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Review Article

Role of the Natural Super Disintegrant's in Mouth Dissolving Tablets

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Abstract:
Oral route is the safest, most convenient, and economical route for administration of different drugs. Oral disintegrating tablets becoming very popular in the current scenario, as they facilely disintegrated in mouth within few seconds of the time after its administration without the need of water. Conventional dosage form has a limitations like dysphagia (arduousness in swallowing), in pediatric and geriatric patients, which have been overcome by oral disintegrating tablets. To prepare the same super disintegrating agents plays vital role. Natural Super disintegrants gained an advantage over the synthetic super disintegrants since they are chemically inert, non-toxic, less expensive, easily available, biodegradable in nature. Natural polymers like locust bean gum, banana powder, mango peel pectin and *Hibiscus rosa-sinenses* mucilage ameliorate the properties of tablet and utilized as binder, diluent, and superdisintegrants increase the solubility, dissolution of poorly water-soluble drug, decrease the disintegration time. Natural super disintegrants are obtained from various sources of natural origin and they are cost efficacious, nontoxic, biodegradable, eco-friendly, devoid of any side effect and renewable. From the different extensive literature review, It is observed that from the studies that natural polymers are safer and more efficacious than the synthetic polymers. The current review article is aimed to study the FDA-approved natural polymers utilized in fast dissolving tablets.

Keywords: *Mouth Dissolving Tablets, Plantago ovata, Fenugrek seeds, Dehydrated Banana Power*

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INTRODUCTION:

FDT can be a helpful substitute when compared to traditional dosage forms. Fast-dissolving tablets are a cutting-edge drug delivery technology that, with or without water intake, quickly dissolves, disintegrates, or disperses the API in saliva[(1)]. The faster the medicine dissolves in the solution, the quicker it is absorbed and its clinical effects start to manifest. FDT or MDT (mouth dissolving tablets) are examples of innovative medicine delivery that have solved various drawbacks including dysphagia or limited access to water while traveling of all the dosage forms administered orally, the tablet is one of the most preferred dosage forms. Disintegrants are agents integrated to tablet and some encapsulated formulations to promote the breakup of the tablet and capsule "slugs" into more small fragments in an aqueous environment thereby incrementing the available surface area and promoting a more rapid release of the drug substance [(2)]. 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 accentuation on the availability of drug highlights the importance of the relatively rapid disintegration of a tablet as a criterion for ascertaining uninhibited drug dissolution behaviour. Number of factors affects the disintegration replace of tablets [(3)]. The disintegrants have

the major function to oppose the efficiency of the tablet binder and the physical forces that act under compression to compose the tablet. The stronger the binder, the more efficacious 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 additionally into powder particles from which the granulation was yare. Disintegrants are an essential component to tablet formulations. The ability to interact strongly with water is essential to disintegrate function. Combination of swelling and/or wicking and/or deformation are the mechanisms of disintegrant action. The polymers obtained from the natural inchoation are more efficacious and safer [(4)]. They are facilely available in natural regions around the world therefore they are preferred over synthetic polymer. Natural polymers are utilized in most of the preparation and are more propitious over synthetic polymers as they are economical, and they have low cost and are facilely available in the sufficient quantity. Natural polymers are nontoxic; they do not have any adverse effects on the body. Natural polymers are environmental friendly as they are biodegradable in nature, they do not cause any pollution. Natural polymers are devoid of side effects as they are obtained from the natural source. Natural polymers are mainly preferred by the patients as they are safer and more efficacious as compared to the synthetic polymers and have more patient compliance [(5)]. Natural polymers provide nutritional supplement and are renewable as they are utilized again and again in different reactions.

Merits:

- No need of water to swallow the tablet.
- FDTs can be easily administered to pediatric, elderly and mentally disabled patients.
- Accurate dosing as compared to liquids.
- Dissolution and absorption of the drug is fast, offering rapid onset of action.
- Bioavailability of drugs is increased as some drugs are absorbed from mouth, pharynx and oesophagus through saliva passing down into the stomach [(5)].
- Advantageous over liquid medication in terms of administration as well as transportation.
- First pass metabolism is reduced, thus offering improved bioavailability and thus reduced dose and side effects offering improved safety.
- Suitable for sustained/controlled release actives.
- Allows high drug loading.

Demerits:

- Grittiness, residual taste or incomplete dissolution of tablet in mouth.
- Large Poor mechanical strength and Fragility require careful handling.
- doses difficult to formulate.
- Patients on anticholinergic medications & patients with Sjogren's syndrome experiencing dryness of the mouth due to decreased saliva production, the tablet may not produce desired disintegration and effects [(6)].
- Several FDT are hygroscopic cannot maintain physical integrity under normal condition from humidity which requires specialized package.
- FDT are very porous and soft moulded metrics or compressed in a tablet with low compression, which makes tablet friable and brittle which difficult to handle [(6)].
- Bad tastes drugs are difficult to formulate as FDT; special precaution should have to be taken before formulate such kind of drug.

