# A Perspective Review: Influential Role of Natural Disintegrating Agants in formulation of Oral Disintegrating Tablets (ODTs)

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## Abstract

The most favored method of administering medicine is orally because it is the safest, most convenient, and most cost-effective way. But sometimes conventional oral dosage form can create swallowing related issues in some geriatric and pediatric patients and these issues has been solved by Oral Disintegrating Tablets (ODTs). They are solid unit dosage forms that get dissolves smoothly within the mouth and swallowed without the necessity of hydrating media. It is examining that superdisinterants considered as leading excipients in ODTs. There are several types of super-disintegrants available, including natural and synthetic super-disintegrants. Natural super-disintegrants superior over synthetic ones as they have peculiar and valuable properties like innocuous, biodegradable, chemically inert, economical, ecofriendly,and furnish nutritional supplement. Oral disintegrating tablets have attained popularity in the pharmaceutical company for certain medications with delayed disintegration and limited oral bioavailability. The current study goal highlights and ameliorate the oral disintegrating tablet benefits by the help of natural super-disintegrants like *Plantagoovata, Cassia fistula, Hibiscus rosasinesis, Locust bean gum, Chitosan, Aleovera, Fenugreek, Gum karaya, Agar, Guar gum, Soy polysaccharides, Gellan gum, Lepidiumsativummucilage, Aeglemarmelos gum, Dehydrated Banana powder, Ocimumbasilium and Cassia tora*. This review relates crucial research studies carried out in the preparation phase of oral disintegrating tablets based on "rapid dissolving" way of deliveryby engaging diverse natural super-disintegrants. Initial investigation focus is to approach quick disintegration along with superior bioavailability by means of patient compliance. Furthermore, the review also highlights and provides a viewpoint regarding future prospectus.

**Keywords:** Oral disintegrating tablets • Oro-ispersible tablets • Natural gum • Natural disintegrating agents • Super-disintegrants

## Introduction

From the ancient times, oral route is considered as idyllic way for management of administering tablets. Tablets are active solid pharmaceutical unit dosages which have major concerns for the therapy of numerous disorders along with providing convenient, secure, inexpensive, efficient mode of effective oral drug delivery [1,2]. Orally delivered medications follow diverse compartments in the gastrointestinal system, which aid in the adhesion and ensuing absorption of drug molecules [3-5]. Most current medications, however, are unable to endure the severe conditions of the gastrointestinal system and are removed without emphasizing the intended pharmacological effects. The practice of tearing tablets, opening capsules, or blending powders with meals or liquids may result in dosage inaccuracy and other significance for patient safety and therapeutic efficacy [6,7]. The essential requirement will be needed during the direct compression method as shown in figure 1.

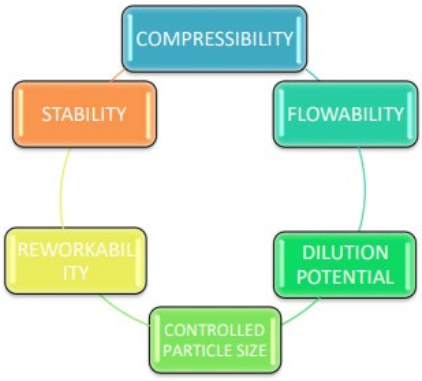


**Figure 1.** Shows the ideal requirements of the direct compression method.

Often, pharmaceutical activity also affects by hepatic metabolism [8,9]. Somehow, occasionally patients scrutinize tablet swallowing intricacy owing to their huge dimension affects their surface and shape profile with taste [3,10]. So, requirement of developing platform and Significant efforts are continuously being for novel delivery is necessary to address the special attention towards patients. ODTs are solid dose forms that, when placed on the tongue, quickly breakdown or disintegrate, releasing the medication in a matter of seconds without the need for water. The synonyms of ODTs are fast melting, fast dispersing, Mouth dissolving tablets, Oro-dispersible tablets, rapidly disintegrating tablets, rapidly dissolve, rapid melt and/or quick disintegrating tablet [3,4,10]. Rapid dissolving tablets are substitute of tablets, capsules, powder, and syrups for which was formed in 1970 and observe good experience for pediatric and geriatric patients. USFDA approved definition on ODT as "A solid dose form containing medicinal chemicals that disintegrates swiftly, usually within seconds, when put on the tongue" [10,11].The importance and the different stages of drugdissolution showed in figure 2.

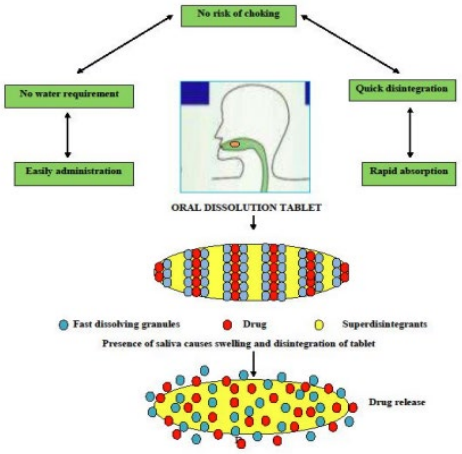


**Figure 2.** Depicts the advantages along with stages of drug dissolution and release of the tablets.

Patients experiencing swallowing difficulties, motion sickness, frequently vomiting (*emesis*) and psychological issues prefer these medications since they are unable to consume huge quantities of liquids.Furthermore, drugs that have a high oral mucosal absorption rate or are designed to have a rapid pharmacological impatcan be produced in these dosage forms [13,14]. Current sustained-release technologies may be explored and implemented into an ODT to improve patient adherence and give higher therapeutic benefit by decreasing the requirement for multiple daily dose regimens [15, 16]. It is special effort to fabricate a protected and competent substitute to the conventional oral dosage forms. ODTs are constructed using hydrophilic polymers that allow the dosage form to quickly hydrate bysaliva, connect to the mucosa, disintegrate within a few seconds, dissolve, and release medication for mucosal absorption when put on the tongue or oral cavity [17]. An oral dissolving tablet requires a variety of excipient which performs peculiar activities. One of them is disintegrating agents actively disintegrate tablets into smaller fragments and promotes the increment in surface area also consequently emphasize rapid drug release [18,19]. The basic function of disintegrants is to opposing the effective function of the tablet binding agents and the mechanical forces used to form the tablet during compression.The more effective the disintegrating agents must be to allow the tablet to release its drug, the stronger the binder. It should ideally cause the tablet to disintegrate not just into the granules from which it was compacted, but also into the powder particles from which the granulation was produced. The capacity to strongly engage with water is required for the disintegration function [20]. ODT requires quick disintegrating agents followed by fast dissolution, absorption and speedy onset of action alternatively achieve better bio-availiabity.Super-disintegrants are advanced disintegrants that play an important role in the breakdown of orally disintegrating tablets, requiring no water to swallow and maintaining a pleasant mouth feel [9]. Superdisintegrants are typically used in low doses ranging from 1% to 10% by weight of the total weight of the dosage unit [16]. They are divided into two types: natural super disintegrants and synthetic super-disintegrants. Synthetic super-disintegrants, such as Sodium Starch Glycolate (SSG), Cross-linked poly-vinyl Pyrrolidone (Cros-povidone), Modified cellulose (Croscarmellose sodium, Ac-Di-Sol), and others, are used in tablet formulation to increase the rate of medication dissolution. Natural super-disintegrants promote quicker pharmaceutical disintegration and increase bioavailability, resulting in greater efficacy and greater compliance among patients. As a consequence, natural super-disintegrants could be employed as disintegrants in tablet formulations with success. Natural super-disintegrants considers natural polymers such as *Plantago ovate, Locust bean gum, Cassia fistula, Chitosan, Aleo-vera, Agar, Guar gum, Gum karaya, Fenugreek seed mucilage, Gellan gum, Soya polyssacharides, Lepidiumsativummucilage, Ocimumbasilium, Banana powder, Pectin, Mangiferaindicagum, Mango peel, and Hibiscus rosa-sinenses mucilage alleviate* the tablet characteristics. Natural polymers are used in many formulations and are preferable to synthetic polymers since they are less expensive and more readily available in adequate quantities. Natural polymers are completely safe and have no negative effects on human beings. Natural polymers are ecologically friendly since they degrade naturally and do not contaminate the environment. Because they are sourced from nature, natural polymers have no negative impacts. Natural polymers provide nutritional supplements and are sustainable due to their reuse in a variety of processes. Polymers made from natural materials provide nutritional supplements and are sustainable due to their reuse in a variety of processes [21]. As a result, super-disintegrants emerge with quicker disintegration, providing speedy release of the medicine during an emergency, but they can also cause undesirable alterations in drug release kinetics as well as bioavailability [22]. The future perspective in ODTs provide biofriendly, preservative free, masked taste, high relative bioavailability without any side effects with reduce the cost [18-20]. Different practices in methodology are accessible for the formulations of ODTs are freeze drying, sublimation, direct compression, moulding, spray drying, mass extruction, cotton candy process, phase transition, wet granulation etc [5,7,15,22]. The direct compression process shown in Figure.3

