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# NATURAL SUPER-DISINTEGRANT AGENTS USED IN VARIOUS ORAL SOLID DOSAGE FORMS- REVIEW

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## ABSTRACT
Super-disintegrating agents are one of the ingredients used in pharmaceutical solid dosage forms. These substances play vital role in formulation design. Natural super- disintegrants have gained more popularity due to their oral bioavailability. It disintegrates the tablets into smaller particles to enhance the dissolution rate. Fast dissolving, chewable tablets, and other orally administered dosage forms consist of super-disintegrating agents which shows rapid and quick action. Natural super disintegrating agents in pharmaceutical dosage forms are very effective due to their eco-friendly nature as well as these are biocompatible and biodegradable. These are abundantly and cheaply available from nature. Today the researchers are focusing on naturally available excipients.

**KEYWORDS:** Natural Super disintegrants, Disintegration, Bioavailability, Biocompatible, Biodegradable.

## INTRODUCTION
The active pharmaceutical components (with therapeutic activity) and excipients (diluents, binders, disintegrants, etc.) that aid in drug administration and release at the intended site of action are combined to make oral solid dosage forms. In a split second, the super disintegrant makes it easier for the tablets to break down in the buccal cavity without making swallowing difficult when saliva is present. The word "super disintegrant" implies superior disintegration, as implied by its name. Super disintegrants are materials that help reduce the disintegration time (DT) even at low concentrations, usually between 1 and 10% by weight in relation to the dosage unit's total weight. Gums (locust bean, chitin, and chitosan) and mucilage (ispaghula husk, cress, gum karaya, fenugreek seeds and powders) are examples of natural super disintegrants.[1]

### 1.1. Advantages of Natural super disintegrants[2]
- Easily available
- Economic
- Biocompatibility & biodegradability
- Increases patient compliance.
- Non- irritant and non-toxic
- Offer secure and effective drug delivery systems in the patients.

### 1.2. Disintegration of oral solid dosage forms based upon
- Quantity of super disintegrant subjected in the formulation.
- Methods involved in the addition of super disintegrant.
- Compatibility of super disintegrants with drug and other additives.

### 1.3 Methods involved in the addition of super disintegrants

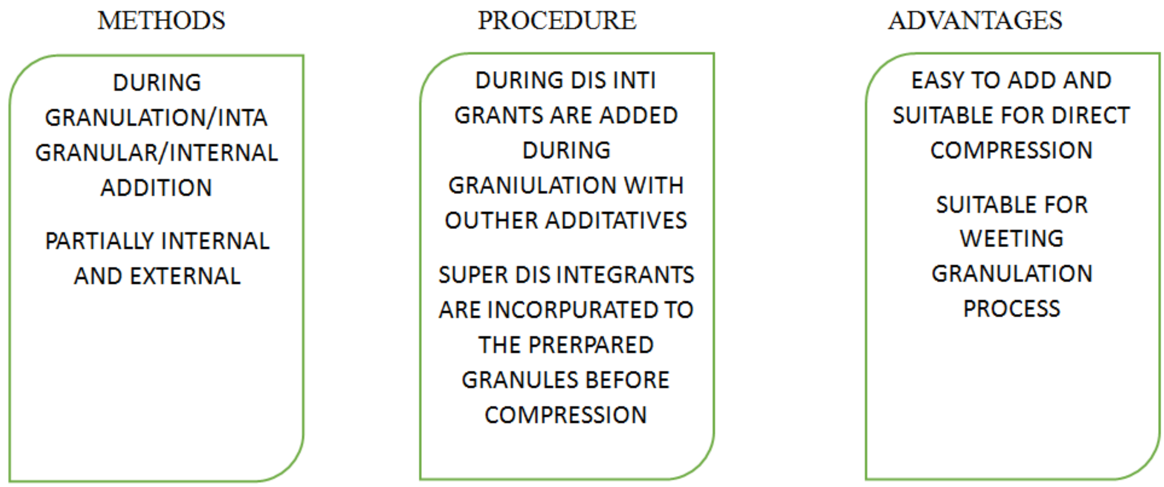


**Fig. 1: Methods Involved In The Addition Of Super Dis-Integrants.**

### 1.4 Mechanism of action

Super disintegrants work by breaking down tablets quickly into tiny fragments, which speeds up dissolve and hastens the start of action.

