants swells when it comes in contact with water, the adhesiveness of other pharmaceutical ingredients present in a tablet can be overcome which causes the tablet to Break[16,24] The mechanism of disintegration through swelling is shown in figure.

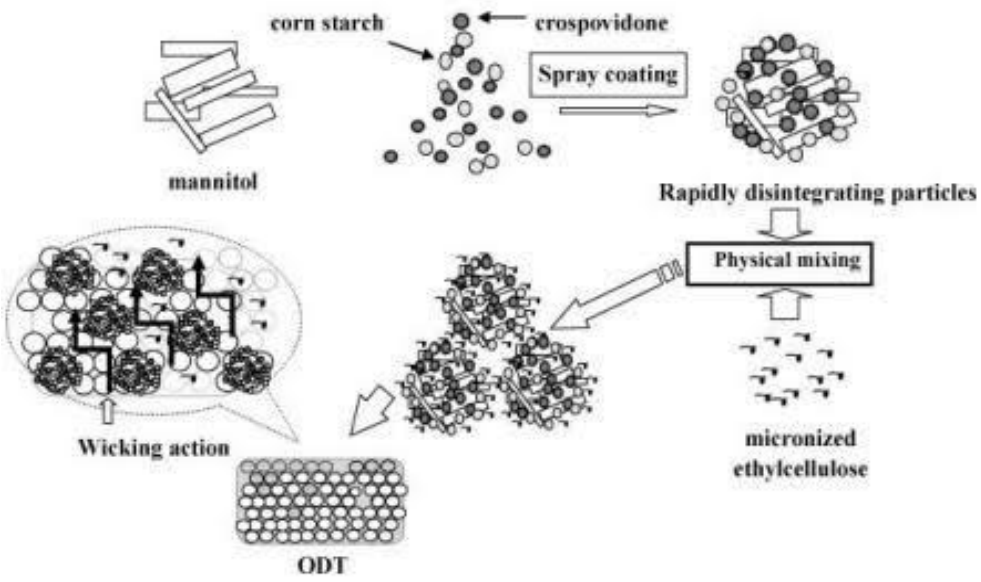


➢ **Porosity and Capillary Action (Wicking)**

Disintegrating agents which does not swell, act by the mechanism of porosity and capillary action. Porosity of the tablet produce pathways for the fluid penetration into tablets. When we put the tablet into suitable aqueous medium, the medium penetrates into the tablet and replaces the air adsorbed on the particles, which weakens the intermolecular bond and breaks the tablet into fine particles. Water uptake by tablet depends upon hydrophilicity of the drug/excipient and on tableting conditions. Liquid is drawn up or "wicked" into these pathway through capillary action and break the bonding of inter particles which causes the tablet to break apart. For these types of disintegrants maintenance of porous structure and low interfacial tension towards aqueous fluid is necessary which helps in disintegration by creating a hydrophilic network around the drug particles.[30]

➢ **Combination Action**

In this mechanism, the combination of both wicking and swelling action to disintegration3, 19. The mechanism of tablet disintegration by wicking shown in figure.[3,16]

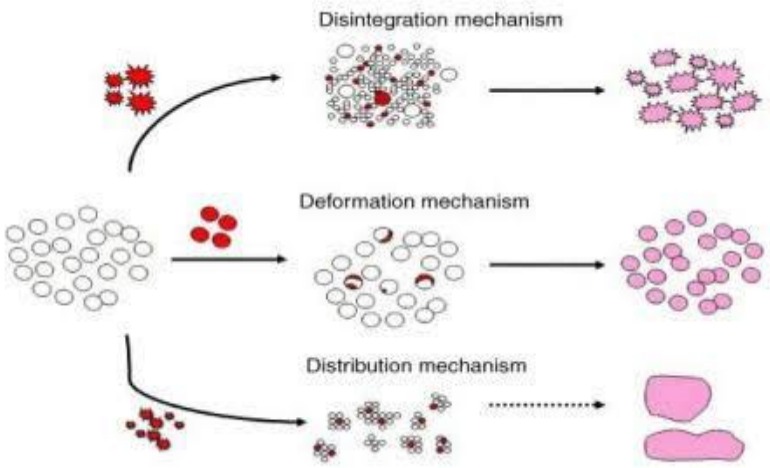


➢ **Heat of wetting**

When disintegrating agents with exothermic properties becomes wetted, capillary air expansion generates localized stress, which helps in tablet disintegration. This mechanism of action explains the action of some types of disintegrants and cannot describe the action of most modern disintegrants.[26]

