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A COMPREHENSIVE REVIEW ON SUPERDISINTEGRANTS: ACCELERATING DISSOLUTION FOR ENHANCED DRUG PERFORMANCE

Lalita Tyagia[1], Priyanshub[2]

[1]Department of Pharmacy, Meerut Institute of Engineering and Technology (MIET), Meerut-250005, U.P, India.

[2]Department of Pharmacy, Kalka Institute for Research and Advanced Studies (KIRAS), Meerut-250005, U.P, India.

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Abstract

To improve medication bioavailability and therapeutic efficacy, oral dosage forms must dissolve quickly and effectively. Drug release from solid formulations can be accelerated with the use of superdisintegrants, which are specialized chemicals that encourage disintegration. This study offers a thorough analysis of superdisintegrants, emphasizing their kinds, uses in pharmaceutical formulations, and modes of action. Superdisintegrants that speed up tablet breakdown, such as crospovidone, sodium starch glycolate, and croscarmellose sodium, enable quicker dissolving and absorption. Superdisintegrants are classified as natural, semi-synthetic, synthetic, and co-processed in the review, which also discusses their special qualities, benefits, and drawbacks. The physicochemical characteristics of the medicine and a number of other factors affect how well superdisintegrants promote disintegration. The drawbacks, such compatibility problems and possible impacts on medication stability, must be carefully considered despite their advantages. In addition, this review discusses current studies and potential directions for creating and using superdisintegrants

	for improved drug delivery systems. In order to facilitate the creation of high-performance medication formulations and enhance patient compliance and treatment results, this thorough review attempts to deepen our understanding of the roles and functions of superdisintegrants.

[1] INTRODUCTION

Due to its simplicity of production, compact size, and self-administration convenience, The most often utilized dosage form at the moment is the tablet.. Poor patient compliance results from the inability of elderly, young, and mentally ill patients to take traditional medications. Scientists have created a novel medicine delivery method called mouth dissolving/disintegrating tablets to get over these issues.[13]

The term "tablet disintegration" describes the fragmentation of a compacted tablet into several pieces upon encountering an aqueous liquid.[1] They could cause swelling and tablet disintegration by pulling water into the tablet. Superdisintegrants provide rapid disintegration because due to the combined effects of water absorption and swelling. [2] To reveal the therapeutic ingredient for dissolving, a disintegrants utilized this kind of formulations just needs to shatter the tablet. For the formulation creation of such tablets, the appropriate disintegrant selection and consistency of performance are crucial.[3]

The perfect characteristics for superdisintegrants:.

1. Disintegration quickly.
2. Excellent flow and molding qualities.
3. There is relatively little solubility in water.
4. More effective in producing more effective activity at very low concentrations
5. It shouldn't be prone to forming drug compounds.
6. It should have favorable tableting qualities and work well with the other excipients.[2]
7.When administered, they don't need water or any other liquids.
8. They ought to combine and break up into little pieces with ease.
9. The unpalatable taste of the medication or substance should be covered up or improved.
10. They ought to be heavily loaded with drugs.
11. They need to have a satisfying oral experience.
12. Following dosing, their oral cavity should have little to no residue.
13. They ought to be as insensitive as possible to external factors like temperature, moisture, and so on.
14. They should be simple to administer to patients who are recalcitrant and mentally ill.
15. They ought to be transportable without any concerns about fragility.
16. At the lowest possible cost, they must be produced using standard tablet processing and packaging equipment.
17. It must have a compressibility index, fantastic hydration ability, and extremely good particle size.
18. It must make tablets that are more compact and less friable.
19. It ought to taste well and be harmless.[4]

[2] FACTORS TO TAKE INTO ACCOUNT WHILE CHOOSING SUPER DISINTEGRANTS

1.**Disintegration:** The disintegrant must quickly wick saliva into the tablet, producing the necessary volume expansion and hydrostatic pressure, to allow for quick breakdown in the mouth.[14]

2.**Compactibility**FDT with a suitable hardness and decreased friability at a given compression force is recommended to produce robust tablets that do away with the requirement for specialized packaging while maximizing production speed.[15]

3.**Mouthfeel**: Large particles may cause the mouth to feel grainy. Small particles are therefore desired. However, if the tablet becomes gel-like when it comes into touch with water, it creates a sticky feel that many customers find disagreeable. [16]

4**.Flow**: Super disintegrating agents are used at weight percentages ranging from 2 to 5% in tablet formulations.. The disintegrant amount can be considerably increased using FDT formulation [12].

