INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Article

A Review on Natural Disintegrating Agents

S.T.V. Raghavamma[1], K. Hemavarshini[2], G. Naga Sai Sandeepthi[3], M. Pavani[4], P. Suma Sri[5]

[1,2,3,4,5] *Department of Pharmaceutics, Chalapathi Institute of Pharmaceutical Sciences, Lam, Guntur-522034*

ARTICLE INFO

Published: 29 Jun. 2026
Keywords:
Disintegrants; Natural excipients; Biopolymers; Solid dosage forms..
DOI:
10.5281/zenodo.21024002

ABSTRACT

Disintegrants are the substances which plays a vital role as crucial excipients in modern pharmaceutical formulations especially in the solid dosage forms by promoting rapid tablet disintegration and improving drug dissolution and bioavailability. There are different types of disintegrating agents such as synthetic disintegrants like Crospovidone (Cross-linked PVP), Semisynthetic disintegrants such as Sodium carboxymethyl cellulose (NaCMC) and Natural disintegrating agents like Guar gum, pectins etc. The Natural disintegrants are derived from the natural sources that are plants, marine organisms and microbial sources. The commonly used plant-derived materials (starch, guar gum, fenugreek mucilage, ispaghula husk, gum karaya, pectins), marine-derived polymers (agar, alginates, carrageenan, chitin, chitosan) and microbial polysaccharides (xanthan gum, gellan gum), along with their trade names and formulation relevance. Natural disintegrants promote tablet disintegration through mechanisms including swelling, capillary action, elastic recovery, electrostatic repulsion, enzymatic degradation and heat of wetting. In recent years, the naturally derived disintegrants gained significant attention over the synthetic due to their biodegradability, biocompatibility, low toxicity, cost-effectiveness and improved patient acceptability. Emphasis is placed on their multifunctional roles as disintegrants, binders and release-modifying agents in conventional, fast-disintegrating, effervescent and herbal dosage forms. This review comprehensively summarizes the naturally derived disintegrating agents, their sources, classification and mechanisms of action in pharmaceutical formulations.

INTRODUCTION

Disintegrants are the excipients used in the formulations that are incorporated into solid dosage forms mainly tablets to facilitate their rapid breakdown into smaller fragments upon contact with aqueous fluids**[1].**This process of disintegration increases the surface area available for dissolution thereby enhancing drug release and bioavailability**[2].** The disintegrating agents are

***Corresponding Author:** S.T.V. Raghavamma
Address: *Department of Pharmaceutics, Chalapathi Institute of Pharmaceutical Sciences, Lam, Guntur-522034*
Email : stvraghavamma@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

divided into three categories based on their source they are natural disintegrants, semisynthetic disintegrants and synthetic disintegrants **[3].**

Natural disintegrating agents are substances of plant, microbial, marine origin it includes starch, Guar gum, fenugreek etc., **[4].** Semi synthetic disintegrants are the chemically modified natural disintegrants such as Sodium carboxymethyl cellulose (NaCMC) is a *semi-synthetic derivative* of natural cellulose produced by carboxymethylation, Croscarmellose It is a *cross-linked sodium carboxymethyl cellulose*, originally obtained from natural cellulose, sodium Modified starch (It is a chemically modified form of natural starch), Low-substituted hydroxypropyl cellulose (L-HPC) is a partially substituted cellulose ether derived from natural cellulose), Microcrystalline cellulose (MCC) is produced by controlled acid hydrolysis of natural cellulose**[5].** Synthetic disintegrating agents are artificially prepared (chemically modified) substances such as Crospovidone (Cross-linked PVP) is a synthetic polymerization of N-vinyl-2-pyrrolidone, a petrochemical monomer, Cross-linked Carboxymethyl Cellulose (crosslinked CMC), Ion-exchange resins e.g., Polacrilin potassium**[6].** Unlike synthetic disintegrants, natural agents are preferred due to their biodegradability, biocompatibility, low toxicity, cost -effectiveness and regulatory acceptance **[7].** Natural disintegrants consist of a wide variety of materials such as natural and modified starches, plant gums, mucilage, pectin, cellulose derivatives, chitosan and other miscellaneous biopolymers **[8].** These substances disintegrate using several mechanisms such as fast water uptake and swelling, capillary action, particle repulsion using electrostatic forces and in certain instances, enzymatic degradation **[9].** The idea of using natural materials as pharmaceuticals excipients is not a new one with some of the first pharmaceutical preparations depending largely on plant material **[10].**

Recent improvements in extraction methods, analytical techniques and modification technologies have however once again focused attention on natural disintegrants and led to the production of more effective and standard natural substituants **[11].** Hence this review focuses on naturally derived disintegrating agents, their source and mechanism of disintegration **.**

Mechanism of Action of disintegrating agents

Disintegrants are the excipients used in the formulations that are incorporated into solid dosage forms mainly tablets to facilitate their rapid breakdown into smaller fragments upon contact with aqueous fluids **[12].** These substances disintegrate using several mechanisms such as swelling, capillary action, deformation, particle repulsion using electrostatic forces, enzymatic degradation and heat of wetting. **[13].**

Swelling Many disintegrants (e.g., starch, sodium starch glycolate, croscarmellose sodium) absorb water rapidly and swell many times to their original volume **[14].** The swelling creates internal stress and pressure within the tablet matrix, leading to rupture and breakup of the tablet into granules and particles **[15].** For example, Sodium starch glycolate can swell up to 200–300% of its original volume in contact with water **[16].**