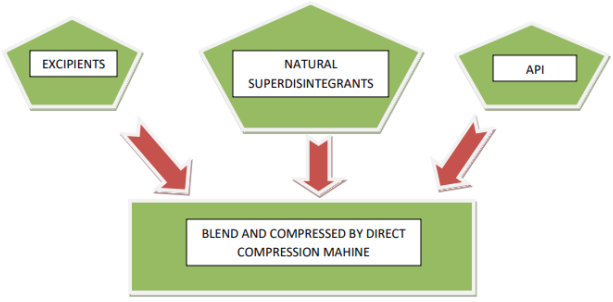


**Figure 3.** Schematic flowchart of direct compression method.

# Literature Review

## Natural super-disintegrants

**Plantago ovata:** The polymers of natural origin perform functional benefits and contribute in a great way in oral medication delivery systems. Natural polymers have the capacity to keep drugs at the absorption site for a longer period of time and provide easy intimate contact with the underneath absorptive surface, thus improving bioavailability. Because of its numerous favorable properties like as biodegradability, biocompatibility, aqueous solubility, swelling ability, ease of availability, and cost-effectiveness, the development of natural polymer-based drug delivery systems has become a major issue [23]. *P.ovata* is also a member of natural polymers with characteristics beneficial properties utilized for various traditional remedial purposes for ailments. *P.ovata* exhibits a unique structure along with long history of successful consumption as medicine and neutraceutical supplements as well as cosmetics also due to its rich content of bioactive polysaccharides [24]. Natural Plantago herbs have a potential to manage antioxidants, antiinflammatory, antibacterial, anti-diabetics, anti-obesity associated activities and it also furnishes admirable properties as pharmaceutical excipients. The synonyms of Plantagoovata (family Plantaginaceae) are *Psyllium, isabgoletc*] and generic names of *P.ovata* are *Psyllium husk and Ispaghula husk*. The attracted and interesting role played by *P.ovata* in fast dissolving tablet as a natural superdisintegrants by its swelling, gelling ability, rapid disintegrating properties [22,25,26]. *P.ovata* husk obtained from plant after milling the seed. The viscous water-soluble colorless Plantago fiber compound may include a significant amount of hemicellulose, which is made up of a *xylan backbone* connected with arabinose, rhamnose, and galacturonic acid units and aids in the maintenance and attainment of a therapeutic profile that has mild systemic effects.The Plantago seed contain of 35% soluble and 65% insoluble polysaccharides [27]. *Psyllium* can be easily added to pharmaceutical formulations and does not change the characteristics of the product. Furthermore pharmaceutical, nutraceuticals along with cosmeceutical industry are paying attention towards natural polymer *P.ovata* in the prevention of acute or chronic diseases [28]. Direct compression method is desirable, inexpensive and convenient approach for formulating fast dissolving tablet of sufficient mechanical strength. In these recents studies of natural super-disintegrating *P.ovata* oro-dispersible tablets have been mainly prepared by this convenient method. Draksiene et al. investigated the use of *Psyllium* husk powder, a natural super-disintegrant, to manufacture oro-dispersible tablets containing meloxicam, a non-steroidal anti-inflammatory medicine, using the direct compression method.They discovered that *psyllium* husk powder greatly increases meloxicam dissolution rate, and formulations incorporating this polymer had the shortest wetting time, maximum water absorption ratio, and shortest disintegration time. The powder might be useful as a natural super-disintegrant in oro-dispersible meloxicam formulations [29]. D.Swamy et al formulated oral disintegrating tablets of Mirtazapine, an atypical antidepressant drug by direct compression method utilizing various natural

and synthetic super-disintegrants like as *Cross-povidone, SSG, Lycoat, dried banana powder and P.ovata* . Different natural and synthetic super disintegrants were utilized for improving oral bioavailability of mirtazapine. The dispersion duration of tablets was observed to decrease as the concentration of super disintegrants increased [30]. Swati S. Talokaret al. performed a comparative examination of candesartan fast dissolving tablets utilising natural and synthetic super-disintegrants. The formulation containing *P.ovata* 10 mg showed maximum dissolution in short period of 5 minutes [31]. V. Sai Kishore et al formulated and studiedoro- dispersible tablets of Sotalol Hcl utilising various concentrations of natural super-disintegrating agents such as *P. ovatamucilage*, *Bhringaraj* powder as well as synthetic and semi-synthetic super-disintegrants such as cross-povidone and cros-carmellose sodium using the direct compression method. All of the formulated tablets were tested for hardness, weight variations, friability, thickness, disintegration time, dissolution time, and wetting time. They came to the conclusion that formulations contained 5% w/w of the natural super-disintegrant P. ovata demonstrated quicker and higher medication dissolution [32]. Shrisand et al., created and manufactured rapid dissolving tablets of Prochlorperazine maleate using the method of direct compression to improve patient compliance. To improve mouth feel and for masking the taste of unpleasantodours, natural and synthetic super-disintegrants (2-8% w/w) were combined with microcrystalline cellulose (20%-60% w/w) and directly compressible mannitol.The formulations made with 8% w/w P. ovata mucilage and 60% w/w Microcrystalline Cellulose (MCC) was the most effective with superior drug release characteristics [33]. Subhashini et al. developed and tested quickly dissolving Domperidone tablets with P. ovata mucilage to achieve the desired results. Domperidone, a water insoluble drug is found to possess problem of variable bioavailability and bio-inequivalence. The tablets have beenprepared using direct compression with MCC as the directly compressible excipient. The inclusion of varying concentrations of natural super-disintegrants and formulation including 12.5% super-disintegrant exhibited faster disintegration as well as dissolution [34]. Sharma et al., investigated the comparison of various natural super-disintegrants such as *Povat*a, *Lepidium sativum, Fenugreek, and Guar gum*, in the manufacture of rapid dissolving Carvedilol tablets by direct compression. They observed that the formulation containing *P.ovata* mucilage performed the other natural superdisintegrants in terms of disintegrating property and release profile [35]. More et al. created and tested Lornoxicam fast dissolving tablets for oral administration. Several batches of tablets were created using the direct compression method with varying doses of super-disintegrants such as P. ovata, cross-povidone, Cross Carmellose Sodium (CCS), and SSG.P.ovate is found to be more effective at 10% concentration. All the formulations of *P.ovata* along with drug disintegrated within 20-160 seconds [36]. Mehta et al. carried out investigation of *P.ovata* husk powder and starch maize as a disintegrant in the formulation of tablets of Famotidine, a selective $H_2$ histamine receptor antagonist. The *P.ovata* husk exhibited high swelling index due to major part of mucilage contained in it. The study postulated that tablets formulated utilizing *P.ovata* husk powder proved better than standard disintegrant maize starch and other marketed preparations [37]. Khinchi et al. carried out the studies on disintegrating properties of mucilages, husk powder and seed powder of Isapghula via synthesized orally disintegrating tablet of Fexofenadine HCl through direct compression method. The results depicted that due to high swelling index formulation containing *P.ovata* exhibited faster drug dissolution and improved bioavailabilty [38]. Ghenge et al. developed and characterized rapid dissolving tablets of Amlodipine Besylate, a long-acting calcium channel blocker, utilising a direct compression approach with varying concentrations of P. ovata mucilage as a natural super-disintegrant. According to FT-IR measurements, Amlodipine besylate and other excipients exhibit no physicochemical interaction. All formulations were examined for weight fluctuation, hardness, friability, disintegration time, drug content, and solubility. The formulations containing *P. ovata* (10.5 mg) had a shorter in vitro disintegration time (11.69 sec) and a faster in vitro dissolution time (within 16 mins). The in vitro disintegration time was shown to decrease as the concentration of natural superdisintegrant increased [39]. Chaturvedia et al. performed comparative study of natural and semisyntheticsuperdisintegrants in the preparation of norfloxacin, an antibacterial agent, orodispersible tablets. Direct compression was used to formulate several formulations with variable quantities of natural super-disintegrant, *P. ovata* husk, as well as synthetic super-disintegrants, Kyron T-314 and CCS. Dissolution profile of the oro-dispersible tablets containing croscarmellose sodium and *P.ovata* husk suggested that 90% of drug released within 15 minutes in phosphate buffer 6.8 pH [40]. All the formulations containing *P.ovata* mucilage powder was shown to be comparable toformulations made with other super-disintegrants and shown a drug releasing rate of 99% above the other super-disintegrants, allowing it to be used as a natural super-disintegrant. Yadav et al. conducted a comparative study on the effect of both synthetic and natural super-disintegrants in the manufacture of a rapid dissolving tablet of aspirin, an analgesic, using the direct compression technique. Swelling index of *P.ovata* was calculated and compared with synthetic super-disintegrants such as Ac-di-sol, SSG and crospovidone. The results depicted that natural super-disintegrants (husk of *P. ovata* ) shown superior disintegration properties than the most commonly used synthetic super disintegrants in formulation of Fast Dissolving Tablets (FDTs) [41]. Preparation of FTDs of Glipizide, an antidiabetic drug was carried out by Srinivasarao et al employing natural superdisintegrant such as mucilage of *P.ovata* and using various methods of formulation i.e. direct compression, lyophillisation and molding. According to the findings of the study, mucilage of P. ovata has greater disintegrant properties than other super-disintegrants, and formulations containing mucilage made by direct compression technique have high bioavailability when compared to other hypoglycemic formulations [42]. Shahidulla et al. formulated and studied FDTs of Domperidone, an antiemetic drug utilizing mucilage of *P.ovata* by direct compression method. The formulations created with 10% w/w mucilage and 60% w/w of MCC had the best t1/2 of 2.75 minutes [43].According to the study, formulations including natural super-disintegrants require shorter disintegration time than formulations containing synthetic super-disintegrants. Comparative success of natural super-disintegrants over synthetic super-disintegrants was studied by Patil et alwhile formulations of fast disintegrating tablets of Amlodipine besylate, an anti-anginal drug. Tablets were prepared using different concentrations of synthetic super-disintegrants and natural super-disintegrants i.e. Cros-povidone, CCS and *P.ovata* employing direct compression method. Current study revealed that FTDs formulated by using husk of *P.ovata* as super-disintegrants showed very less disintegration time and comparable dissolution profile to synthetic superdisintegrants [44]. Mahant et al.developed and tested mouth dissolving tablets of Ondansetron hydrochloride, a serotonin receptor antagonist, using a natural super-disintegrating ingredient and a direct compression approach. Natural super disintegrating agent (*P. ovatamucilage*) in various doses was used to make mouth dissolving tablets. After 15 minutes, formulations containing *P. ovata* mucilage exhibited the quickest disintegration time (7 seconds) and the greatest drug release rate (98.57%) [45]. Formulation and evaluation of fast disintegrating tablets of *Etoricoxib*, a second-generation cyclooxygenase inhibitor was carried out by Jejurkar et al.employing direct compression method and natural superdisintegrants i.e. *P.ovata* as well as gelatinized starch. Dissolution study showed that rapid release rate of drugs from formulations containing natural super-disintegrants. Thus, it was concluded that natural superdisintegrants based preparation proved less expensive and with less disintegration time [46]. In a study, formulation and studied of Oro-dispersible tablets (ODTs) of *Promethazine* was carried out by Jaswal et al. employing direct compression method and mucilage isolated form *P.ovata* as natural super-disintegrant. *P.ovata* mucilage-based formulations were shown to be the overall best formulations, with in-vitro drug release characteristics and an in-vitro dispersion time of 8s when compared to standard tablets formulations without disintegrant [47]. Hence, from the above-mentioned survey we have observed that continual efforts have been focused on development of oral disintegrating tablets utilizing either mucilage isolated from *P.ovata* or husk of its seeds. *P. ovata* has proved a significant super-disintegrant due to its high swelling index, abundant availability, non-toxic and non-irritating behavior when compared with synthetic super-disintegrants. Moreover, direct compression method has been utilized in most of the studies due to its simple, inexpensive, better stability of thermo-sensitive drugs and faster dissolution of formulations characteristics. Formulations prepared by this method possess less disintegration time and fast dissolution rate.