Merits of Superdisintegranting agents:

1. A notable propensity for wetness that leads to quick breakdown.
2. There is no lumping upon disintegration.[17]
3. Compatible with excipients and medicinal agents that are often utilized.
4. They doesn't stick to the punches and dyes.
5. Tendency to Workable at reduced concentrations.[18]
6. Less impact on flow capacity and compressibility.
7. More efficient at the intragranular level.
8. Because they are anionic, some of them may somewhat bind to cationic medications in vitro.
9. They are Biodegradable.[19].

Demerits of Superdisintegranting agents:

1. Pricey.
2. Both delicate and taking time.
3. Naturally hygroscopic and more hypersensitive.[5]

Different categories of superdisintegrants:

1) Naturally found superdisintegrants.
2) Synthetically obtained superdisintegrants.
3) Semi-Synthetic superdisintegrants.
4) Co-processed superdisintegrants.

1)Natural polymers for tablets that dissolve quickly(Natural Superdisintegrants):

a) **Chitosan and chitin:**

Chitin is made up of poly-β(1–4)-N acetyl-D-glucosamine, which is a linear amino polymer. [32] The natural polysaccharide is produced from crab and shrimp shells. It is composed of an amino group that has been covalently attached to the acetyl group, as opposed to the independent amino group present in chitosan. [22]

Following chitin's deacetylation, chitosan is created. Current research is being done on the uses of chitosan in wound healing [35], tissue engineering technologies [34], medication delivery [33], and other areas. Chitosan has also been utilized in several investigations to replace other materials in electrical applications, including transducers, actuators, and sensors [36]. Free energy at the surface might be used to investigate wetting time and the DT in the oral cavity. Because of its many uses in the pharmaceutical sector, chitosan is the best-known natural polysaccharide.

b) Guar gum:

The bulk of guar gum is composed of high- molecular-weight (about 50,000–8,000,000) polysaccharides derived from galactomannans.. Most parts of globally (Like the European union, United State of America, Australia, and Japan) have authorized it for use as a thickening agent, stabilizing agent, and emulsifying agent. It's gum that grows organically. It is a neutral polymer made out of sugar units that is free flowing, completely soluble, and permitted for use in food. It is not affected by the dissolution of the tablet matrix, pH, or moisture levels. It is not usually perfectly white; in alkaline tablets, it can occasionally go from white in color to brown and tend to tarnish with time.[22]

c) Gum karaya:

A gum made of vegetables known as gum karaya is created by Sterculia trees as an exudate.
Due to its intense viscosity, gum cannot be used as a binder or disintegrant in conventional dosage forms. Research has been done on gum karaya's potential as a tablet disintegrant.
Numerous studies showed that customized gum karaya accelerates the dissolution of tablets.. Gum karaya's affordability, biocompatibility, and ease of availability make it a viable substitute for widely used synthetic and semisynthetic superdisintegrants. [20]

d) Agar and treated agar:

It is the dry gelatin-like material that is extracted from several red algae species, such as Pterocladia (Gelidaceae) and Gracilaria (Gracilariaceae), as well as Gelidium amansii (Gelidanceae). Agar is available as coarse powder, sheet flakes, or divests. It is white to almost colorless, yellowish-gray, odorless, and has a mucilaginous taste. Agar is composed of two polysaccharides: agarose and agar pectin. Agar is a good choice for disintegrants because of its high gel vigor.

e) Fenugreek seed mucilage:

Trigonella foenum-graceum, a kind of herb belonging to the leguminous family, is usually referred to as fenugreek. Mucilage, a naturally occurring sticky material found in the coats of many seeds, makes up a large portion of fenugreek seeds. Mucilage does not dissolve in water, but when it comes into contact with liquids, it becomes a viscous, sticky substance. When fenugreek seeds are exposes to the liquids, they swelling up and became slippery, just like other materials that contain mucilage.
According to the study, fenugreek mucilage, a natural disintegrant, had greater preponderant disintegration properties than Ac-di-sol, a synthetic superdisintegrant that is most frequently employed in FDT formulations. According to studies, the obtained mucilage is a breaking agent and a useful medicinal adjuvant.