Drugs that can be integrated in fast dissolving tablet:

S. No	CATEGORY	DRUG
1	NSAIDS	Ketoprofen, Piroxicam, Paracetamol,
2	Antiulcer	Famotidine, Lansoprazole
3	Anti-depressant[(7)]	Mitraxepine, Fluoxetine
4	Anti-parkinsonian agent	Bromocriptinemesylate, Lysuride maleate
5	Anti-migraine	Sumatriptan,Rizatriptan,Zolmitriptan
6	Anti-histaminic	Loratadine, Diphenhydramine,Buclizine

7	Hypnotics and sedatives	Zolpidem, Clonazepam
8	Antipsychotics	Olanzapine, Risperidone, Pirenzepine
9	Antibacterial agents[7]	Albendazole, Bephenium, Hydroxynaphthoate
10	Anti-arrhythmic agents	Amiodarone, Disopyramide, Flecainide Acetate
11	Anti-epileptics	Beclamide, Carbamazepine, Clonazepam
12	Anti-hypertensive agents	Amlodipine, Carvedilol, Benidipine,
13	Antineoplastic	Aminoglutethimide, Amsacrine, Azathiopnne
14	Anti- fungal agents	Clotrimazole, amphotericin, griseofulvin
15	Cardiac Inotropic agents	Amrinone, Digitoxin, Digoxin
16	Diuretics[8]	Acetazolamide, Triamterene, Amiloride
17	Anti-gout agents	Allopurinol, Probenecid, Sulphinpyrazone
18	Anti-muscarinic agents	Atropine, Benzhexol

Super disintegrating agents:

In many Orodispersible tablet technologies based on direct compression, the addition of super disintegrants primarily affect the rate of disintegration and thus dissolution [9]. The presence of other ingredients such as water-soluble fillers and effervescent agent's substances further accelerate the decomposition process.

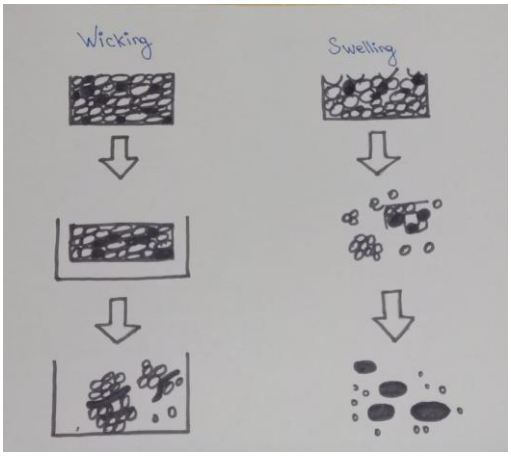
Mechanism of super disintegrating agents:

Swelling: Perhaps the most widely accepted general mechanism of action for tablet disintegration is swelling. 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].

Porosity and capillary action (Wicking):

Disintegration by capillary action is always the first step. 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 [10]. Water uptake by tablet depends upon hydrophilicity of the drug /excipients 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.

Fig No.1: Mechanism of super disintegrating agents



Due to deformation:

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. Occasionally, the swelling capacity of starch was improved when granules were extensively deformed during compression [11].

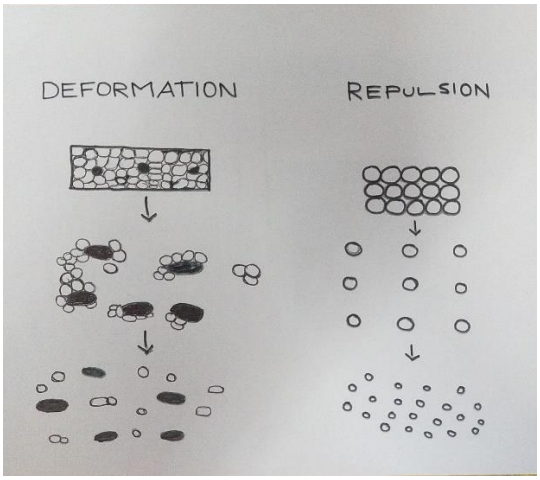


Fig. 2: Disintegration by deformation and repulsion process

Types of Super disintegrants:

- Natural Super Disintegrants
- Synthetic Super Disintegrants

Natural super disintegrants:

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 [(12)].