## Cassia fistulad

Cassia has huge tropical genus and contain approximately 600 species that have been extensively adopted in medication [48,49]. *Cassia's* trees are generally deciduous and medium in size along with their seeds are flattened, smooth, teardrop in shape and mildly poisonous in nature [50,51]. The whole plant is potentially utilized such as seeds, flowers, and fruits to treat the various kinds of disorders [51,52]. *Cassia fistula (Caesalpiniaceae*) is also a member of cassia genus with various names such as *Amaltas, Aragvadha,* Disease killer etc [53,54]. In ancient time period, this plant was considered as a golden shower and utilized in ayurvedic treatment. It influences all three "*Doshas*" i.e. Vata, Pitah, and Kapha [55,56]. *C. fistulas eeds* are made up of β-(1,4) linked *d-mannopyranose* units with irregular distribution of α-(1,6) linked d-galactopyranose units as the side chain with a mannose:galactose ratio of 1:1. It contains numerous chemical components having significant

pharmacological properties. In comparison to native gum, *carboxymethylation* and c*arbamoylethylation* of C. fistula gum have been shown to improve cold water solubility, viscosity, and microbiological resistanc [57]. *C. fistula* shows wide ranges of compatibility with respective medicaments, other components and considered as essential pharmaceutical excipients [58,59]. These constituents are investigated and explore to possess various biological and pharmacological activities such as antioxidant, antimicrobial, antidiabetic, antitumor and antimelasmic, anti-inflammatory, anti-dysentery, anti-diarrheal, anti-obesity, antipyretic, antigout, antifertility etc [60,61]. C. fistula is recommended to manage and treat abdominal pain, leprosy, liver disorders, and central nervous disorders [62,63]. There seeds are slightly sweetish and improve appetite also possess laxative and carminative properties [64,65]. The flowers of *C. fistulahave* triterpenes that are pharmacologically capable for pest and diseasecontrol [59,63]. *C. fistula*, which serves as a natural super-disintegrant and has been demonstrated to have a broad spectrum of pharmacological action and low toxicity, has resulted in increased interest in development and utilization of FTDs. Huanbutta et al. developed crude seed gum and carboxymethyl derivatives from Tamarindusindica and *C. fistula* and used them to make Fast dissolving Thai cordial tablets. The direct compression approach was used to create the fast-dissolving tablet. Finding indicates that modified crude gums could provide great hardness, lessen disintegration time due to particle repulsive forces and increased dissolution rate of drug [66]. Rai et al studied the use of calcium salts of carboxymethylated (CaCOG) or carbamoylethylated (CaCEG) C. fistula gum derivatives as super-disintegrants in the fabrication of direct compression FDTs and demonstrated outstanding disintegration capabilities. Because to the shorter water sorption time and higher particle packing index, FDTs have excellent disintegration properties. As a result, these C. fistula gum derivatives may be beneficial in the development of FDT formulations in the near future [67].Chouhan et al. used the direct compression method to fabricate and optimize Rosuvastatin's orodispersible tablet incorporating varied concentrations of *C. tora* seeds mucilage as natural superdisintegrants. It was discovered that the formulation containing 50 mg of -cyclodextrine inclusion complex and 50 mg of mucilage extracted from C. tora seeds possessed substantial dissolving and disintegration properties [68]. Singh K. et al. To improve bioavailability and effectiveness, oro-dispersible tablets containing propranolol hydrochloride were developed and characterized using a calcium cross-linked derivative of carboxymethylated C.fistula gum and CCS. Wet and dry granulation, lyophilization, direct compression, cotton candy processes, and other techniques are employed [69]. The results revealed thatoro-dispersible tablets manufactured by cotton candy process containing cross-linked C. fistula gum has the least disintegration time and found to release the drug within the shortest time when compared to CCS. As a result of the foregoing research, it has been shown that *C. fistula* gum, as a natural super-disintegrant, may be preferable to synthetic super-disintegrants for the making of orally disintegrating tablets with appropriate mechanical strength.

## Chitosan

Chitin and chitosan are natural organic polymers [70,71]. Chitin is present in the structure of many invertebrates and the cell walls of fungus, but chitosan is only found naturally in a few fungi (*Mucoraceae*) [72,73]. Chitosan's amino group is more acetylated than that of chitin [70]. Chitin and chitosan are chemically related linear polysaccharides composed of two monomeric units (N-acetyl-2 amino-2-deoxy-D-glucose) and (2-amino-2-deoxy-D glucose) linked by β (1,4) links [74]. Chitosan, compared to chitin, is extremely soluble and may be dissolved in dilute acid conditions to produce cationic polymers, which can then be linked with a wide range of natural or synthetic anion species, including DNA, proteins, lipids, and negatively charged synthetic polymers [75]. *Chitosan* is biodegradable and may be digested by lysozyme or chitinase to a non-toxic residue [76]. Chitosan and chitin that has been widely used for several applications and utilized as superior excipients in biomedical, food, biotechnological, agricultural and cosmetics [77]. Cirri et al developed *Flurbiprofen-cyclodextrin* complex fast dissolving tablets using chitosan as a super-disintegrant. These tablets were formulated using the direct compression approach. The findings indicated that super-disintegrants used in the formulation of rapid dissolving tablets increased drug solubility, disintegration time, and produced a rapid start of action [78]. Goel H. et al explored the explanation for the paradoxical effects of ionised and unionised chitosan during the production of Ondansetron Hcl ODTsutilising wet granulation and direct compression techniques. A glycine-chitosan mixture was used as a natural super-disintegrating agent as well as to provide a sweet flavour, whilst croscarmellose and crospovidone were used as synthetic superdisintegrating agents. In ODTs made using the direct compression technique, it was observed that chitosan's $NH^{3+}$ moieties interacted with glycine's COO-moieties, however in ODTs made using the wet granulation method, it was found to be present in the un-ionized state. The results showed that the direct compression method performed wet granulation in this study, and that the chitosan-glycine combination not only improved disintegration time but also crushing strength [79]. Nagar et alfabricated fast mouth dissolving tablets of Cinnarizine an antiemetic and antimigraine agent using chitosan owing to its super-disintegrant property. The results revealed that chitosan based ODTs showed better in-vitro dispersion and wetting properties without compromising the mechanical strength of tablets and exhibits great potential for rapid absorption and improved biaoavailability [80]. According to Ridwanto et al., biopolymer-based oral disintegrating tablets work well. The direct compression approach was used to manufacture ODTs using single biopolymers and mixtures of chitosan, xanthan gum, CMC, and maltodextrin. ODTs that were made with a *maltodextrin* and chitosan mixture disintegrated the fastest, in only 19 seconds [81]. Malviya et al. prepared, examined, and used a polyelectrolyte complex made of chitosan and alginate for fast-dissolving tablets.Different proportions of complex i.e. from 5%-60% were utilized for formulation of FDTs. As a consequence of the ionic interaction and the chitosanalginate polyelectrolyte complex, which proved to be an effective excipient for rapid dispersible formulation, the results showed that tablets release medicine up to 99.97% of the time.Consequently, it has been concluded that as chitosan too liberally swallow up water when encounters aqueous medium and burst owing to pressure exerted by their capillary action, it can be a cost-effective alternative to more expensive super-disntegrants [82].

