Review Article

Escalation of Drug Effectiveness by Incorporation of Superdisintegrants: A Review

Lakhvir Kaur[1], Gurjeet Singh[1*], Satinder Kaur[2], RK Dhawan[2]
[1] Department of Pharmaceutics, Khalsa College of Pharmacy, Amritsar, Punjab, India.
[2]Department of Pharmacology, Khalsa College of Pharmacy, Amritsar, Punjab, India.
***Corresponding author's E-mail:** sainigurjeet21@gmail.com

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ABSTRACT

Oral route is considered as one of the most expedient routes for administration of solid dosage forms. Almost around 85% of solid dosages are administered by oral route because of convenience and low costs. Superdisintegrants (SD) are very renowned as tablet additives which are soluble or collapse from the dosage form in fewer spans without the aid of water. The drawbacks of oral dosage forms are mainly difficulty in consuming by children and aged people and this can be avoided by rapid solubilizing tablets by the addition of SD. Because of non-reactive, no toxic, cheap, eco-friendly and effortlessly obtainable herbal SD are better compared to artificial SD. These natural SD have unique features in a dosage form as a binder, diluents and good dissolving capability for less hydrophilic drugs which affects the solubilizing rate and supplies as nutritional aids.

Keywords: Superdisintegrants, Disintegrants, Natural, Synthetic, Multifunctional Superdisintegrants

INTRODUCTION

Disintegrates are agents added to tablet and some encapsulated formulations to help the disintegration of the tablet and capsule "slugs' into smaller fragments in an aqueous environment there by increasing the available surface area and promoting a more rapid release of the drug substance. They promote moisture penetration and dispersion of the tablet matrix. Tablet disintegration has received considerable attention as an essential step in obtaining fast drug release. The emphasis on the availability of drug highlights the importance of the relatively rapid disintegration of a tablet as a criterion for ensuring uninhibited drug dissolution behavior. Number of factors affects the disintegration behavior of tablets. The disintegrants have the major function to oppose the efficiency of the tablet binder and the physical forces that act under compression to form the tablet. The stronger the binder, the more effective must be the disintegrating agents in order for the tablet to release its medication. Ideally, it should cause the tablet to disrupt, not only into the granules from which it was compressed, but also into powder particles from which the granulation was prepared. Disintegrants are an essential component to tablet formulations. The ability to interact strongly with water is essential to disintegrant function. Combinations of swelling and/or wicking and/or deformation are the mechanisms of disintegrant action. A disintegrant used in granulated formulation processes can be more effective if used both "intragranularly" and "extragranularly" thereby acting to break the tablet up into granules and having the granules further disintegrate to release the drug substance into solution. However, the portion of disintegrant added intragranularly (in wet granulation processes) is usually not as effective as that added extragranularly due to the fact that it is exposed to wetting and drying (as part of the granulation process) which reduces the activity of the disintegrant. Since a compaction process does not involve its exposure to wetting and drying, the disintegrant used intragranularly tends to retain good disintegration activity. There are three methods of incorporating disintegrating agents into the tablet: A. Internal Addition (Intragranular) B.External Addition (Extragranular) C. Partly Internal and External. In a direct compression process, drug is blended with a variety of excipients, subsequently lubricated and directly compressed into a tablet. A disintegrant used in this type of formulation, simply has to break the tablet apart to expose the drug substance for dissolution.[1,2]

Most common tablets are those intended to be swallowed whole and to disintegrate and release their medicaments rapidly in the gastrointestinal tract (GIT). The proper choice of disintegrant and its consistency of performance are of critical importance to the formulation development of such tablets. In more recent years, increasing attention has been paid to formulating not only fast dissolving and/or disintegrating tablets that are swallowed, but also orally disintegrating tablets that are intended to dissolve and/or disintegrate rapidly in the mouth. Most prior studies have focused on the function related properties of superdisintegrants with special emphasis on correlating these functional properties to disintegrant efficiency and drug release rate. Water penetration rate and rate of disintegration force development are generally positively related to disintegrant efficiency in nonsoluble matrices. However, such a positive correlation is not always observed between tablet disintegration time and drug dissolution rate.[3]