Table 1: Various Natural Super Disintegrates with their Disintegration Time

S. No	Natural Polymer	Drug	Disintegration time
1	Guar gum	Glipizide	60 sec
2	Gum Karaya	Amlodipine	30 sec
3	Gellan gum	Metronidazole	45 sec
4	Fenugreek seed	Metformin	20 sec
5	Soy polysaccharide	Lornoxicam	18 sec
6	Plantago Ovata	Granisetron HCl	17 sec
7	Locust Bean gum	Nimesulide	9 sec
8	Dehydrated Banana Powder	Ondansetron	13 sec

Guar Gum

- Guar gum is mainly consisting of high molecular weight (approximately 50,000–8,000,000) polysaccharides composed of galactomannans and is obtained from the endosperm seed of the guar plant, *Cyamopsis tetragonoloba* (L) Taub. (Syn. *Cyamopsis psoralioides*).
- It is used as thickener, stabilizer, and emulsifying agent. It is natural gum (marketed in the trade name of Jaguar).
- It is free flowing, consummately soluble, neutral polymer composed of sugar units and is approved for used for food product[(13)].
- It is not sensitive to pH, moisture contents, or solubility of the tablet matrix and not always pristine white and sometimes varies in color from off-white to tan that inclines to discolor with time in alkaline tablets

Gum Karaya

- Gum karaya is a vegetable gum which is exudate from trees of the genus *Sterculia*. Chemically, gum karaya is an acid polysaccharide composed sugars galactose, rhamnose, and galacturonic acid.
- The high viscosity nature of gum limits used 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[(14)].

- Gum karaya used in an alternative super-disintegrant available in synthetic, semisynthetic superdisintegrants, and biocompatibility as well as facile availabile.

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 available in the form of divests, sheet flakes, or coarse powder[(15)].
- Agar consists of two polysaccharides, agarose and agar pectin. Agarose is for gel vigor and agar pectin is for viscosity of agar solutions.

Fenugreek Seed Mucilage

- *Trigonella foenum-graceum* commonly kenned as fenugreek. It is an herbaceous plant of the leguminous family. Fenugreek seeds contain a high percentage of mucilage (a natural gummy substance present in the coatings of many seeds).
- It is insoluble in water; mucilage forms a viscous tacky mass when exposed to fluids. fenugreek seeds swell up and become slick when they are exposed to fluids [(16)]. Hence, the study proves that this natural disintegrant (fenugreek mucilage) shows more preponderant disintegrating property than the most widely used synthetic superdisintegrants like Ac-di-sol in the formulations of FDTs.
- Studies betokened that the extracted mucilage is a good pharmaceutical adjuvant and concretely a disintegrating agent

Gellan Gum

- Gellan gum is a water-soluble polysaccharide produced by *Pseudomonas elodea*, a bacterium [(17)].
- Gellan gum is categorized into two major low acyl and High acyl acetate groups attached to polymers
- Gellan gum is an anionic, high molecular weight, deacetylated exocellular polysaccharide gum produced as a fermentation product by a pristine culture of *Pseudomonas elodea* with a tetra saccharide reiterating unit of one α-L-rhamnose, one β-D-glucuronic acid, and two β-D-glucose residues.

Mango Peel Pectin

- Magnifera Indica is commonly known as Mango, Family with Anacardiaceae. Mango peel constitutes 20–25% of the mango processing waste was found to be a good source for the extraction of pectin, felicitous for the preparation of film, and acceptable jelly.
- Pectin is volute heteropolysaccharide which is a hydrophilic colloid.

***Plantago ovata* Seed Mucilage**

- Plantago ovata is commonly known as Indian wheat. Psyllium or ispaghula is the prevalent name utilized for several members of the plant genus *Plantago* where seeds are utilized commercially for the production of mucilage.
- Mucilage of *Plantago ovata* has different characteristics like binding, disintegrating, and sustaining properties.
- In an investigation fast disintegrating tablets of amlodipine besylate by direct compression method utilizing different concentrations of *Plantago ovata* mucilage as natural superdisintegrants.

Hibiscus Rosa Sinensis Mucilage and Treated Agar

- Hibiscus is called as 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 it has a mucilage L-rhamnose, D-galactose, D-galacturonic acid, and D-glucuronic acid [(18)].

Dehydrated Banana Powder (DBP)

- Banana is additionally called plantain. DBP is 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 diarrhoea. It contains vitamin B6, which helps 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 helpful for more preponderant brain functioning [19 &20].

Conclusion:

Natural polymers have more preponderant effects on fast dissolving tablets than synthetic polymers. Natural polymers incremented the drug release rate from the tablet and decremented the dissolution and disintegration time, and they are utilized as binder superdisintegrant and diluent. Natural polymers are preferred over synthetic polymers as they are nontoxic, facilely available at low cost, utilized in low concentration, and are naturally extracted to provide nutritional supplement. The disintegrating properties of *Plantago ovata*, *Lepidium sativum*, *gum karaya*, *Guar gum*, *Fenugreek seed mucilage*, *mango peel pectin*, and so forth, have been studied in comparison to artificial super disintegrants. Thus natural superdisintegrants exhibit faster drug dissolution and increased bioavailability, thereby, availing in efficacious therapy and improved patient compliance. Thus the natural superdisintegrant can be efficaciously utilized as disintegrants in tablet formulations.

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