## Hibiscus rosa sinensis

*H. rosasinensis*, often known as china rose, belong to family *Malvaceae*, is a well-known plant that is also used in the traditional Unani medicinal system.*H.rosasinensis* is cultivated across the tropics and subtropics for its beauty and therapeutic properties [83,84]. Phytoconstituents including *quercetin, carotene, niacin, riboflavin, malvalic acid, gentisic acid, margaric acid, lauric acid, anthocyanin, and anthocyanidine* are associated to the pharmacological effects of *H.rosasinensis* [85,] all of which function as reducing agents when metal salts are present. In addition, these extracts are abundant in phytochemicals known as polyphenols, which serve as stabilising agents [86-88]. H. rosasinensis may be used as a source of fibres for the pulp and paper industries as well as a possible remedy for chemical and poisonous mushroom poisoning [89,90]. A few species of the genus *Hibiscus* have been found to have beneficial biological properties, including antihypertensive, anti-inflammatory, antipyretic, hepatoprotective, anti tumor, antidiabetic, anticonvulsant, antihelminthicimmunomodulator, antioxidant and antimutagenic agents, antimicrobial and antioxidant activities [91,92]. Chinese *Hibiscus* has long been used to heal skin ulcers and furuncles in traditional medicine. The therapeutic properties of *H.rosa-sinensis* may be isolated from the leaves and flowers and used to promote hair growth and cure wounds. It has also been demonstrated to be effective in treating venous irritation and breast discomfort [93,94]. In order to create Levocetrizine Dihydrochloride, an orally active H1 receptor antagonist, Lakshami et al. conducted a comparative analysis of natural and synthesised super-dintegrants. Utilising both synthetic (Kyron T-314, CCS, and crospovidone) and natural (*H. rosasinensis Linn*) super-disintegrants, several formulations were created using the direct compression approach.Natural super-disintegrants, such as *H.rosasinensis Linn mucilage* powder, shown comparable disintegration properties to the most commonly used synthetic super-disintegrants [95]. Patro et al. performed the study of reflective and collaborative influence of synthetic and natural super-disintegrants on characteristics of ODTs of cetirizine hydrochloride, H1-receptor antagonist. ODTs prepared by direct compression were found to achieve relatively quick release of the drug over agreeable period. Combinations of synthetic and natural super-disintegrants exhibited their mutual influences i.e. biocompatibility, inexpensive and better pharmacokinetic profile [96]. Naveen et al., carried out extraction of mucilage from P. ovata, H.rosa and treated agar and investigated their effect on drug release by formulatingoro-dispersible tablets atenolol, a β1-selective adrenergic blocking agent. Tabletswere fabricated by direct compression method and comparative studies of synthetic and natural super-disintegrants was carried out. Finding indicated that combination of natural and synthetic superdisintegrants showed better drug release rate and decreased side effects along with dose reduction [97]. Desu et al., developed the mouth dissolving tablets of Sumatriptanvia direct compression method utilizing H.rosasinesisas natural super-disintegrants and observed that sumatriptan loaded mouth dissolving tablets with superdisintegrants exhibited increase in rate and extent of uptake with reduced undesirable metabolites [98]. Prabhu et al., fabricated and

optimized the oro-dispersible famotidine tablets using H.rosasinesis and treated agar as natural super-disintegrants. Direct compression method proved suitable as well as better option for preparation of oro-dispersible tablets with great bioavailability. This study revealed that natural polymer (H. rosasinesis) is inexpensive and helps to provide better effects than synthetic without any major side effects [99]. Arora et al., formulated and evaluated Cefiximetrihydrate FTDs using natural along with synthetic super-disintegrants i.e. *H. rosasinesis, P.ovata* and SSG, crospovidone, CCS respectively employing direct compression method. It was observed that all the natural super-disintegrants showed good drug release but P.ovata was found to exhibit better disintegrating property than other natural super-disintegrants [100]. Gupta et al., developed and assessed Atorvastatin calciumoro-dispersible tablets using H. rosasinesis as a natural super disniegrant. Tablets were prepared via direct compression method and showed improved bioavaiablitity and reduced first pass hepatic metabolism [101]. The research shows that the mucilage powder from H. rosasinesis disintegrates more readily than synthetic super-dintegrants. Being cheap, biodegradable and easily available it can be utilized as one of the excipients of choice for ODTs formulations. The preparation methodology of orally disintegration tablets as shown in Figure 4.

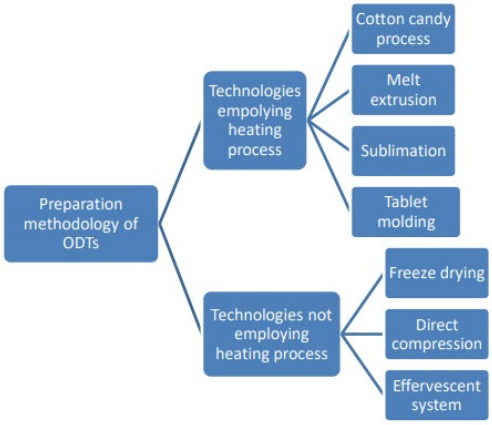


**Figure 4.** Represent the preparation methodology of orally disintegrating tablet.

## Aleo vera

Aloe vera is tropical plant found in hot and dry climates [102]. In medicines of Ayurveda, denoted as Kathalai having 60 cm-100 cm height and is a member of Liliaceae family [103,104]. All over existence for aloe vera around 200 species in biosphere [105]. The phytochemical aloe extract comprises several contents, which are beneficial for human health such as carbohydrates, terpenoids, alkaloids, tannins, steroids etc. [106]. Aloe contains two main products in their leaves [107]. The aloe Vera differentiated into two main fragments one is gel composed of water and sugar present in inner portion leaf and rest is yellowish bitter juice present on outer side of inner layer contains anthraquinone indicates laxative action [108-110]. This compound strengthens the immune system; possess anti-inflammatory, anti-allergic, laxative, wound healing, anticancer, gastro-protective and antibacterial properties [111]. Aloe gel reported with minimum risk of allergies has versatile action in cosmetics and favorable for skin [112,113]. Aloe vera has wide applications in the pharmaceutical excipients also [114,115]. Additionally, it serves as a natural super-disintegrant in the production of tablets that dissolve quickly. Panigrahi et al fabricated and evaluated the outcome of natural super-disintegrants blend on Fast dissolving tablets of Lisinopril, an Angiotension Converting Enzyme (ACE) inhibitor. In order to create fast dissolving tablets with the ideal release profile, hardness, and disintegration time, a variety of natural super-disintegrant components, such as isolated mucilage of Aloe vera, P. ovata, and H. rosasinesis, were used. The pills dispersed swiftly in the mouth within 40 seconds, with 0.065% friability mentioned [116].

## Natural gums

A family of naturally occurring polysaccharides referred to as "gum" are recognized for their capacity to create "gel" or "viscous solution." [117]. Theyare mostly used because they are environmentally friendly, biocompatible, and biodegradable [118]. Based on their place of origin, inherent properties, structural characteristics, and intended applications, natural gum hydrocolloids are categorized [119]. Due to their ability to reduce interfacial tension in a variety of frameworks, including gas-liquid, liquid-liquid, and solid-liquid, natural gums offer unique surface characteristics. Through steric, electrostatic interaction, and hydration forces, this capacity bestows stability [120]. Guar gums, locust bean gums, pectin tree gums, gellan gum, dextran and xanthan gums Gums include arabic, karaya, tragacanth, ghatti, and kondagog, as well as alginate, carrageenan, and agar [121]. Applications for plant gums in the food industry include coating, binding, and stabilising agents in baked goods, confectionery, fried foods, and fruits; clarifying, clouding, flavour encapsulating, or stabilising agents in alcoholic and non alcoholic beverages; glazing agents in candies and chewing gums; and fabricating agents in restructured meat, fish, fruit, and vegetable products. Gums are also advantageous in pharmaceutical industries as excipients [122,123].