Fast disintegrating tablets mainly prepared by direct compression using superdisintegrants additions method. Disintegrants are substances or mixture of substances

added to the drug formulation that facilitates breakup or disintegration of tablet content into smaller particles that dissolve more rapidly than in the absence of disintegrants. Examples of superdisintegrants are crosscarmelose, crosspovidone, sodium starch glycolate which represent example of crosslinked cellulose, crosslinked polymer and a crosslinked starch respectively.[4,5] These are the commonly used synthetic origin superdisintegrants, similarly various natural origin substances like karaya, modified starch and agar have been used in the formulations of ODTs. The uses of natural origin substances are comparatively cheaper with desired properties like abundantly available, non-irritating and non-toxic in nature. Mucilage of *Plantago ovata* has various characteristics like binding, disintegrating and sustaining properties.[6]

Natural polymers are utilized in most of the dosage forms and are more favourable over artificial polymers as they have these advantages.[7]

- ✓ Reasonable
- ✓ Nontoxic
- ✓ Straightforwardly obtainable in the sufficient amount
- ✓ Lacking side effects
- ✓ Biodegradable
- ✓ More patient compliance
- ✓ Renewable

The given factors are to be kept in mind in the selection of a good SD.[8]

- ✓ Quantity of disintegrates present in a preparation
- ✓ Tablet hardness
- ✓ Kind of accumulation and mixing
- ✓ Drug nature
- ✓ Good flowability.
- ✓ Compressible to formulate intact tablets
- ✓ Good mouthfeel

MECHANISM OF SUPERDISINTEGRANTS

Superdisintegrants provide quick disintegration due to combined effect of swelling and water absorption by the formulation. Due to swelling of superdisintegrants, the wetted surface of the carrier increases, this promotes the wettability and dispersibility of the system, thus enhancing the disintegration and dissolution. The optimum concentration of the superdisintegrant can be selected according to critical concentration of disintegrant. Below this concentration, the tablet disintegration time is inversely proportional to the concentration of the superdisintegrant, whereas if concentration of superdisintegrant is above critical concentration, the disintegration time remains almost constant or even increases.[9]

- Swelling action
- Capillary action (Wicking)
- Deformation recovery
- Heat of wetting
- Chemical reaction (acid base reaction)
- Particle repulsive forces/ due to disintegrating particle
- Enzyme reaction

Swelling action

Swelling is widely accepted mechanism for tablet disintegration. Although water penetration is a necessary first step for disintegration. Particles of disintegrants swell on coming in contact with suitable medium the adhesiveness of the other ingredient in tablet is overcome causing the tablet to fall apart (fig. 1). Tablets with high porosity show poor disintegration due to lack of adequate swelling force. On the other hand, sufficient swelling force is exerted in the tablet with low porosity. It is worthwhile to note that if the packing fraction is very high, fluid is unable to penetrate in the tablet and disintegration is again slows down.[10]

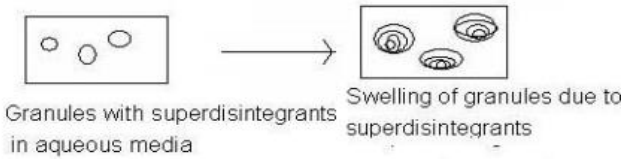

Figure 1: Swelling mechanism

Capillary action (Wicking)

Effective disintegrants that do not swell are believed to impart their disintegrating action through porosity and capillary action. Tablet porosity provides pathways for the penetration of fluid 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 (fig. 2).

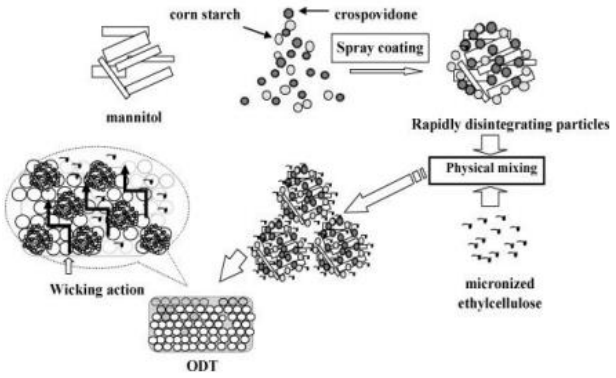

Figure 2: Capillary action

Water uptake by tablet depends upon hydrophilicity of the drug/excipient and on tableting conditions. 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.[11]