f) Soy polysaccharide :

This naturally obtained superdisintegrant can be used in nutritious goods because it doesn't include any sugar or starch Using lactose and phosphate of dicalcium dihydrate as additives, soy polysaccharide, a family of high-MW polysaccharides produced from soybeans, was evaluated as a disintegrant in tablets made by direct compression.. In the direct compression formulations, soy polysaccharide works effectively as a disintegrating agent, producing results that are similar to linked CMC's.

g) Gellan gum:

The bacteria Pseudomonas elodea generates gellan gum, a soluble in water, polymer. Gellan gum is a deacetylated exocellular gum made of polysaccharides with a high molecular weight and an anionic nature. Gellan gum was investigated as a disintegrant by Antony and Sanghavi in 1997. The gum's effectiveness was contrasted other commonly used disintegrants, which includes dry maize starch, Explotab,

Ac-di-sol, Avicel (pH 10.2), and Kollidon CL. The tablet's disintegration may be caused by gellan gum's high hydrophilia and its ability to expand instantly

when water comes into touch with it. The tablet's ultimate disintegration demonstrated itself to be a superior disintegrant.

h) Mango peel pectin:

It was discovered that mango peel, by makes up 20 to 25% of the waste generated during the processing of mangos, is a useful source for extracting high-quality pectin that is suitable for making film and palatable jelly. Despite not being as potent as synthetic superdisintegrants, investigations revealing that Pectin from mango skin is a promising agent for use as a superdisintegrant. Its high swelling index as well as excellent solubility make it suitable for use in the production of rapidly dissolving tablets.

i) Mucilage of Lepidium sativum:

It is Known as Asaliyo, L. sativum (family: Cruciferae) is used extensively as a herbal medicine in India. It is widely available on the market and reasonably priced. Among the ingredients are seeds, oil, roots, leaves, and so on. Seeds have higher amounts of mucilage, two initial monomers imidazole alkaloids (semilepidinoside A and B), and dimeric imidazole compounds (alkaloids) (lepidine B, C, D, E, and F). Mucilage from L. sativum has many different qualities, such as binding, dissolving, gelling, and so on.

j) Mucilage from Plantago ovata seeds:

Psyllium and ispaghula are common names for multiple species of plants in the genus Plantago which seeds are utilized commercially to make mucilage.

Plantago ovate mucilage has a variety of qualities, including the ability to bind, disintegrate, and maintain. In one study, various quantities of Plantago ovate mucilage were used as natural superdisintegrants to create fast-dissolving amlodipine besylate tablets using the direct compression method.

k) Aegle marmelos gum (AMG):

It is derived from the fruits of A. marmelos, which decompose more swiftly and consistently than croscarmellose sodium. The scarlet, mature berry pulp is an astringent, mucilaginous flavor. The carbohydrates, amino acids, dictamine, angelenine, marmeline, O-methyl fordinol, isopentenyl halfordinol, and vitamins C and A everything found in the pulp. Treatment from

the heat method used to produce AMG. Which makes poorly soluble medications more solubleL-rhamnose (6.5%), D-galactose (71%), D-galacturonic acid (7%), and L-arabinose (12.5%) are all present in purified bael gum polysaccharides.

l) Locust bean gum:

We call it cocoa bean gum. The carob tree's (Ceratonia siliqua) seeds are the source of this galactomannan vegetable gum. In the food sectorLocust bean gum is used as a bioadhesive that increases solubility and as a thickener and gel-forming agent.. The gum is odorless powder that ranges from white to yellowish-white. The majority of organic solvents, including ethanol, do not dissolve it. It is somewhat soluble in room temperature water and soluble in hot water, but it has to be heated to a temp over 850 for ten minutes to become fully soluble. [23]

m) Ficus indica Fruit Mucilage:

The ficus indica fruit's pulp is used to make the sticky substance, which is used as a superdisintegrantFicus indica is a tree of enormous size that may reach a height of three meters. It grows quickly, with extended branches and aerial roots. Cherry-sized fruits are produced by the ficus indica plant. It has nutritional as well as medicinal advantages. Ficus indica fruit, dried and uncooked, has 230 kcal (963 KJ) per 100 grams, or 3.5 ounces. It is employed to treat fever, pain, inflammation, wound regeneration, blood issues, and urinary issues.