## Guar gum

Guar Gum is a naturally occurring high molecular weight carbohydrate polymer and considered as an Indian gum because of their origin [124,125]. It is produced from the seed endosperm of *Cyamopsistetragonoloba* and belongs to the family *Leguminosae*[126]. It is composed of a linear chain with a 1,4-linked D-mannose backbone that branches with 1,6-linked Dgalactopyranose residual units almost every other position [127]. It has an average of 80% *galactomannan*, 12% water, 5% protein, 2% acidic insoluble ash, 0.7% ash, and 0.7% fat. It is biocompatible, biodegradable, hydrophilic, easily available, eco- friendly, non-toxic, costeffective and facile [128]. It is used as suspending, emulsifying, gelling and stabilising agent in the variety of dosage forms [129]. Due to its high viscosity and gel-forming ability, many forms of guar gum and its derivatives are used as effective drug delivery agents [130,131]. Hence, guar gum is natural polysaccharides with characteristics properties and has been recommended as natural super-disintegrants in the fabrication of FTDs. Sharma et al. produced *Zolmitriptan* FTDs and studied how starch and guar gum 4000 affected the drug's dissolving rate and behavior.The FDTs were created using the direct compression approach and analyzed for multiple parameters. The study revealed that formulations containing guar gum (5%) and starch (10%) disintegrated rapidly and plasma concentration of drug was found to increase [132].

## Gum karaya

Sterculiaurens trees, which are part of the Sterculiaceae family, produce gum Karaya, a dried exudate [133,134]. This species is mostly found on sloppy, scattered tropical rocks between 1300 and 2600 feet in height [135,136]. D-galacturonic acid that is α-(1,4) connected and L rhamnosyl residues that are α-(1, 2) linked make up the primary chain of karaya gum. The side chain is made up of (1, 3)-linked β-D-glucuronic acid or β-(1,2)-linked D-galactose where one half of the rhamnose is replaced with (1,4)-linked β-D-galactose on the galacturonic acid unit [137,138]. Gum Karaya includes 1.2-1.63% protein, 1-2% lipids, and 8% acetyl groups [139,140]. It is widely utilized because of its biocompatibility, lack of toxicity, affordability, ecologically friendly manufacture, and accessibility locally. In the food, drug, and cosmetic sectors, they are preferred to synthetic polymers. These are chosen over synthetic polymers in the food, pharmaceutical, and cosmetic industries [141,142]. Gum Karaya is employed in the pharmaceutical sector, among other things, as a suspending agent, emulsifying agent, bulk laxative, dental adhesive, binder, and disintegrant [143]. *Phytoconstituents* in gum karaya are potentially used as an anti-inflammatory, antitumor, antioxidant, antispasmodic, antitoxic, antidepressant, and antidiabetic agents. The modified form of gum karaya provides fastest disintegrating properties, hence, utilized in fast disintegrating tablets [144]. Bansal et al., produced and analyzed Ondansetron HCl oral disintegrating tablets including natural and synthetic Super-disintegrants. Tablets containing varied concentrations of super-disintegrants, such as modified gum karaya, altered natural agar, CCS, and SSG, were made using dry granulation. The findings showed that modified gum karaya and altered natural agar produced rapid tablet disintegration and showed that, because of their low cost, biocompatibility, and simplicity of availability, they may be used as excellent super-disintegrants [145,146]. Shahtalebi et al formulated and evaluated ODTs of Captopril using synthetic super-disintegrants i.e. CCS and crospovidone, as well as karaya gum and natural agar, are natural super-disintegrants. ODTs containing karaya gum demonstrated a faster disintegration time and were thus recommended for future research. With a 9% weight-to-weight concentration, Karaya gum rapidly disintegrated in 25 seconds and demonstrated 100% drug release in 5 minutes. It was concluded that ODTs of captopril can be successfully formulated using karaya gum and used in the emergency condition of high blood pressure and heart failure for providing relief to the patient [147]. Sulthana et al., carried out the formulation, development, and evaluation of Paracetamol mouth dissolving tablets. By

combining synthetic and natural super-disintegrants suchascrospovidone, SSG, CCS, soy powder, and gum karaya, tablets were formulatedutilising the direct compression approach. The result revealed that formulations containing gum karaya exhibited rapid disintegration comparable to synthetic super-disintegrants [148].

## Gellan gum

It is produced fromaerobic fermentation of bacterium *Sphingomonas elodea* [149]. It is an anionic polysaccharide that is present in nature and has four repeating carbohydrates, including two from d-glucose, one from l-rhamnose, and one from d-glucuronic acid [150]. It acts as a gelling agent, with a water content of up to 0.65 g/g gellan at 25 °C. High acyl gellan gum produces soft, elastic, and flexible gels, whereas *deacylatedgellan* gum produces non-elastic, brittle, and hard gels (162). High swelling capacity, increased hydration capacity, biocompatibility, biodegradability, mucoadhesion, ductility, and non-toxic nature are all features of this substance (163). It is strongly recommended as safe excipient for pharmaceutical and human use (food, cosmetic) (164,165). Gellan gum is recognized as a key oral medication delivery method and a possible natural disintegration agent because of its high swelling and hydration capacity [151-155]. Development and evaluation of Fexofenadine hydrochloride oro-dispersible tablets utilizing three different natural and synthetic super disintegrants in various ratios and comparison of these formulations for their disintegration properties was carried out by Sivadasan et al., for the preparation of ODTs direct compression technique was employed. The results displayed that oro-dispersible tablets containing gellan gum as natural super-disintegrants showed comparable disintegrating property to SSG [156-158]. Biswas et al prepared compressed coated doxazosin tablets and also determine the influence of synthetic and natural super-disintegrants i.e. CCS, hydroxyl propylcellulose and gellan gum respectively on drug release. *Doxazosin* an anti-hypertensive agent and its tablets were formulated by direct compression. The physical and chemical characteristics, medication content, or dissolution pattern of the pulsatile tablets did not alter throughout the accelerated stability. The result shows that gellan gum as natural super disintegrants revealed better and quick release of drug [159]. Shah et al. used a super disintegrant called modified gellan gum in the factorial tablet design. Shah et al., utilized modified gellan gum as a super-disintegrant in tablet making factorial design.The swelling ratio of modified gellan gum was shown to be superior to pure. The optimized batch was found to have a potential disintegration time of 155 s as well as a percent drug release of 39 and 78% in 2 and 5 min, respectively [158].

## Locust bean

It is a non-starch vegetative white to creamy white powder and extracted from the seed endosperm of carob tree (Ceratoniasiliqua) [159]. Hence, it is well known as carob gum and belongs to leguminosaefamily [160,161]. The seed is divided in three portions husk, germ, endosperm, and each portion have desirable potential therapeutic applications [162,163]. The locust bean structure is made up of linear chains of high-molecular-mass hydrocolloidal polysaccharides and is made up of galactose and mannose units linked together by glycosidic connections, which are chemically characterized as galactomannan and long galactose chain [164]. It shows characteristics properties such as inert, safe, non-toxic, biocompatible, biodegradable and easily availability [165,166]. It is often used and valued as an ingredient in a variety of products, including those for the food, pharmaceutical, cosmetics, and other sectors [167,168]. Locust bean has an ability to control many health issues such as diabetes, bowel movements, heart disease, cancer etc. Locust bean gum biopolymer has an attractive potential to produce fast dissolving tablets due to its disintegrating property [169-171]. Using the direct compression approach, Shirsand et al. created, characterized, and assessed Metoclopramide hydrochloride FTDs. In various ratios, mucilages from Musa paradisiaca Linn (banana fruit), Cucurbitapepovar. turbinata (cucurbita maximum pulp), Ceratoniasiliqua Linn (locust bean seeds), and crospovidone (a synthetic super-disintegrant) were used. The results shows that formulations containing mucilage of locust bean seeds were found to exhibit significant dispersion rate comparable to synthetic disintegrants [172]. The formulation and evaluation of oro-dispersible Metoprolol tartrate tablets with natural and synthetic super-disintegrants, such as locust bean gum and SSG, crospovidone, and CCS, were done by Kumar et al., using various ratios of the natural and synthetic super-disintegrants, such as locust bean gum and SSG, crospovidone, and CCS [173]. The optimized formulation of locust bean gum was shown to have the shortest disintegration period. Malik et al investigated the disintegrating properties of locust bean gum and CCS as natural and synthetic super-disintegrants respectively while formulation of Nimesulide oro-dispersible tablets. According to the findings, formulations containing 10% locust bean gum were shown to dissolve 13 seconds quicker than CCS [174]. Mohammadi et al prepared and characterized Lornoxicam oro-dispersible tablets using Gum karaya, *P.ovata* and locust bean gum as super-disintegrating agent. The formulations were made by direct compression method. They observed the enhanced dissolution rate and aqueous solubility in fast dissolving tablets [175].