Deformation recovery

Hess had proved that during tablet compression, disintegrated particles get deformed and these deformed particles get into their normal structure when they come in contact with aqueous media or water (fig. 3). Occasionally, the swelling capacity of starch was improved when granules were extensively deformed during compression. In case of starch (such as potato starch and corn starch) are believed to be elastic in nature, but due to high compaction force in case of tableting the elasticity deformed to plasticity with energy rich potential. When these tablets are exposed to aqueous environment, the energy potential of deformed starch grain will be triggered to cause disintegration.[12,13]

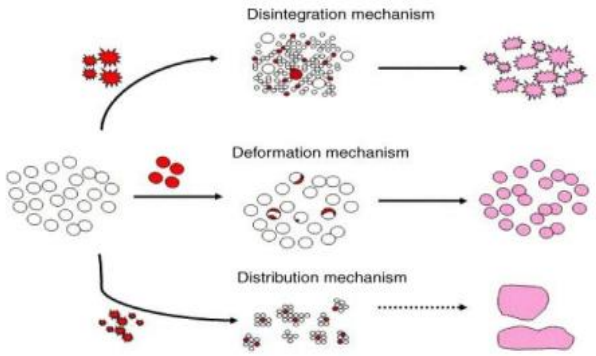

Figure 3: Deformation mechanism

Heat of wetting

When disintegrants with exothermic properties get wetted, localized stress is created due to capillary air expansion, which aids in disintegration of tablet. This explanation, however, is limited to only a few types of disintegrants and cannot describe the action of most modern disintegrating agents.[14]

Chemical reaction (acid base reaction)

By internal liberation of CO_2 in water due to interaction between tartaric acid and citric acid (acids) with alkali metal carbonates or bicarbonates (bases) in presence of water tablet quickly broken apart. The tablet disintegrates due to generation of pressure within the tablet. Due to liberation in CO_2 gas, the dissolution of active pharmaceutical ingredients in water as well as taste masking effect is increased. As these disintegrants are highly sensitive to small changes in temperature and humidity level, control of environment must be required during preparation of the tablets. The effervescent blend is either added immediately prior to compression or can be added in two separate fraction of formulation. The effervescent blend is added immediately before compression or can be added into two separate fraction of formulation. [14]

Particle repulsive forces/ due to disintegrating particle

This is another mechanism of disintegration that attempts to explain the swelling of tablet made with nonswellable disintegrants. According to Guyot-Hermann's particle-particle repulsion theory, water penetrates into tablet through hydrophilic pores and a continuous starch network is created that can convey water from one particle to the next, imparting a significant hydrostatic pressure (fig. 4). The water then penetrates between starch grains because of its affinity for starch surfaces, thereby breaking hydrogen bonds and other forces holding the tablet together. The electric repulsive forces between particles are the mechanism of disintegration and water is required for it. Researcher found that particle repulsion force is secondary to wicking.[11,13,15]

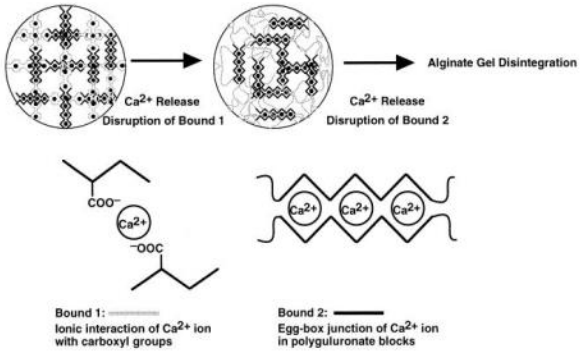

Figure 4: Electrostatic repulsion

Enzyme reaction

Enzymes present in the body also act as disintegrants. These enzymes dearth the binding action of binder and helps in disintegration (fig. 5). Due to swelling, pressure is exerted in the outer direction that causes the tablet to burst or the accelerated absorption of water leads to an enormous increase in the volume of granules to promote disintegration.[11] Various Superdisintegrant along with their mechanism of action and brand names as depicted in table 3.[13, 16-18]