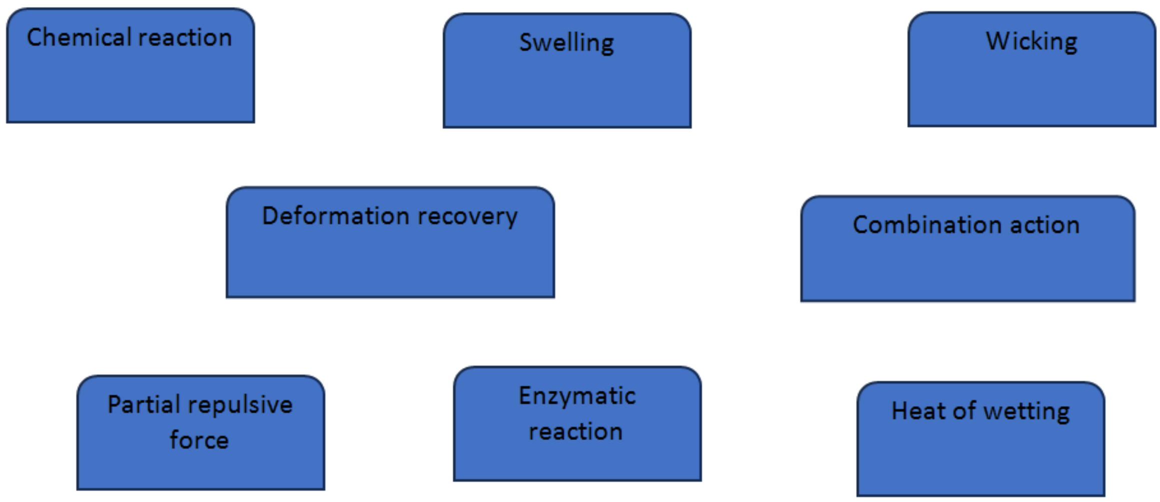


**Fig. 2: Mechanism of action.**

### i. SWELLING MEDIUM

The mechanism's first stage is water penetration, which is followed by the disintegrant's swelling. Super disintegrants often work by causing a swollen particle to break down, which breaks down the pill that breaks down the pills when it comes into touch with appropriate.

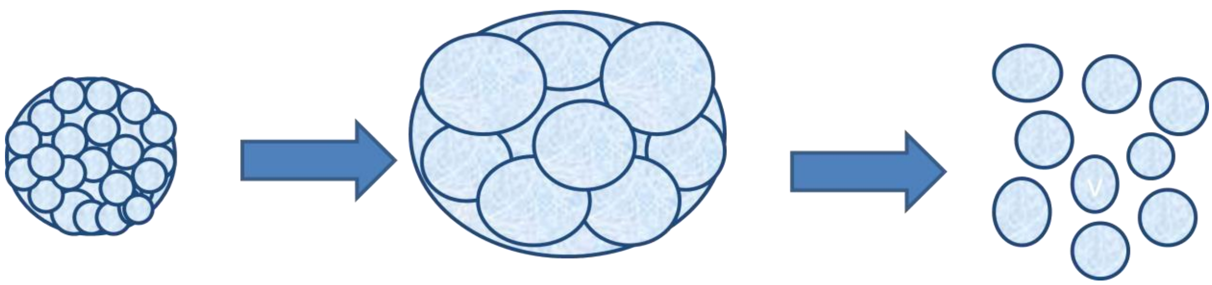

**Fig. 3: Swelling mechanis of tablet disintegration.**

**II. Wicking (Capillary Action And Porosity)**

Tablets break down into their fine particles when the medium penetrates and replaces the air that has been adsorbed on the particles. This weakens the intermolecular link. The hydrophilic qualities of the medication and excipient, as well as the tableting environment, influence the tablet's ability to absorb water. Maintaining a porous structure and low interfacial tension towards aqueous fluid is a critical stage in this technique for forming a hydrophilic network spanning drug particle**.**

**iii. Heat Of Wetting**

The wetting mechanism's heat is relevant to disintegrants with exothermic properties. Tablet disintegration results from capillary air expansion that creates localised stress when these disintegrants come into touch with appropriate conditions and get moist.