## Agar

It is a crucial component of the cell wall. The interesting hetero-polysaccharide known as rhodophyta, or red algae, has a backbone made up of repeated units of 1,3-linked D galactopyranose and 1,4-linked 3,6-anhydro-L-galactopyranose [176,177]. Generally, it is colourless, odourless with mucilaginous taste. Agar may range from 80,000 g/mol to 140,000 g/mol in molecular weight [178,179]. Agar is soluble in hot water when dried, but it is insoluble in cold water and very slightly dissolves in ethanolamine [180,181] The inclusion of water-soluble (phycoerythrobilin) and fat-soluble (chlorophyll a and carotenoids) pigments in agar creates its yellow-brown colour, which has a considerable influence on its characteristics and applications [182,183]. Agarose and Agaropectin are two polysaccharides that make up agar. Agarose is in responsibility of gel strength, while Agaropectin is in charge of agar solution viscosity [184]. It can function as a disintegrant due to its high gel strength [185]. Gums are used in concentration from 1% to 10% [186]. Agar is used as a stabiliser, gelling agent, and cryoprotectant in the pharmaceutical, medical, cosmetic, and biotechnological industries due to its gel reversibility and natural biodegradability [187]. It has emerged as a promising compound due to its distinct biological activities, which include anti-obesity, anti-diabetic, immunomodulatory, anti-tumor, antioxidant, skin-whitening, skin-moisturizing, anti-fatigue, and anti-carcinogenic activities, as well as other industrial applications such as toxic waste treatment, photobleaching, and anti cariogenic activities, among others [188]. Rao et al studied the oral disintegrating tablets of Sumatriptan succinate, an anti-migraine agent using treated agar as natural and CCS as synthetic super-disintegrants via direct compression method. The results suggested that formulated sumatriptan succinate oral disintegrating tablets containing 7.5% concentration of treated Agar showed good and rapid disintegration without affecting the release profile when compared with CCS [189]. Lakshmi et al Natural modified polysaccharides, natural super-disintegrants such as modified karaya gum and modified agar with glycine and mannitol were used to make Donepezil hydrochloride oro-dispersible tablets. Formulations with natural super-disintegrants were compared with formulations containing synthetic super disintegrant Kyron T-314, for improvement in disintegration time. When compared to modified karaya gum formulations, oral dispersible tablets produced with modified agar with glycine exhibited faster disintegration time. The results indicate that modified polysaccharides agar with glycine can be utilized as a natural super-disintegrant, which would be a more cost-effective alternative to manufactured super disintegrants like Kyron T-314 and give a superior drug release profile [190]. Sharma et al developed oro-dispersible tablets of Roxithromycin, a macroloide antibiotic, using natural super disintegrants modified polysaccharides i.e. treated agar and treated guar gum as rapidly disintegrating excipients. Results indicated that formulation containing modified polysaccharides, treated agar exhibited least disintegration times without any friability concerns [191]. Thus, the study showed that employing modified polysaccharides as rapid disintegrating excipients provided better stability of formulation along with fastest release of drug. Influence of directly compressible excipient along with treated agar was studied by Venkateswarlu et al on release of drug from ODTs of Clopidogrel, an antiplatelet drug. To improve bioavailability and patient compliance, ODTs were designed utilising two alternative methods: direct compression and effervescent approach using directly compressible natural excipient, i.e., treated agar [192]. The results showed that the treated agar formulation generated by direct compression approach was the best formulation based on in vitro drug release characteristics. Metoprolol tartrate oro dispersible tablet formulation and assessment, a beta blocker, containing natural and synthetic super-disintegrants was carried out by Thumbarappully et al.Several oro-dispersible formulations have been produced by varying the ratios (concentrations ranging from 3% to 12%) of natural super-disintegrants (agar, treated agar) and synthetic super-disintegrants (SSG, CCS, and crospovidone). They concluded that formulations containing treated agar disintegrated in the range of 19 seconds-30 seconds, with 95%- 100% drug release happening in 5 minutes. The formulation demonstrated stability, with a quick disintegration time and a high rate of drug release [193]. Balamuralidhara et alstudied the effect of several disintegrants on oro-dispersible tablets of Rabeprazole, a proton pump inhibitor. Direct compression tablets were created utilizing diluents and a

variety of natural and synthetic super-disintegrants. i.e., treated agar powder and crospovidone and CCS respectively. The results revealed that disintegration time decreased as super-disintegrant content increased, and formulations followed first-order release kinetics [194].

## Fenugreek

*Fenugreek* or *Trigonella-foenum graecum*, an aromatic plant containing alkaloids is one the most promising medicinal herbs belonging to *leguminous* family [195,196]. Because of its food- related and therapeutic benefits as an herbal treatment, this plant has been widely used for over 2500 years [197,198]. Fenugreek is a small seeded plant that is commonly grown in Mediterranean countries and widely used in Indian diet as a spice [199]. Taproots, light green foliage, light white blooms, and 10 cm-15 cm long pods with yellow and brown seeds are all characteristics of fenugreek plants [200,201]. The abundance of polyphenolic compounds such as alkaloids, flavonoids, salicylate, and nicotinic acid contributes to the benefits of fenugreek seeds. Flavones di c-glycosides, flavonol o-diglycosides, flavone tri- and tetra o-c-glycosides, and acylated flavone o-c-glycosides have been identified in fenugreek seeds. Among the flavones found are epigenin, luteolin, orientine, querceitin, vitexin, and isovitexin [202]. Fenugreek seeds also contain around 7%-10% crude oil, which is high in unsaturated fatty acids [203,204]. This plant's seeds and leaves are widely used for a variety of therapeutic and medical uses, including anti-diabetic, anti-inflammation, anti-cancer, and antioxidant agents [205,206]. They are also effective in anticholestrolemic, antimicrobial, anthelmintic, anti-leprotic and anti bronchitic properties [207,208]. Their seed mucilage has been employed as a medical excipient due to its non-toxicity, low cost, free availability, emollient, and non-irritating properties. Hence, fenugreek seeds and mucilages considered as good natural super-disintegrants for the formulations of fast dissolving tablets. Kumar et al., created FTDs of Diclofenac sodium with fenugreek gum as a natural super-disintegrant that also has anti-inflammatory properties.FDTs were created utilising the direct compression approach with varying concentrations (1%-6% w/w) of fenugreek gum and compared to synthetic super-disintegrants such as SSG and CCS.The current study discovered that fenugreek gum, act as a natural super-disintegrant, outperformed the most commonly used synthetic super-disintegrants in FDT formulations, such as SSG and CCS, at 6% concentration [209]. Sukhavasi et al., produced FDTs of Amlodipine besylate, an antihypertensive and antianginal drug, including natural polymers such as fenugreek seed *mucilage* and *Ocimumbasilicum* gum to achieve rapid start of action.Simple and cost-effective tablets were created using the direct compression technology. According to the findings of this investigation, FDTs with fenugreek seed *mucilage* and O. *basilicumgum* as superdisintegrants decomposed quicker than synthetic super-disintegrants with high stability [210]. Kumar et al., isolated mucilage from seeds of fenugreek and evaluated its disintegrating properties by fabricating MDTs of Metformin HCl, an antidiabetic agent. FDTs of metformin HCl were formulated using different concentration of natural super-disintegrant (fenugreek seed) and compared with synthetic super-disintegrants (CCS). FDTs with 4% fenugreek mucilage demonstrated a 15-second disintegration time and 100% drug release in 18 minutes, making them the optimal formulation. As a consequence, the study discovered that this natural disintegrant (fenugreek - mucilage) outperformed the most widely used synthetic super disintegrants in FDT formulations, such as CCS [211].

## Lepidium sativum mucilage

*Lepidium sativum L.* (Garden cress) is a member of the family *Brassicaceae*, which includes 53 genera and 103 species in Egypt, and grows well in all types of soil and climate [212,213]. In Egypt, "Habel Rashaad" is the genus of L. sativum, whereas in Saudi Arabia, it is also known as Rashad or Thufa [214]. It is an annual herbaceous plant that grows to a height of 15 cm. L to 45 cm. L. sativum bears long racemes with little white flowers and broad or obovate pods that are winged and emarginated at the apex [215,216]. Traditional medicine in several nations uses the leaves, stem, and seeds of L. sativum. Its seeds have been utilized to treat coughs, bronchitis, asthma, dysentery, skin illness, splenomegaly, scurvy, tonic, seminal weakness, gastrointestinal disorders, hair loss treatments, immune boosters, and it also boosts milk supply during lactation [217]. It has also been reported to have anticancer, antihypertensive, diuretic, anti-inflammatory, analgesic, anticoagulant, fracture healing, antioxidant, anti-malarial effect, hypoglycemic, antidiarrheal, antispasmodic, antimicrobial, kidney and liver protective effects, hypolipidemic and *hypocholesterolemic* effect, as well as anti-diabetic properties [218,219]. The current study was conducted to investigate the disintegrating impact of *L. sativum ethanolic* and aqueous seed extracts in the formulation of ODTs [220]. L. sativum seeds contain 24% oil, the bulk of which is ALA (32%), followed by Linolenic Acid (LA) (12%). This oil is reactively stable due to its high antioxidant and phytosterol content [221]. Mehta et al., evaluated Nimesulide FTDs containing natural super-disintegrants *L. sativum*, commonly known as Asaliyo, which is widely used as a natural medicine and pharmaceutical excipient. The mucilage of *L. sativum* seed was extracted and employed to make the fast dissolving tablet of Nimesulide. The disintegration capabilities of extracted mucilage in FDTs were compared to widely employed synthetic super disintegrants such as SSG, Kyron T314, and Ac-Di- Sol. The study indicated that higher dissolution of tablet was obtained with 10% mucilage and mannitol concentration. The FTDs enhance the drug dissolution (79.9%) after 30 min than the other tablets [222].