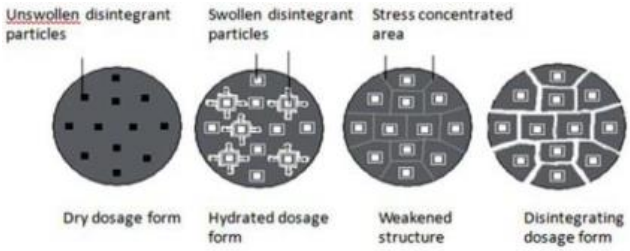

Figure 5: Enzymatic reaction

TYPES OF SUPERDISINTEGRANTS

1. Natural Superdisintegrants.
2. Synthetic Superdisintegrant.
3. Co – processed.

1. Natural Superdisintegrants

These are various plant based material. Plant based material serve as an alternative to synthetic products because of following reasons:-

- Local accessibility.
- Eco –friendly.
- Bio-acceptable.
- Renewable source and low price as compared to synthetic products.

Isapghula Husk Mucilage (*Plantago ovata*)

Isapghula Husk consists of dried seeds of the plant known as plantago ovata. The plant contains mucilage in the epidermis of the seeds. Mucilage of plantago ovate has different characteristics like binding, disintegrating and sustaining properties. Mucilage can be used as superdisintegrant to formulate fast dissolving tablets because it has very high percentage of swelling index (around 89±2.2%v/v) as compared to the other superdisintegrating agents. The rapid disintegration of the FDTs are due to the swelling of Superdisintegrants to create enough hydrodynamic pressure for quick and complete disintegration of the tablet. The rate at which swelling develops and significant force of swelling also determine its disintegrating efficiency. [19, 20]

Lepidium sativum Seed Mucilage

It is also known as a saliyo. Natural Lepidium sativum (family: Cruciferae), has wide application in pharmaceutical field as disintegrating agent and as herbal medicine. Seeds contain a major proportion of mucilage, dimeric imidazole alkaloids lepidine B, C, D, E and F and two new monomeric imidazole alkaloids semilepidinoside A and B. The mucilage can be extracted from seeds by different procedures and its yield varies from 14% to 22%. Mucilage of Lepidium sativum has various characteristic like binding, disintegrating, gelling etc. The extracted mucilage is used to develop fast dissolving tablets. Mucilage is found to be a brownish white powder which decomposes above 200°C and have characteristic odour evaluating its various physicochemical characteristics, the values of swelling index, angle of repose, bulk density and tapped density are estimated as following 18, 32°C, 0.58g/cc and 0.69g/cc respectively.[21]

Fenugreek Seed Mucilage

Trigonella Foenum-graceum (leguminous family). It is an herbaceous plant. It has found wide applications as a food, a food additive, and as a traditional medicine. The leaves and both the ripe and unripe seeds of *Trigonella foenum*-Graceum are used as vegetables. Fenugreek has been used in treating dyspepsia with loss of appetite, chronic cough, dropsy, enlargement of liver and spleen, rickets, colic flatulence, dysentery, diarrhoea, gout, and diabetes. It also used as gestro protective, antiurolihiatic, antidandruff agent, diuretic inflammatory agent and as antioxidant. The seed is stated to be a tonic. It also is used in post-natal care and to increase lactation in nursing mothers. Fenugreek seeds contain a high percentage of mucilage (a natural gummy substance present in the coatings of many seeds). Although it does not dissolve in water, mucilage forms a viscous tacky mass when exposed to fluids. Like other mucilage-containing substances, fenugreek seeds swell up and become slick when they are exposed to fluids. The resulting soft mass is not absorbed by the body, but instead passes through the intestines and triggers intestinal muscle contractions.[22, 23]

Gellan Gum (Kicogel)