➢ **Deformation**

The disintegrated particles gets deformed during tablet compression and these deformed particles regain their normal structure when they come in contact with water. The swelling capacity was improved during deformation which results in breakup of tablets. In case of starch (such as potato starch and corn starch) are believed to be elastic in nature, but due to high compaction force during tableting, the elasticity of grains that are deformed under pressure will return to their original shape, when that pressure is removed. When these tablets are exposed to aqueous environment, the energy potential of deformed starch grain will be triggered to cause disintegration[25,27] The mechanism of disintegration by deformation shown in figure.



➢ **Enzymatic action**

Enzymes available in the body also act as disintegrants. These enzymes act on binding action of binder and helps in disintegration. Due to swelling, pressure is exerted in the outer direction that causes the tablet to breakup or burst. The accelerated absorption of water leads to an enormous increase in the volume of granules to promote disintegration i.e swelling exerts the pressure towards the outer direction, which causes the tablet to break and helps in enhancing the water absorption.[3,28]

➢ **Electrostatic Repulsion**

This is another mechanism of disintegration that attempts to explain the swelling of tablet made with non-swellable disintegrants. Guyot-Hermann's has proposed a particle – particle repulsion theory based on the observation that non swelling particle also cause disintegration of tablets. The electric repulsive forces between particles are the mechanism of disintegration

and water is required for it. The water penetrates between starch grains because of its affinity for starch surfaces, thereby breaking hydrogen bonds and other forces holding the tablet together.[29]

- **Chemical Reaction (Acid Base Reaction)**

Liberation of carbon dioxide within tablets on wetting due to interaction between tartaric acid and citric acid (acids) with alkali metal carbonates or bicarbonates (bases) in presence of water causes breaking of tablets. The tablet disintegrates due to generation of pressure within the tablet. This effervescent mixture is used when pharmacist needs to formulate very rapidly dissolving tablets or fast disintegrating tablets. As these disintegrants are highly sensitive to small changes in humidity level and temperature, strict control of environment is required during manufacturing of these tablets. The effervescent blend is either added immediately prior to compression or can be added in two separate fractions during formulation.[30]

Table no. 2: List of synthetic superdisitgrants along with their source & mechanism of action.[41]

Sr no	Superdisintgrants Name	Nature	Brands	Mechanism	Properties
1	Sodium starch	Modified starch	Explotab Primogel	Abosorb water quickly	Swells in dimension and high level acts as sustained release matrix
2	Crospocidone	Cross-linked	Polyplasdone	Combination of swelling and wicking	Water insoluble, spongy in nature
3	Croscarmellose Sodium	Modified cellulose	Ac-Di-Sol Nymce ZSX Primellose Solutab Vivasol L-HPC	Swelling and wicking Within 10 seconds, swells upto 4-8 folds	Swells in 2 dimension
4	Croslinked Alginic acid	-	Alginic acid NF	Rapid swelling or wicking	Promotes disintegration in both dry and wet granulation
5	Ion exchange resins	Crosslinked polyacrylic	Indion 414 Tulsion 339 Amberlite IRP 88	Swelling	Has high water uptake capacity and high purity pharmaceutical grade weak acid cation resin supplied in dry form.

CONCLUSION

The article discussed the overviews of various types of superdisintegrants which are available at present. With the progress in the formulation of fast dissolving tablets, now it is possible to formulate these tablets with numerous types of superdisintegrants in reduced quantity. Approximately one-third of the patients need quick therapeutic action of the drug. Superdisintegrants used in fast dissolving tablet offers combined advantages of ease and convenience of dosing, release the medicaments with an enhanced rate, also provide safe, effective drug delivery with better patient compliance and enhanced therapeutic benefits.

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