## *Ocimum basilicum*

*Ocimum basilicum* is an aromatic herb, the scientific name of which is sweet basil or Reihan related to the family Labiatae [223]. Many Asian, African, European, and American countries grow it extensively [224] and because of the high concentration of anthocyanins in its leaves, it has a purple colour [225]. *O. basilicum* derived chemicals mostly consist of triterpenoids, polyphenols, steroids, and phenylpropanoids, with rosmarinic acid being one of its primary phenolic components. [226]. It has been widely used to treat a wide range of neurological disorders that can lead to serious health problems, including anxiety, headaches, migraines, nerve pains, carminative, antispasmodic, anti-HIV, anti-aging, anti-cancer, anti-inflammatory, kidney dysfunction, acne treatment, abdominal pain, inflammation, diabetes, and eye diseases [227,228]. The essential oils of *O. basilicum* show activity against a wide range of bacteria, fungi and parasites. *O.basilicum* is used in perfumes, soap, dental treatments, and mouthwashes, in addition to in Mediterranean foods including soup, cream cheese, and pasta [229,230]. Hence, *O. basilicum* is essential natural product which is also utilized as pharmaceutical excipients. Sharwaree et al.,evaluated a FDTs of Paracetamol made from dried mucilage extracted from *O. basilicum* seeds as a novel disintegrating agent. Paracetamol FTDswere developed by using traditional wet granulation techniques. FDTs of paracetamol made from isolated mucilage were compared to synthetic super-disintegrants CCS, crosspovidone, and SSG. According to research, paracetamol tablets manufactured using dried mucilage as a disintegrating agent resulted in tablet breakdowns comparable to known synthetic super-disintegrants. [231]. Prasanna et al formulated oro-dispersible Valsartan tablets with seed mucilage from Carica papaya and *O.basilicum* as a unique natural super-disintegrant. The study's rationale was to develop oro-dispersible valsartan tablets with better oral bioavailability and to make administration easier for patients who have difficulty swallowing. Valsartan containing *O. basilicum* seed mucilage and C. papaya seed mucilage as the super-disintegrant showed better results in 10% concentration. It took less disintegration time of around 156 s and 99.2%-99.0% of drug release within 10 min [232]. Sharma et al fabricated fast dissolving tablet loaded with Lamotrigine to increase the bioavailability as well as the initial phase of action to control seizures during an epileptic phase. Natural super-disintegrants (*O. basilicum*) and synthetic super-disintegrants were used in the preparation of FDTs. The results showed that formulations with different combinations of super disintegrants were found to exhibit quicker and better disintegration when compared with synthetic super-disintegrants [233]. Panda et al., evaluated the synergistic effects of oro dispersible Diclofenac sodium tablets combined with natural super-disintegrants from P. ovata and seed mucilage from O. basilicum.These were discovered to dissolve in 36 seconds, with a cumulative percent drug discharged of 99.2% after 25 minutes [234]. Development and evaluation of Paracetamol FDTs containing mucilage isolated from O. basilicum were carried out by Bucktowar et al., Total six formulations were prepared containing increasing amount of mucilage via direct compression method. They revealed that formulation containing 65 mg of mucilage was stable found to disintegrate within 180.01 s and 99.6% of drug release [235].

## Cassia tora

Cassia Tora (CT) Linn, an herbaceous plant of the Caesalpinaceae subfamily and the Leguminosae family, popularly known as "takrike" in India [236,237]. C.tora is an annual weed found in Central America, India, and South Asia. This plant grows to be around 100 cm tall, and its young leaves are edible [238,239]. C. tora seed extracts include a variety of useful compounds, includes cinnamaldehyde, gum, tannins, mannitol, coumarins, essential oil, and other phenolic components such as anthraquinones, naphthopyrones, naphthalenes, hydroanthracenes, and their glucosides [240,241]. C. tora is used in the treatment of jaundice, asthma, intestinal problems, ulcers, skin diseases, antihelmenthic, cardiotonic, expectorant, dyspepsia, constipation,

bronchitis, and as an anti-oxidant, antibacterial, antifungal, antihelminthic, anticancer, antimutagenic, antinociceptive, anti-allergic, hypotensive, hypolipidemic, and in arthritis, ophthalmological disorders, urinary symptoms, and hemoglobinopathies [242,243]. In this work, polysaccharides extracted from C. tora are tested for superdisntegrant action in the composition of orodispersible tablets [244]. Pawar et al., developed and evaluated oro-dispersible tablets of Valsartan, an anti-hypertensive medication, utilising natural polysaccharide obtained from C. tora seeds and synthetic SSG as a super disintegrant. Direct compression was used to create the oro-dispersible tablets. C. tora seed polysaccharide has a great potential for application as a disintegrant in the formulation of oro dispersible tablets, according to the study [245]. Garg et al., to increase patient compliance, Glibenclamide rapid dissolving tablets were created. FTDs were made by direct compression from the natural super-disintegrants C. tora and P. ovata. They determined that glibenclamide's quick dissolving drug delivery technology may be successfully designed. They demonstrated that all formulations disintegrated between 30-73 seconds and that 100% of the medication was liberated from these formulations within 15 minutes [246].

## Aegle marmelos

Aegle marmelos, often known as bael, is a plant native to India that belongs to the Rutaceae family. Bengal quince, Indian quince, holy fruit, golden apple, and bael or bilva in Hindi are some more names for them [247]. Bael is an isolated plant in the genus Aegle (bera) and is a slow-growing, hardy subtropical tree. The tree grows naturally in well-drained soil and may reach a height of 12 to 15 m even in tough and arid conditions [248] The fragrant blossoms grow in bunches along the young stems [249]. The fruit is grey green when raw and yellowish when mature [250]. The shells contain minute aromatic glands that generate a very nice odor. The pulp is pale orange in colour, pasty, sweet, resinous, and aromatic [251,252]. A. marmelosincludes phyoconstituents that include carotenoids, phenolics, alkaloids, pectins, tannins, coumarins, flavonoids, and terpenoids [253]. According to sources, the bael fruit gum includes d-galactose (54.26% w/w), l-arabinose (6.1% w/w), l-rhamnose (18.83% w/w), and glucouronic acid (20.8% w/w) [254]. Many medical characteristics of the plant have been discovered, including astringent, aphrodisiac, demulcent, haemostatic, antidiarrheal, antidysenteric, antipyretic, antiscourbutic, antimalarial, and antidote to snake venom [255,256]. The seed extract has antifungal and antiviral action against Vibrio cholerae, Staphylococcus aureus, and Escherichia coli. The fruit is edible and possesses antibacterial and antihistaminic properties. [257]. A. marmelos gum exhibits wide applications in various disease and used as superdisintegrants in the formulation of FDTs [258]. Kulkarni et al., developed and examined Aceclofenac FDTs after enhancing its solubility. A solid dispersion method and modified A. marmelos gum were used to modify the solubility of a specific medicine. According to the findings, aceclofenac solid dispersion with modified A. marmelos gum may be useful in enhancing drug solubility and dissolution as well as producing quick dissolving tablets [259].

## Dehydrates banana

The banana (*Musa paradisica L.*) of the *Musaceae* family is a significant fruit across the world, particularly in the tropics [260]. It is the most produced and consumed fruits in the world, and has a high nutritional value [261]. Varieties of bananas are utilized for the preparation of dehydrated banana powder [262]. It contains vitamin A and is useful to treat stomach ulcers and diarrhoea [263,264]. It also contains vitamin B6, which helps to reduce stress and anxiety [265]. It contains potassium, which is necessary for proper brain function, and it is an excellent source of energy because of its high carbohydrate content [266,267]. Dehydrated banana powder used as pharmaceutical excipients (super-disintegrants) in the fabrication of FDTs [268]. Formulation and characterization of FDTs of Lornoxicam using different natural and synthetic super disintegrant via direct compression technique was carried out by Taksande et al. FDTs were developed using natural super-disintegrant banana powder, soy polysaccharide, and the synthetic super-disintegrant crosspovidone. It was reported that tablets formulated by addition of natural superdisintegrant were found to possess less disintegration time, more water absorption as well as drug release [269]. Bharathi et al., developed and studied orally disintegrating tablets of Telmisartan, an antihypertensive drug using natural super-disintegrant banana powder. In the manufacture of ODTs, they compared it to other synthetic super-disintegrants. It was investigated that banana powder had significant disintegrating property and can be very well utilized for preparing ODTs. Banana powder tablets were found to disperse swiftly within 15 seconds and to have 92.09% drug release in 15 minutes [270]. The various natural superdisintegrants and their properties is entitled in Table 1.