Gellan gum is obtained from Pseudomonos elodea. It is a linear anionic polysaccharide biodegradable polymer consisting of a linear tetrasaccharide repeat structure as shown in Fig and is used as a food additive. Gellan gum as a superdisintegrant and the efficiency of gum is compared with other conventional disintegrants such as dried corn starch, explotab, avicel (pH 102), Ac di-sol and Kollidon CL studied by Antony et al. The disintegration of tablet might be due to the instantaneous swelling characteristics of gellan gum when it comes into contact with water and owing to its high hydrophilic nature. The complete disintegration of tablet is observed within 4 minutes with gellan gum concentration of 4 percent w/w and 90 percent of drug dissolved within 23 minutes. Ac-di-sol and Kollidone CL shows very similar pattern of disintegration and in vitro dissolution rates. With the same concentration tablet with explotab show 36 minutes for 90% of drug release and with starch show 220 minutes. From this result gellan gum has been proved itself as a superdisintegrant.[24]

Locust Bean gum

Locust bean gum also called Carob bean gum. It is extracted from the endosperm of the seeds of the carob tree Ceretoniasiliqua, which grows in Mediterranean countries. Some other familiar polysacharides are starch and cellulose, which are made of long chains of the sugar glucose. In locust bean gum, the ratio of mannose to galactose is higher than in guar gum, giving it slightly different properties, and allowing the two gums to interact synergistically so that together they make a thicker gel than either one alone. It shows as a binder and as a disintegrant property at different concentration. Locust bean gum has been widely used in food industry as a thickening and gelling agent. Locust bean gum has also been reported to have bio adhesive and solubility enhancement properties.[25, 26]

Chitin and Chitosan

Chitin (*β*-(1→4)-N-acetyl-D-glucosamine) is a natural polysaccharide obtained from crab and shrimp shells. It possesses amino group covalently linked to acetyl group as compared to liberate amino group in chitosan. Chitosan is produced commercially by deacetylation of chitin, which is the structural element in the exoskeleton of crustaceans (such as crabs and shrimp) and cell walls of fungi. Bruscato and Danti, 1978, reported that when chitin was included in

the conventional tablets, the tablets disintegrated within 5 to 10 minutes irrespective of solubility of the drug. The disintegration time in the oral cavity as well as wetting time could be analyzed by surface free energy. Chitosan is the best kenned natural polysaccharide utilized for its multifarious applications in pharmaceutical industry.[27]

Gum Karaya

Gum karaya is a vegetable gum produced as an exudates by trees of the genus *Sterculia*. Chemically, gum karaya is an acid polysaccharide composed of the sugars galactose, rhamnose, and galacturonic acid. The high viscosity nature of gum limits its uses as binder and disintegrant in the development of conventional dosage form. Gum karaya has been investigated for its potential as a tablet disintegrant. Different results showed that modified gum karaya produces rapid disintegration of tablets. Gum karaya can be utilized as an alternative superdisintegrant to commonly available synthetic and semisynthetic superdisintegrants due to its low cost, biocompatibility as well as facile availability.

Agar and Treated Agar

It is the dried gelatinous substance obtained from *Gelidium amansii* (Gelidanceae) and several other species of red algae like *Gracilaria* (Gracilariaceae) and *Pterocladia* (Gelidaceae). Agar is yellowish-gray or white to proximately colorless, inodorate with mucilaginous taste and is available in the form of divests, sheet flakes, or coarse powder. Agar consists of two polysaccharides, agarose and agar pectin. Agarose is responsible for gel vigour and agar pectin is responsible for the viscosity of agar solutions. High gel vigour of agar makes it a potential candidate as a disintegrants.

Soy Polysaccharide (Emcosoy®)

It is a natural superdisintegrants that does not contain any starch or sugar so can be utilized in nutritional products. Halakatti et al. 2010 evaluated soy polysaccharide (a group of high molecular weight polysaccharides obtained from soy beans) as a disintegrant in tablets made by direct compression utilizing lactose and dicalcium phosphate dihydrate as fillers. A cross-linked sodium carboxymethyl cellulose and corn starch was utilized as control disintegrants. Soy polysaccharide performs well as a disintegrating agent in direct compression formulations with results paralleling those of crosslinked CMC.