**iv. Chemical Reaction**

The primary reason of the tablet's disintegration is the pressure that is created inside it when carbon dioxide from water is released, which happens when tartaric or citric acid reacts with alkali bicarbonates or carbonates (acid reacts with bases). The release of carbon dioxide gas also speeds up the dissolution of the active substance and excipients like taste masking agents. Since these disintegrants are extremely sensitive to even slight changes in humidity and temperature, the surrounding environment needs to be closely monitored.

**v. Parctical Repulsive Forces**

Tablet disintegration is frequently caused by a particle repulsive force mechanism in non-swellable disintegrant particles. Water is necessary for the disintegration of tablets because of the electrostatic repulsion between the particles. The theory of particle repulsiveness was presented.

**vi. Deformation Recovery**

The primary idea behind deformation recovery is that some disintegrant particles undergo structural distortion during compression, and when they come into touch with aqueous solutions after compression, they revert to their precompression structures, which causes the tablet to disintegrate. For instance, starch has demonstrated a greater ability to inflate upon granule compression. Starches having high elastic properties, such as those found in potatoes and maize, distorted into plasticity when compressed with a high compaction force and a rich potential for energy. Tablet breakdown happens when these distorted starch particles come into touch with water because this activates the deformed starch's energy-rich potential.

**vii. Emzymatic Reaction**

Some of the body's natural disintegrants, such as cellulase, protease, amylase, and invertase, serve as disintegrants by reducing the binder's capacity to bind. The pill may burst due to swelling causing pressure in the outer direction, or it may disintegrate due to increased water absorption resulting in an excessive granular volume.

**viii. Actions in combination**

Here, disintegrants work in tandem with the wicking process and swelling to break down the pill. Crosspointe, for instance, works by wicking and swelling together.

**1.5 Super-disintegrants derived from organic materials**

**1. Lepidium Sativum seeds**

Most herbal formulations contain Lepidium sativum plant. It is sometimes referred to as cress and is a member of the Cruciferae family. Mucilage, which is primarily based on the swelling process, functions as binding and dissolving agents in it. Seeds have more mucilage than leaves do.

**2. Ispaghula seeds and husk**

These are from the Plantago Ovata plant, which is a member of the Plantaginaceae family. The seeds' epidermis has mucilage from the plant. Because of its swelling characteristic, mucilage functions as a super disintegration agent in tablets that dissolve quickly.

**3 Pectin from mango skin**

It is derived from the Anacardiaceous family plant Mangifera indica. It was discovered that mango peel, which makes up 20–25% of the waste produced during the processing of mangos, is a useful source for extracting high-quality pectin that can be used to make jelly and films. Pectin is a hydrophilic colloid composed of complicated heteropolysaccharides. The high swelling index and superior solubility of this material make it suitable for use in the production of rapidly dispersible tablets.

**4. Treated agar and agar**

The dried gelatinous material known as agar is derived from Gonidium amnesia (Guidance) and a few other red algae species, including Pterocardiac (Galilaeae) and Gracilaria (Gracilariaceae). Agar has a mucilaginous taste, is doorless, yellowish grey or white to almost colourless, and is readily available.

**5. Banana powder**

Plantains are a synonym for bananas and are members of the Musaceae family. It has retinol, or vitamin A, in it. Additionally, it has pyridoxal, or vitamin B6, which is recommended to lessen stress. It contains abundant amounts of potassium and carbohydrates, which are necessary for healthy brain function. The use of natural banana powder as a super disintegrant in medication formulations for elderly patients shows greater promise in terms of cost and compatibility.