n) Mangifera indica gum:

M. indica is a part of the Anacardiaceae family and is called by its Mundane name, mango. It is a non-toxic disintegrant, adhesive agent, suspended agent, and emulsifying agent that is utilized in a variety of compositions. The gum powder is soluble in water but practically insoluble in alcohol, methanol, ether, acetone, and chloroform. It has a white to off-white color..[21]

o) Hibiscus rosa-sinensis mucilage and treated agar:

It belongs to the family Malvaceae and is sometimes called the China rose, shoe flower plant, or Chinese hibiscus. The mucilage serves as a thickening agent, a disintegrant, a suspending agent, and a water-retention agent. The mucilaginous leaves of the plant, which contains D-galactose, D-rhamnose, D-galacturonic acid, and D-glucuronic acid, are freely accessible. The term "treated agar" refers to agar that has been soaked in water for a day.

p) Dehydrated banana powder (DBP):

Another name for bananas is plantains. DBP is a member of the Musaceae family and comes from the Ethan and Nethran (Nenthra vazha) banana varieties. It is use to cure diarrhea and gastric ulcers since it includes vitamin A. Additionally, it includes vitamin B6, which helps to lower stress and solicitousness. Its high level of carbohydrates makes it a great energy source, and potassium, which is in charge of more dominant brain activity, is also present.[7]**3.**

2) Synthetic Superdisintegrants:

a) **Crospovidone, Polyplasdone XL, and XL10 are examples of cross-linked polyvinylpyrrolidone:**

Crospovidone produces disintegration by combining swelling and wicking. It expands rapidly in water with out gel-forming because to its high crosslink density. Granular and very porous, crospovidone particles allow fluids to seep into the tablet and cause fast disintegration; in

general, larger particles disintegrate more quickly than smaller ones.[24, 25] Crospovidone's distinct particle shape makes it a highly compressible material. Crospovidone, which comes in two particle sizes such as XL and XL-10 Polyplasdone, is also utilized as a solubility enhancer.

b) Avicel, or microcrystalline cellulose:

Avicel disintegrates quickly at concentrations below 10%. This method weakens the hydrogen connection between neighboring bundles of cellulose microcrystals by permitting water molecules to pass via capillary holes into the tablet matrix. Higher concentrations may cause it to adhere to the tongue because of the tablet's surface's quicker drying and capillary absorption. When combined with starch, microcrystalline cellulose's quick water wicking rate might make it a great and quick disintegrant. [26,27]

c) Modified Cellulose (Croscarmellose sodium, Ac-Di- Sol):

According to certain theories croscarmellose sodium is a interconnected carboxymethyl cellulose polymer. A structure and production of this polymer differ from those of sodium starch glycolate. Croscarmellose sodium receives a higher degree of substitutions than sodium starch glycolate when using Williamson's ether synthesis, and the crosslinking process is unique.. Since part of the carboxymethyl groups in sodium starch glycolate are used to crosslinking the cellulose chains, their chemistry differs from that of croscarmellose sodium. For instance, in contrast to croscarmellose sodium, Primogel cross-links via phosphate ester other than carboxyl ester linkages. [28, 29] Croscarmellose sodium is used in tablet disintegrants at levels of up to 5% w/w, 2% w/w in tablets produced by direct compression, and 3% w/w in tablets produced by the wet granulation process.[30] This polymer of CMC sodium is internally cross-linked. It breakdown quickly because to its high swelling capacity and low gelling.[31] Because of their fibrous nature, croscarmellose particles also exhibit wicking activity. Both wet granulation and direct compression can employ croscarmellose sodium. Because of its wicking and swelling properties, croscarmellose sodium can be applied in both intra and extragranular processes.

d) Sodium Starch Glycolate SSG(Explotab, Primogel):

The Na+ derivative of the carboxymethyl ether starch is sodium starch glycolate. These modified starches have high disintegration qualities and are made by cross-linking potato starch. For the superdisintegrating effect, the degree of substitution and cross-linking are crucial variables. [39, 40] Cross linking has the effect of decreasing the polymer's Water Soluble percentage as well as its water dispersion viscosity. The volume of the modified starches increases by 200–300% in water, while the native pre-dried starches swell by 10–20%. This process is caused by the fast absorption of water, which greatly increases the granules' bulk and induces their rapid, even disintegration.