Mango Peel Pectin

Mango peel which constitutes 20–25% of the mango processing waste was found to be a good source for the extraction of pectin of good quality, felicitous for the preparation of film, and acceptable jelly. Pectin is an in volute heteropolysaccharide which is a hydrophilic colloid.[22] investigated and found that mango peel pectin stands as a good candidate as superdisintegrant, though not as more strong than synthetic superdisintegrants, but due to its good solubility and higher swelling index, it may be utilized in the formulation of fast dispersible tablets.

***Aegle marmelos* Gum (AMG)**

It is obtained from the fruits of *Aegle marmelos* belonging to the disintegrated faster and consistently than the croscarmellose sodium. The ripened fruit pulp is red in colour with mucilaginous and astringent taste. The pulp contains carbohydrates, proteins, vitamin C, vitamin A, angelenine, marmeline, dictamine, O-methyl fordinol and isopentyl halfordinol. AMG is prepared by heat treatment technique. It increases the solubility of poorly soluble drugs. It increases glucose level and glycosylated haemoglobin in diabetic patients, decreases plasma insulin and liver glycogen in diabetic patient, decreases lipid per oxidation, stimulates macrophage functioning, and causes significant deviation in the GSH (glutathione) concentration in liver, kidney, stomach, and intestine. Purified, bael gum polysaccharide contains D-galactose (71%), D-galacturonic acid (7%), L-Rhamnose (6.5%), and L-arabinose (12.5%).

***Ficus indica* Fruit Mucilage**

The mucilage of *Ficus indica* fruit is utilized as superdisintegrant which is obtained from the pulp of fruit *Ficus indica*. *Ficus indica* is an astronomically immense tree up to 3 meters and very fast-growing with spread branches and arial roots. The fruits of *Ficus indica* are of the size of cherry. It has nutritional as well as medicinal value. The dried and uncooked *Ficus indica* fruit gives 230 kcal (963 KJ) of energy per 100 gm or 3.5 oz. (ounce). It is utilized in assuaging fever, pain, inflammation, wound rejuvenating, blood quandaries, and urinary quandaries.

***Mangifera indica* Gum (MIG)**

Mundane name of *Mangifera indica* is mango, and it belongs to Anacardiaceae family. It is nontoxic and utilized as disintegrant, binder, suspending agent, and emulsifying agent in different formulations. The gum powder is white to off white in colour, and the powder was soluble in water and virtually insoluble in acetone chloroform, ether, methanol, and ethanol. It is facilely available, and gum is devoid of toxicity, and each and every component of the tree has pharmacological activity like diuretic, astringent, diabetes, asthma, diarrhea, urethritis, and scabies.

Hibiscus *Rosa sinensis* Mucilage and Treated Agar

It is withal called shoe flower plant, China rose, and Chinese hibiscus and belongs to the family Malvaceae. Mucilages are utilized as thickeners, suspending agent, water retention agent, and disintegrants. The plant is facilely available and its leaves contain mucilage and is present in mucilage L-rhamnose, D-galactose, Dgalacturonic acid, and D-glucuronic acid. Treated agar is yare by treating it with water for one day.

Dehydrated Banana Powder (DBP)

Banana is additionally called plantain. DBP is yare from the variety of banana called Ethan and nenthran (*nenthra vazha*) and belongs to the family Musaceae. It contains vitamin A, so it is utilized in the treatment of gastric ulcer and diarrhea. It withal contains vitamin B6, which avails in

reducing the stress and solicitousness. It is a very good source of energy due to high carbohydrate content, and it contains potassium, which is responsible for more preponderant brain functioning.

Cassia fistula gum

Seeds of Cassia fistula gum obtained from cassia fistula tree. Gum obtained from the seeds of Cassia fistula comprises β-(1→4) linked d-mannopyranose units with random distribution of _α (1→6) linked dgalactopyranose units as side chain having mannose: galactose ratio of 3.0). Carboxymethylation as well as carbamoylethylation of Cassia gum is reported to improve cold water solubility, improve viscosity and increase microbial resistance as compared to native gum Therefore, an attempt was made to incorporate calcium or sodium salts of carboxymethylated or carbamoylethylated C. fistula gum as superdisintegrant in the formulation development of FDT.