**6. Gellan gum**

The bacterium Pseudomonas elodea. A pure culture of Pseudomonas elodea2 produces gellan gum, a high molecular weight, anionic, deacetylated exocellular polysaccharide gum, through fermentation. It has a tetra saccharide repeating unit consisting of one α-L-rhamnose, one βD-glucuronic acid, and two β-D-glucose residues. Gellan gum was studied extensively as a disintegrant, and its effectiveness was contrasted with that of other common disintegrants, including exploitable, advice (pH 10.2), dried maize starch, Ac-di-sol, and Kallidin CL. The immediate swelling properties of gellan gum upon contact with water and its high hydrophilicity may be the cause of the tablet's disintegration.

**7. Soy Polysaccharide**

It can be utilised in nutritious products since it is a natural super disintegrant free of sugar and starch. Using lactose and dicalcium phosphate dihydrate as fillers, soy polysaccharide (a class of high molecular weight polysaccharides derived from soybeans) is used as a disintegrant in tablets produced by direct compression. Corn starch and a cross-linked sodium carboxy-methyl cellulose were employed as control disintegrants. In direct compression formulations, soy polysaccharide works effectively as a disintegrating agent, producing outcomes that are comparable to cross-linked CMC.

**8. Chitosan and chitin**

The natural polysaccharide chitin (β-(1-4)-N-acetyl-D-glucosamine) is derived from the shells of crabs and shrimp. Unlike the free amino group found in chitosan, it has an amino group that is covalently bonded to an acetyl group. Commercial chitosan is made by deacetylating chitin, the structural component of fungal cell walls and the exoskeleton of crustaceans (such as prawns and crabs). According to the findings presented, the addition of chitin to traditional tablets caused the tablets to dissolve within 5 to 10 minutes, regardless of the drug's solubility. The surface free energy could be used to assess both the wetting and the disintegration times in the oral cavity. The most well-known naturally occurring polysaccharide with a wide range of uses in the pharmaceutical sector is chitosan.

**9. Gum Karaya**

Trees in the genus Sterculia exude a vegetable gum known as gum Karaya. The sugars galactose, rhamnose, and galacturonic acid combine to form Gum Karaya, an acid polysaccharide. Gum's high viscosity makes it unsuitable for use as a disintegrant and binder in the creation of conventional dosage forms. Research has been done on the potential of kaya gum as a tablet disintegrant. Different outcomes demonstrated that the modified Gum Karaya causes the pills to dissolve quickly. Because gum karaya is inexpensive, biocompatible, and readily available, it might be utilised as a substitute for popular synthetic and semisynthetic super disintegrants.

**2. Classification of natural excipients based on their functionality.**

**Table 1: Classification of natural excipients according to their function.**

| **Fillers & Diluent** | **Gelatine Plant Cellulose, Lactose, Sucrose Mannitol, Glucose** |
|---|---|
| Disintegrant | Gellan gum, Guar gum, Agar, Leucaena seed gum Silicon, Starch, pudica, Lepidium Sativumseeds, Locust Bean gum, Mimosa Ispaghula, Fenugreek, Banana powder, Mango peel pectin, husk/seeds, Agar and treated agar, Soy polysaccharide, Chitin and chitosan, Gum Karaya |
| Emulsifiers& Suspending agents | Agar, Ghati gum, Tragacanth gum, Bavchi mucilage, Acacia gum, Cashew gum, Neem gum, Asario mucilage, Xanthan gum, Guar gum, Leucaena seed gum, Karaya gum, Ispagol mucilage, Hibiscus mucilage, Pectin, Sodium alginate, Tamarind seed polysaccharide, Ocimum seed mucilage, Ski waxes, Tea saponins. |
| Lubricants/ Glidants | Mineral oil, Paraffin oil, Castor oil, Vitamin D, Talc, Ispagol mucilage. |
| Preservatives/ Antioxidants and Chelating agents | Cumin seeds, Onions, Neem oil, Cayenne pepper, Cinnamon, Clove oil, Coca Garlics, Turmeric, Clove oil, Chlorella, Brazil nuts. |
| Flavouring agents, Perfumery and Fragrant agents | Raspberry, Lemon, Ginger, Orange, Menthol, Jasmine oil, Peppermint, Cardamom oil, Musk Rose oil, Sandal Wood Oil |
| Sweating agents | Glucose, Lactose, Honey |
| solvents | Purified water, oils |
| Colouring agents | Caramel, Chlorophylls, Carotenoids, Red beetroot, Turmeric, Saffron |
| Thickening, Viscosity imparting and Gelling. agent | Neem gum, Tragacanth, Pectin, Agar, Carrageenan, Aloe mucilage, Fenugreek mucilage, Gelatin, Aloe mucilage, Gums, Carrageenan, Tragacanth, Xanthan. |
| Demulcents /Emollient in cosmetics | Acacia gum, Fenugreek mucilage, Tragacanth gum, Ispagol mucilage |
| Stabilizers | Carrageenan, Sodium alginate, Xanthan gum, Curdlan and Scleroglucan |