They come in the form of low substituted carboxymethyl starches called Primogel and Explotab.[41] When big water loving carboxymethyl groups are added, the H+ bonds inside the polymer structure are broken. As a result, the polymer become soluble in cold water and water may enter the molecule.[39]

e)Resins:

Despite being insoluble, resins operate as disintegrants because of their strong affinity for water. Additionally, they are superdisintegrant due to their rapid rate of swelling caused by their tiny

particle size. They provide the pills strength in addition to not lumping like traditional disintegrants do. Ion exchange resins have been pushed for use in drug delivery systems due to their physicochemical stability, benign nature, uniformly sized spherical shape that facilitates coating, and equilibrium driven reproducible release of drugs in an ionic environment Ion exchange resins are insoluble polymers with basic or acidic functional groups that have the ability to exchange counter-ions in the surrounding aqueous solutions.[42]

As can be seen below, free drug molecules diffuse out of the resins after the release of drug molecules attached to the resins by the appropriate charged ions in the gastrointestinal tract.

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

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

where X and Y are ions in the digestive system.

f) Calcium Silicate:

It is a light-weight very porous superdisintegrant that works via wicking. [43]

g) Ion Exchange Resins:

The typical ionic form of INDION 414 is K+, and it is a chemically linked together polyacrylic having an amino group of –COO–. It can absorb a lot of water. Oral dissolving pills employ it as a superdisintegrant. This dry powder is a mild acid cation exchange resin. With an efficient disintegration action, it gives the tablet the required hardness and chemical stability. When dosage forms come into touch with water or gastrointestinal fluids, they expand to a large extent and quickly disintegrate without lumping. Because it cannot be absorbed by human tissues, this high molecular mass polymer is safe for human consumption..[8]

h) Semi-Synthetic Superdisintegrants: A substance which is partially manufactured by organic substances and slightly altered chemically to improve its disintegration capabilities in pharmaceutical formulations is known as a semisynthetic superdisintegrant. These substances are appropriate for a variety of dosage forms where quick dissolution and disintegration are crucial because they combined the benefits of natural materials with customized properties achieved by chemically modification.[37]

i) Co-processed Superdisintegrants:

A specific kind of additive utilized in pharmaceutical preparations, especially in solid oral dosage forms. example tablets and capsules, is known as a co-processed superdisintegrant. Co-processed superdisintegrants, as opposed to single-component superdisintegrants, are made by mixing two or more separate excipients using a particular manufacturing procedure to improve their disintegrant performance and functionality. Co-processed excipients work in concert to improve tablet dissolving and disintegration rates, which in turn increases patient compliance and medication bioavailability.[38]

Mechanism of action (MOA) of Super disintegranting agents:

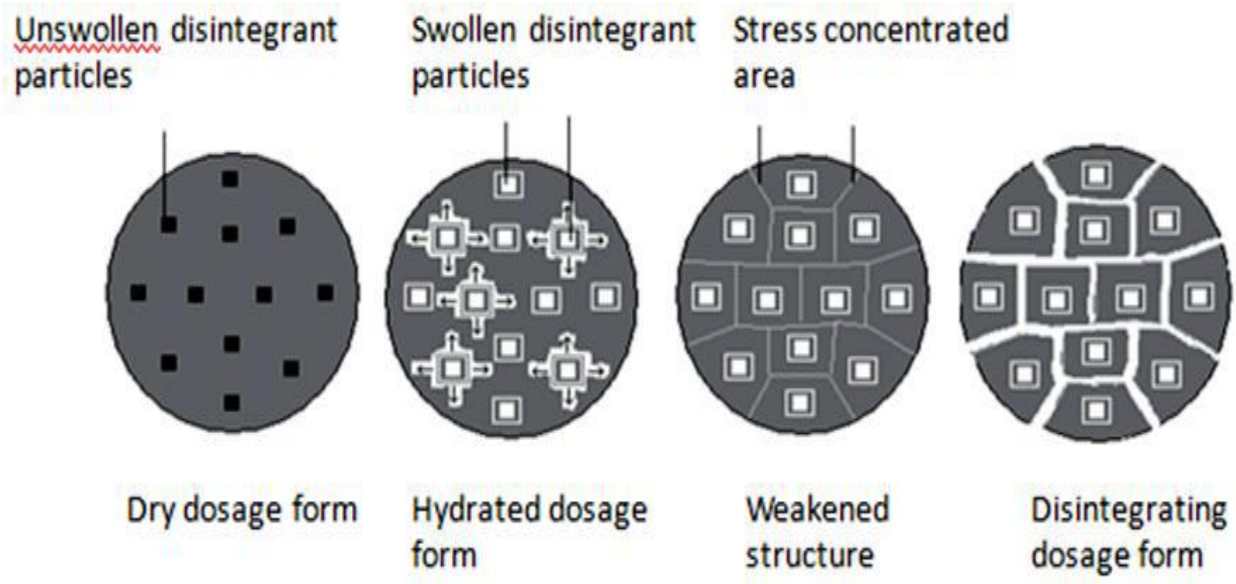

Figure-1: Disintegration Mechanism of Superdisintegrant Materials [11].

1. Swelling.
2. Porosity and capillary action (wicking).
3. Combination action.
4. Heat of wetting.
5. Deformation.[2]
6. Enzymatic reaction.
7. Due to disintegrating particle/particle repulsive forces[9]
8. Electrostatic repulsion.[10]

(a) **Swelling**: It is thought that some disintegration substances, including starch, give the dissolving action through a mechanism called swelling. Swelling overcomes the stickiness of other ingredients in a tablet. when it comes into touch with water, which causes the tablet to crumble.

Example: Sodium starch Glycolate

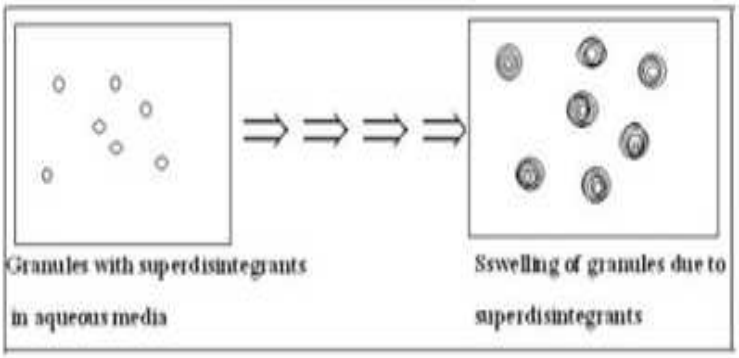

Figure-2: Swelling of granules due to superdisintegrants [9]

(b) Porosity and Capillary Action (Wicking): The disintegration activity of effective disintegrants that do not expand is thought to be imparted by capillary action and porosity. Fluid

can enter tablets through the channels provided by tablet porosity. These paths into the tablet are made possible by the disintegrant particles themselves, which have limited cohesion and compressibility. Through capillary action, fluid is pulled up, or "wicked," into these routes, rupturing the interparticulate linkages and shattering the tablet. For instance, crosscarmillose and crospovidone.[9]

(c) Combination Action: The pills are broken down by the combined action of the swelling mechanism and type wicking.

(d) Heat of wetting: Whenever exothermic Wet disintegrating agents cause locally stress because due to expansion of capillary air, thus facilitates tablet breakup. The behavior of most modern disintegrants can only be partially explained by this method of action.[2]

(e) Deformation process: Most people believe that starch granules are "elastic," This implies that they will return to their former shape when pressure is applied. However, these grains are thought to be more permanently damaged due to the compress forces involves in tableting, and they are described as "energy high" with the energy being released when the grains come into contact with water. Stated differently, "energy rich" starch granules have a greater capacity to expand than do starch grains have not undergone pressure-induced deformation.