Cucurbita Maximum

Pulp Powder Malviya et al., carried of the evaluation of cuccurbita with diclofenac sodium and prepared various concentrations of 2.5, 5, 7.5, 10% and these also sent for various tested like friability drug content, drug disintegration time, and this study also proves that this is a good pharmaceutical adjuvant and disintegrating agent.

***Ocimum americanum* Seed Mucilage**

Patel et al prepared the propanolal hydrochloride tablets using *Ocimum americanum* seed mucilage using various concentrations like 2, 4, 6, 8, 10% the optimum concentration of mucilate for rapid dissolution is shown at 10% and the same concentration with starch and propanaolal hydrochloride is prepared and shows disintegration time of 269 seconds while ocimum shows the disintegration in 154 seconds. The hardness friability drug content is within limit

2. Synthetic Superdisintegrant.

Sodium Starch Glycolate (Explotab® and Primogel®)

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 predried starches swell in water to the 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. These are available as explotab and primogel which are low substituted carboxy methyl starches. The effect of introduction of the large hydrophilic carboxymethyl groups is to disrupt the hydrogen bonding within the polymer structure. This allows water to penetrate the molecule and the polymer becomes cold water soluble.[28]

Cross-linked poly-vinyl Pyrrolidone (Crosspovidone)

Unlike other superdisintegrants, which rely principally on swelling for disintegration, crosspovidone use a combination of swelling and wicking. Due to its high crosslink density, crosspovidone swells rapidly in water without gelling. Crosspovidone particles are found to be granular and highly porous which facilitates wicking of liquid into the tablet and particles to generate rapid disintegration. Larger particles provide a faster disintegration than smaller particles. Crosspovidone disintegrants are highly compressible materials as a result of their unique particle morphology. Crosspovidone can also be used as solubility enhancer. It is available in two particle sizes in the form of Polyplasdone XL and Polyplasdone XL-10.[28]

Modified Cellulose (crosscarmellose sodium, Ac-DiSol)

It is an internally cross linked polymer of carboxymethyl cellulose sodium. It has high swelling capacity with minimal gelling resulting in rapid disintegration .Due to fibrous structure, crosscarmellose particles also show wicking action. In tablet formulations, crosscarmellose sodium may be used in both direct compression and wet-granulation processes. When used in wet-granulation, the crosscarmellose 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.[29]

Resins (Ion Exchange Resin)

The INDION 414 and KYRON 314 have been used as a superdisintegrant for ODT. It is chemically cross-linked polyacrylic potassium (Polacrillin potassium), with a functional group of – COO – and the standard ionic form is K+. It has a high water uptake capacity. It is a high purity pharmaceutical grade weak acid cation exchange resin supplied as a dry powder. It is an extremely effective tablet disintegrant which provides the necessary hardness and chemical stability to the tablet. The product swells up to a very great extend when in contact with water or gastrointestinal fluids causing rapid disintegration without the formation of lumps. It is a high molecular weight polymer; therefore it is not absorbed by the human tissues and totally safe for human consumption.[10]

L-HPC (Low substituted hydroxyl-propyl cellulose)

Insoluble in water rapidly swells in water. Greatest degree of swelling exhibited by Grades LH-11 & LH-21. Certain grades while retaining disintegration capacity can also provide some binding properties. Recommended concentration 1-5%. The main advantages of synthetic super disintegrants are their efficacy in lower concentrations than starch, less interference with

compressibility and flow ability. They are also more effective intragranularly.[16, 30]

Advantages of Synthetic Superdisintegrant

- ✓ Effective in lower concentrations than starch.
- ✓ Less effect on compressibility and flow ability.
- ✓ More effective intragranularly.

Limitation Synthetic Superdisintegrant

- ✓ More hygroscopic (may be a problem with moisture sensitive drugs).
- ✓ Some are anionic and may cause some slight invitro binding with cationic drugs (not a problem in-vivo).
- ✓ An acidic medium significantly reduces the liquid uptake rate and capacity of sodium starch glycolate and crosscarmellose sodium, but not crospovidone.
- ✓ The degree of swelling of Primojel (sodium starch glycolate) and Polyplasdone XL101 (crosspovidone) is minimized following wet granulation formulation. Finally, the medium ionic strength was found to have an adverse effect on the swelling capacity of crosscarmellose.[11, 13, 15]

3. Co – processed blend of Excipients

It involves the mixture blend of more than two excipients to satisfy the required quality using different technique like spray drying and freeze drying etc.