**Table 1**. List of various natural superdisintegrants and their properties.

| S. No. | Plant source (Family) | Part of plant used | Common name | Major Finding | Appearance | Swelling index | Uses | Reference |
|---|---|---|---|---|---|---|---|---|
| 1. | *Plantago ovata* (Plantagi naceae) | Husk powder | Psyllium | Showed better disintegrat ion property | Pleasant and cooling sensation in the mouth | Vigorousl y swell | Laxative and showed lower glycemic index | [271] |
| | | Husk | | *P. ovata* husk better superdisin tegrant | Brownish color | 15% | Combined with drug and showed antidiabetic property | [272] |
| | | Mucila ge husk | | Released up to 90 % drug within 15 minutes | Brown color | 84% | Combined with drug and showed antibacterial agent | [273] |

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| | | Mucila ge | | Showed a disintegrat ion time less than 25 seconds | Brown color, Mucilage taste | 92% ± 2.0% | Combined with drug avoid gastric irritation | [274] |
| 2. | *Cassia tora* (Legumi nosae) | Seed | Panwar gum | Rapid dissolutio n of drug | Light brown color | 133.4% | Asthma, improve visual activity, inflammatory and hepatoprotective activity | [275] |
| | | Seed mucilage | Panwar gum | Mucilage powder produce good drug release | Brown and Odorless | 11.1 ± 0.79 5 | Combined with drug and produce anti-hypertension activity | [276] |
| 3. | Agar (Gelidiac eae) | Powder form | Agar-agar | Showed better disintegrat ion | Red powder, odourless | 123 ± 1.43 | Combined with drug and prevent from Alzheimer diseases | [277] |
| 4. | Locust bean | Powder | Carob bean gum | locust bean gum | White to yellow white | 2000 | Used in food industry as a | [278] |
| | gum (Legumi nosae) | | | was used as better superdisin tegrant | powder | | thickening and gelling agent. Locust bean gum has also used as bioadhesive and solubility enhancement properties | |
| | | Bean Gum | Parkia biglobosa | Better superdisin tegrant and observed rapid disintegrat ion | - | 117.45% | Combined with drug produce an antiemetic activity | [279] |
| | | Seeds powder of the carob tree | carob gum, carob bean gum, carobin | disintegrat ion time was found to be 17 seconds for the optimized formulatio n of Locust Bean Gum | White to yellow white powder. | Good | Combined with Metoprolol tartrate drug manage hyper tension, congestive heart failure. Also LBG is used as a thickening agent and gelling agent in food technology. | [280] |

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|---|---|---|---|---|---|---|---|---|
| 5. | *Aloe barbade nsis*(Lilia ceae) | Inner parts of the fresh leaves gel | Aloe vera,Mille r | Observed disintegrat ion and wetting times. | Colorless gel | - | Used as moisturizer and a healing agent in cosmetics and OTC drugs | [281] |
| 6. | *Hibiscus rosa sinensis* (Malvace ae) | Fresh leaves | Rosa dellachina | *H. rosa sinensis* Linn mucilage powder showed better disintegrating property | - | Faster swelling | Combine with drug uncomplicated skin manifestations of chronic idiopathic utricaria | [282] |
| 7. | *Musa paradisi aca* (Musace ae) | Banana powder | Banana | showed better drug release and disintegrat ion time | - | 71.10% to 91.61% | Combined with Metoclopramide drug produce anti-emetic activity | [283] |
| 8. | *Ocimum basilicu m* (Lamiace ae) | Seeds mucilage powder | - | Dried mucilage as disintegrat ing agent resulted in rapid disintegrat ion | - | 40% | Combined with paracetamol produce antiinflammatory activity | [284] |
| | | *O. basilic um*muc ilage seed | Sweet Basil Seed | *O. basilicum* seed mucilage consider good superdisin tegrants | Brownish yellow | 1712.5% | antibacterial, antifungal, antispasmodic, carminative, diaphoretic, digestive, emmenagogue, expectorant, stimulant, stomachic | [285] |

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| | | seed mucilage powder | Basil seeds | *O. basilicum* powder as the superdisin tegrant in 10% concentrat ion perform better | Brownish yellow powder | - | Combined with valsartan drug produce hypertension management | [286] |
| | | seed mucilage powder | Basil seeds | Showed better disintegrat ing activity | - | Good swelling property | Combined with lamotrigine control the seizures that occur during the epileptic attack. | [287] |
| | | Mucila ge Powder | Basil seeds | Disintegra te in 36 secs and better drug release | | Better swelling ability | Natural superdisintegrants produce synergic effect | [288] |
| 9. | *Tamarin dusindica and Cassia fistula (Leguminosae)* | Powder | Crude gums | Produce fast disintegrat ing agents | | 72%-79% | disintergrant, diluent and drug release controlling agent. | [289] |
| | Cassia fistula (Caesalpi niaceae) | C. fistula powder | Golden shower tree | | Cassia gum was reported to improve cold water solubility, improve viscosity and increase microbial resistance as compared to native gum | 43% | Better natural superdisintegrants | [290] |
| | | *Seed gums powder* | golden shower tree | Good potential of C. fistula mucilage as | Soluble in cold water and hot water forming viscous colloidal solution | 33.0 ± 0.15 | utility of these gums in the field of paper, textile, petroleum recovery and pharmaceutical industries | [291] |
| 11. | Karaya gum | Powder | Amaltas | Better disintegra nt | Whitish-brownish, Odourless Characteristi cs Rough Irregular fracture | 381.66 ± 2.88 | Used in pharmaceutical excipients | [292] |
| 12. | Chitosan | Powder | - | disintegrat e within few seconds | - | Good swelling ability | bioadhesive polymer and having antibacterial activity, chitosan is being used in ophthalmic, nasal, oral, gastrointestinal, colon-specific, vaginal, and transdermal drug delivery systems | [293] |
| 13. | Fenugree k (Legumi nosae) | Seed powder | - | disintegrat ed much faster | Yellowish to brown | 84% | Combine with Amlodipine drug produce anti-hypertensive and in | [294] |

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| | | | | | | | the treatment of angina. | |
| | | Gum | - | least anti-inflamming time 21 seconds and good super anti-inflamming agent | - | 221% | Combine with diclofenac sodium to produced anti-inflammatory activity | [295] |
| | | Seed powder | *Trigonella foenum-graceum* | Good 12iarrhea12ateing agent | Amorphous powder, No characteristic odor, Tasteless, Off whitecream yellow color | - | as a food preservative, seeds have numerous applications in cosmetic and traditional medicine system.Fenugreek has been used in treating colic flatulence, dysentery, 12iarrhea, dyspepsia with loss of appetite, chronic cough, dropsy, enlargement of liver and spleen, rickets, gout, and diabetes. It is also used as gastro protective, antiurolithiatic, diuretic, antidandruff agent, Anti-inflammatory agent and as antioxidant | [296] |
| 14. | *Sterculia urens* (Sterculi aceae) | Gum Powder | Karaya gum | Perform good disintegranting property | - | - | effective bulk laxative and adhesive agent for dental fixtures | [297] |
| | | Gum Powder | - | better disintegration time | - | - | Good pharmaceutical excipients | [298] |
| | | gum karaya | - | Rapidly disintegrant within 90 seconds | - | - | Combined with Paracetamol produce analgesic | [299] |

## Conclusion

Oral disintegrating tablets (ODTs) have emerged as a viable and promising strategy for the manufacturing of tablets with a variety of positive properties that are required for the treatment of a variety of illnesses. ODT-based delivery systems have made significant advances in controlled and sustained release due to their high surface area, tunable porosity, and mechanical endurance, compatible environment for drug encapsulation, biocompatibility, high drug loading capacity, and tailorable release characteristics. According to the findings of this review study, the natural super-disintegrant for oral disintegrating tablets has a significant influence on disintegration. Natural occurring super- disintegrants augment the drug release rate from the tablet and decline the disintegration time. Several investigations reported that the combination of disintegrants is more effective than individual disintegrant. The disintegration properties of natural super disintegrant have been examined due to their beneficial exposure in comparison to artificial super disintegrant. Consequently, it extends the oral route products life cycle due to desirable and valuable effects of quick disintegration. As a result, rapid disintegration of tablets technology proves to be a boon for the pharmaceutical industry and future projects, such as dosage formulation of poorly water soluble drugs, which frequently faces several challenges, including complete dissolution with maximum therapeutic efficiency over a short period of time, particularly via oral administration. In this regard, by combining the favourable feature on oral disintegrating tablets, the challenges associated with the dosage formulation of poorly water soluble drugs may be resolved.

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