(f) By Enzymatic Reaction: Enzymes found naturally in the body also act as disintegrants. These enzymes enhance the binding action of the binder and help in breakdown. Due to swelling, external pressure is exerted, which causes the tablet to burst, or the granule volume increases dramatically due to fast water absorption, which promotes disintegration..[9]

(f) Due to disintegrating particle/particle repulsive forces: The swelling of tablets prepared with "non swellable" disintegrants is attempted to be explained by another disintegration process. Guyot-Hermann created a particle repulsion hypothesis after discovering that non-swelling particles also play a role in tablet disintegration. The method of disintegration, which involves the electric repulsive interactions between particles, requires water.. Researchers discovered that wicking takes precedence over repulsion. The majority of disintegrants are thought to work through a variety of mechanisms. Instead, it is most likely the outcome of these key processes' interactions with one another.[9]

(g)Electrostatic repulsion: Particles that don't swell are another reason why tablets disintegrate. Water is necessary because in disintegration processes relies on electrictrostatic repulsive interactions between particles. Researchers found that wicking is more significant than repelling.[10**]**

[3] TECHNIQUES FOR INCLUDING DISINTEGRANTS IN TABLETS:

1. Internal Addition (Intragranular): The disintegrant is mixed with additional powders and then soaked in the granulating fluid as part of the internal addition procedure, sometimes referred to as intragranular addition. Consequently, the disintegrant is present in the granules..

2. External Addition (Extragranular): This technique involves adding the disintegrant into the sized granulation before compressing it**.**

3. Partially Internal and External: This method enables the insertion of disintegrant both internally and externally. The tablet is immediately broke up into previously compacted

granules as a result, and the internal dissolving ingredient in the granules further erodes them back to their parent powder fragments. Unlike the traditional method of only applying the disintegrant on the granulation surface, the two-step procedure often results in better and more thorough disintegration.[11]

Recent research on the use of several superdisintegrating agents to speed up the pace at which certain medications dissolve:

i) Formulation and Evaluation of Atorvastatin Calcium Fast-Dissolving Tablets with Starch Malonate:

The formulations including 6% starch malonate, 44% microcrystalline cellulose, 35% mannitol, 4% magnesium sterate, 1% talc, and 1% atorvastatin showed a disintegration time of 21 seconds, outperforming formulations containing crosspovidone and croscarmellose sodium. The FDTs containing starch malonate also showed rapid disintegration and dissolution. Starch Malonate demonstrated its better disintegration capability by having the quickest wetting time, followed by crosspovidone and CCS. The ability of the disintegrants to swell in very little water was demonstrated by the correlation between In the oral cavity, the wetting and disintegration times. Because of the fast particle breakdown and rapid drug absorption into the dissolving media, in vitro experiments showed that the medication dissolved quickly—within 10 minutes.[44]

ii) Creation and Assessment of Natural Super Disintegrants for Mouth Dissolving Tablets:

The Xanthan gum and the Guar gum, two natural super disintegrants, were used in varying concentrations to make the tablets. Dexamethasone and Super disintegrants do not interact, according to the results of the FTIR and DSC analyses. The proportion of drug releases increases with the amount of natural Super disintegrants, and order of drug release is 1%<2%<3%. With a soaking period of 47–160 seconds, the disintegration time of 38.33–63 seconds demonstrates that MDT may break down rapidly even in the absence of water. ratio of water absorption between 0.55% and 0.94 percent. For every formulation, the proportion of drug releases ranged between 99.36% to 106.39%.[45]

iii) Formulation and assesment of flurbiprofen fast disintegrating tablets with the help of natural superdisintegrants: They came to the conclusion that the pill broke up quickly within the allotted time when utilizing natural disintegrants such as plantigo ovata seeds, lepidium sativum seeds, and agar agar. The tablet has an advantage for in vitro bioavailability as it releases the medication entirely in a little amount of time. This demonstrates that using natural superdisintegrants, as opposed to synthetic ones, also results in a successful disintegration, and the formulation is also proven to be stable for a lengthy period.[46]

iv) Using several superdisintegranting agents in the formulation, development, and assessment of piroxicam orodispersible tablets:

They find that, in comparison to all other formulations, 5% concentration of croscarmellose sodium provides the rapid disintegration and highest percentage of drug releasing. This is because crospovidone and Na+ start glycolate are superdisintegrants in various preparations.[47]

v) In formulation and assesment of Aceclofenac fast dissolving tablet (FDT) with the help

of using natural and synthetic disintegrants: They check the activity of superdisintegrant like Fenugreek seed powder as natural disintegrant and sodium starch glycolate, crospovidone and croscarmellse sodium as the synthetic superdisintegrants. They concluded that natural superdisintegrant fenugreek gives more promissable results than synthetic formulations and confirm that the natural super disintegrants have amicable caliber in fast dissolving nature of aceclofenac.[48]

vi) In design Optimisation and assesment of acyclovir fast dissolving tablets (FDT) employing starch phthalate – a novel superdisintegrants:

The results of this study showed that starch phthalate is a new superdisintegrant with good disintegration properties. The combination of 5% croscarmelose sodium, 5% crospovidone, and 10% starch phthalate was shown to have a much higher dissolving efficiency in just one minute. Therefore, while making fast-dissolving tablets, starch phthalate can be utilized as an efficient disintegrant.[49]

vii) How core-processed superdisintegrants improve nifedipine's rate of dissolution in sublingual tablets :

This study found that nifedipine was compatible with both regular and co-processed superdisintegrants as a medication excipient. According to Pharmacopoeia, every formulation satisfied the pre- and post-compression evaluation criteria. The combination of SSG and Crospovidone was shown to be more efficient than other combinations.[50]

viii) Favirapir pills that dissolve in the mouth using a superdisintegrant: preparation, optimization, and in vitro assessment:

They discovered that the optimal formulation in terms of disintegration and dissolve rate is a mixture of 5% crospovidone, 5% croscarmelose sodium, and 5% sodium starch glycolate.[51]

Several challenges can present by using superdisintegrants in pharmaceutical formulations, including:

(a) **Compatibility Issues:** The stability, effectiveness, or shelf-life of the finished product may be impacted by interactions between superdisintegrants and other excipients or active pharmaceutical ingredients (APIs).

(b) **High Sensitivity to Moisture:** A lot of superdisintegrants are extremely hygroscopic, including sodium starch glycolate and crospovidone. Premature swelling brought on by moisture exposure might lessen the disintegration process's efficacy and uniformity.

(c) Cost Implications: Superdisintegrants are often more expensive than conventional disintegrants, which affects the total manufacturing budget, particularly when utilized in formulations with large volumes.

(d) Dosing Challenges: To guarantee homogeneity and consistency, superdisintegrants need to be dosed precisely. While underuse may result in insufficient disintegration, overuse may cause fast disintegration, which might compromise the medication release profile.

(e) Effect on Tablet Hardness: Superdisintegrants may weaken the structural integrity of tablets or lessen their hardness, increasing their vulnerability to breaking during handling, storage, or transit.

(f) Complexity of Formulation: Adding superdisintegrants may require modifying other formulation ingredients. For instance, they may impact the tablet's compressibility and need

adjusting the binding agents or compression force.

(g) Environmental Conditions: Superdisintegrants' efficacy can be greatly impacted by variations in temperature, humidity, or storage conditions, therefore careful handling and storage are crucial.

[4] CONCLUSION

Superdisintegrants are now essential in contemporary pharmaceutical formulations because they greatly increase the rates at which oral dosage forms dissolve, boosting medication bioavailability and therapeutic efficacy. By classifying superdisintegrants into four categories—natural, semi-synthetic, co-processed and synthetic—this study draws attention to the unique benefits, workings, and constraints of each kind. Superdisintegrant technological advancements, such as the creation of multifunctional agents and specialized disintegration methods, present encouraging opportunities for improving medication release profiles. The necessity for careful formulation techniques is highlighted by issues like compatibility with active medicinal components and possible effects on medication stability. Future studies that concentrate on improving superdisintegrants and tackling these issues can increase their applicability and produce more dependable and effective medication delivery methods. All things considered, improving high-performance formulations, encouraging greater patient compliance, and attaining better therapeutic results need a deeper comprehension and judicious use of superdisintegrants.

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[8] PLAGIARISM POLICY

The authors declare that any kind of violation of plagiarism, copyright, and ethical matters will be handled by all authors. Journalists and editors are not liable for the aforesaid matters.

[9] CONFLICT OF INTEREST

The authors declared that no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

[10] PROTECTION OF RESEARCH PARTICIPANTS

This study do not involve any such criteria or condition.

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