Ludiflash

Ludiflash is an innovative, unique co-processed blend of Mannitol (95%), crosspovidone (5%) and polyvinyl acetate (5%) manufactured in a validated patented process. It disintegrates rapidly within seconds with soft, creamy consistency. It is specially designed for direct compression on standard high speed tablet machine for hard tablet with very low friability. It gives extremely fast release rate.

F-melt

F-MELT® is a spray-dried excipient used in orally disintegrating tablets that contain saccharides, disintegrating agent, and inorganic excipient. F-MELT exhibits excellent tableting properties and facilitates rapid water-penetration for a fast disintegration time.

Pharmaburst

Pharmaburst is a Quick Dissolving delivery system in which there is addition of active drug in a dry blend with Pharmaburst excipients and compress by tablet machine. Pharmaburst is a co-processed excipient system with specific excipients, which allows rapid disintegration and low adhesion to punches.

Mannogem EZ

Mannogem EZ is spraying dried Mannitol, specially designed for direct compression tablet. It has advantages of highly compatible, non hygroscopic, chemically inert, narrow particle size distribution and mainly rapid disintegration property benefits quick dissolve application. It is highly stable and inert to many of the chemical reactions which are problematic with lactose, microcrystalline cellulose, or starch.

Modified Chitosan with silicon dioxide

This is the new excipients based on co-precipitation of Chitosan and silica. The physical interaction between Chitosan and silica create an insoluble, hydrophilic highly absorbent material, resulting in superiority in water uptake, water saturation for gelling formation. Studies have shown that Chitosan–silica delivers superior performance in wet granulation formulations and is the only disintegrant that is effective at all concentrations in tablet formulation.

Modified Resins

Polacrilin Potassium (Tulsion 339)

It is a crosslinked polymer of methacrylic acid and divinylbenzene supplied as the potassium salt. Polacrilin potassium is weakly acidic cation exchange resin. On wetting, the resin swells by approximately 150 %, thereby causing the tablet to disintegrate. Tablet disintegration property is due to its extremely large swelling capacity in aqueous solutions. Water can exert force between particles within tablet pores, but this force is low. This is used effectively at 1-2% of solid dosage forms. It is bio compatible and non-toxic. It is available in various grades i.e., tulsion-335, tulsio-344, tulsion-345 and tulsion-412.

Modified Mannitol

Pearlitol 200 SD

These are the granulated Mannitol white, odourless, slightly sweet tasting, crystalline powder. It has a unique blend of exceptional physical and chemical stability, with great organoleptic, non-carcinogenic, sugar-free properties. Together with its versatile powder properties, it can be used in different processes wet or dry granulation, direct compression and compaction or freeze-drying. It has properties like flowability, excellent compressibility, non-hygroscopic and excellent chemical stability. Pearlitol SD dissolves very rapidly because of its porous crystalline particles.

Modified sugars

Glucidex IT

Glucidex IT is obtained by moderate hydrolysis of starch. It is micro granulated form enables almost instantaneous dispersal and dissolution in water. Different range of Glucidex IT products is available. All co-processed and modified excipients are playing a vital role in the development of easy dosage forms which are resistant to atmosphere. The improved physical, chemical and mechanical properties of such excipients as compared to existing excipients, have helped in solving formulation problems such as flowability, compressibility, hygroscopicity, palatability, dissolution, disintegration, sticking, and dust generation.

CONCLUSION

With the ongoing demand of novel drug delivery, the fast dissolving drug delivery system has become one of the mile stone of present research. Although, there are many superdisintegrants, the search for newer disintegrating agent is going and researcher are experimenting with multifunctional superdisintegrants like polyplasdone superdry, kollidone CL, kollidone CLF, kollidone CL-SF, kollidone CL-M, starch 1500, etc. Studies have suggested that ease of availability of these agents and the simplicity in the direct compression process developed more economic alternative in the preparation of orodispersible tablet than the sophisticated and patented techniques.

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