### 2.1 Natural Disintegrants

Natural disintegrants are widely used in the production of fast-dissolving pills because they are non-toxic, generally available, affordable, and chemically inert. Thus, natural disintegrants reduce the release time and give patients a favourable result.

Disintegrating agents are substances that are commonly added to tablet formulations to facilitate the dissolution or release of the active components when the tablet is submerged in a fluid environment by dissolving the dense mass into its constituent particles. They facilitate the penetration and dispersion of moisture into the tablet matrix.

The primary function of disintegrants is to oppose the physical forces that arise during compression to form the tablet and maximise the performance of the tablet binder. Recently, novel compounds called super disintegrants have been discovered to improve disintegration.

### 2.2 Selection of disintegrants

Super disintegrant must satisfy several requirements in addition to having swelling qualities because it is utilised as an excipient in the formulation of tablets. The requirements for tablet super disintegrant should be made very explicit.

A. Poor solubility. Disintegrants should have this property.
B. Ineffective gel formation
C. Strong capacity for hydration
D. Good flow and moulding characteristics.
E. Lack of propensity to combine medicines in complexes.
F. Pleasant mouth feel
G. It should also have favourable tableting qualities and be compatible with the other excipients.

## 3. Natural Polymers

Used in Fast Dissolving Tablets The utilization of natural polymers is valuable predicated on proven biocompatibility and safety. Natural gums are among the most popular hydrophilic polymers because of their cost-efficacy and regulatory acceptance. Polymers are generally employed in floating drug distribution systems to target the distribution of drug to a concrete region in the gastrointestinal tract, that is, stomach. Moreover, these polymers are safe, nontoxic, and capable of chemical modification and gel formation.

### 3.1 Advantages of Natural Polymers

The various advantages of natural plant-based materials include the following.

1. Biodegradable: Biodegradable as they are naturally available, and they are produced by all living organisms.
2. Biocompatible and non-toxic: Basically, all these plant materials are reiterating sugar polysaccharides.
3. Low cost: They are cheaper to utilize as natural sources. The production cost is less compared with the synthetic material. India and many other developing countries are dependent on agriculture, and there are substantial amounts of money investment on agricultures.
4. Environmental-friendly processing: There are many types of natural compounds obtained from different plant sources which are widely utilized in pharmaceutical industry and collected in immensely large quantities due to the simple production processes involved.
5. Local availability (especially in developing countries): In India and homogeneous developing countries, there is promotion to produce plants as pharmaceutical excipients being done by government, and it withal provides the facilities for bulk production, like gum and mucilage's because of their wide applications in industries.
6. Patient tolerance as well as public acceptance: There is less chance of side and adverse effects with natural materials compared with synthetic one.

## CONCLUSION

Natural disintegrants are cost-effective, eco-friendly, easily accessible, compared with synthetic disintegrates which prefers widely over synthetic disintegrates. These are widely employed in Pharmaceutical as well as food industry since they are safe and non-toxic to animals and human beings and are extracted from natural products such as plant exudates and seeds of land and marine sources. Natural disintegrates plays an important role in pharmaceutical formulations in many ways over synthetic disintegrates.

Several studies confirm that utilization of natural disintegrants is valuable with proven biocompatibility, safe, chemically inert and non-toxic. The higher availability of natural excipients impact on the development of pharmaceutical products with less cost effective. It is also environmentally friendly processing and biodegradable.


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