Capillary Action (Wicking) When the tablet comes into contact with the dissolution medium, water is drawn into the pores by capillary action **[17].**This reduces interparticulate bonding and causes the tablet to fall apart without significant volume expansion **[18].** For example, Microcrystalline cellulose acts primarily by capillary action **[19].**

Deformation (Elastic Recovery) Certain disintegrants (like native starch) are deformed during compression and regain their original shape when exposed to water and this elastic recovery exerts disruptive forces that contribute to disintegration **[20].**

Repulsion / Electrostatic Mechanism On wetting, repulsive forces may develop between the particles due to electrostatic charges, aiding disintegration**.** This mechanism is usually a secondary effect and complements swelling or wicking **[21].**

Enzymatic Action Some natural disintegrants such as starch or gums can be degraded by enzymes in the gastrointestinal tract (e.g., amylase) aiding disintegration by weakening the binder matrix **[15].**

Heat of Wetting The exothermic process of wetting may cause localized stress and disruption in the tablet structure, promoting disintegration. This effect is usually minor but can contribute to faster breakdown **[23].**

Types of Natural disintegrants

The natural disintegrating agents are usually classified on the basis of source, chemical nature, mechanism of action, functional performance **[24].** Based on source natural disintegrating agents are divided into three categories they are Plant-derived disintegrants, Marine derived disintegrants, Microbe derived disintegrants.

Plant-Derived Disintegrants

Starch derived from seeds of maize (*Zea mays)*, rice (*Oryza sativa)*, wheat (*Triticum aestivum)***[25].** Starch is also derived from tubers / roots of Potato **(***Solanum tuberosum*) Tapioca (*Manihot esculenta Crantz)* **[26 (**Table1**).** Starch consists of polysaccharides amylose and amylopectin and is used as disintegrant, diluent, binder in formulations under trade names such as *Starch 1500* and *Sta-Rx* Starch acts as disintegrating agent mainly by swelling and wicking mechanisms, allowing rapid tablet disintegration and is suitable for conventional tablets and capsules**[27].** In paracetamol and vitamin B-complex tablets, it ensures quick disintegration and improved bioavailability **[28].** In capsules, especially herbal and antibiotic formulations such as ampicillin, starch aids rapid dispersion of the powder after capsule shell dissolution **[4].** It is also used in effervescent and dispersible granules to achieve uniform dispersion in water, as seen in dispersible paracetamol granules and oral rehydration powders **[30].** Additionally, starch supports fast disintegration or softening in vaginal tablets and suppositories and facilitates moisture uptake and breakdown in oral disintegrating films and lozenges, including herbal lozenges and mouth-dissolving vitamin films **[31].** Starch is a safe, non-toxic and well-tolerated disintegrating agent, suitable for routine pharmaceutical use when used in standard concentrations **[32].** Starch is a preferred excipient because it is safe, economical, biodegradable and pharmaceutically versatile **[33].**

Guar gum is obtained from the endosperm of the seeds of *Cyamopsis tetragonoloba***.** It is a galactomannan polysaccharide marketed under names like *Jaguar*® and *Meypro-Guar*® **[34] (**Table1**).** It exhibits excellent hydration by absorbing the moisture from the formulation and leads to swelling, making it effective as a disintegrant, binder and thickening agent **[35].** Its natural origin and compatibility with drugs make it suitable for tablets, capsules and controlled release formulations, although high concentrations may slow drug release**[36].** Guar gum is odorless, non-toxic and compatible with many drugs, making it suitable for tablets, capsules, mouth-

dissolving tablets, controlled-release and herbal formulations, where it may also function as a binder or release-modifying agent **[37].** Although high viscosity, moisture sensitivity and variability can limit its use at higher levels, guar gum remains an important natural excipient recognized in IP, BP and USP and is used in formulations such as diclofenac sodium, amlodipine besylate, ibuprofen mouth-dissolving tablets, ranitidine FDTs and capsule fill masses **[38].**

Ispaghula husk, also known as psyllium husk, is obtained from the seed husk of *Plantago ovata* and is commercially available under names such as *Ispaghula*® and *Metamucil*® **[39] (**Table1**).** It is rich in mucilage and exhibits strong swelling properties when exposed to water, leading to effective tablet disintegration **[40].** Due to its natural fiber content, it is also used in bulkforming laxatives and gastro-retentive formulations **[41].**it is Ispaghula husk is employed in various pharmaceutical applications, including its use as a disintegrating agent, binder, and release-modifying polymer in solid oral dosage forms **[42].** ispaghula husk has been incorporated into immediate-release, fast-disintegrating, matrix and herbal tablet formulations, as well as bulk-forming laxatives, due to its high swelling capacity and multifunctional properties **[24].** It acts as a natural disintegrant in immediate-release and fast disintegrating tablets, such as paracetamol, ranitidine and vitamin C tablets **[44].** It is also incorporated into herbal and nutraceutical formulations, including multivitamins, Ayurvedic tablets and fiber supplements, to promote rapid disintegration **[45].**

Locust bean gum, obtained from the seeds of the carob tree (*Ceratonia siliqua*), is a natural galactomannan polymer marketed as *LBG* or *Viscogum*® **[46] (**Table1**).** It swells in aqueous media and enhances tablet disintegration by water uptake and expansion **[47].** In addition to its disintegrant role, it is used as a binder, stabilizer and release-retarding agent in pharmaceutical dosage forms **[48].** Ispaghula husk is a natural, biodegradable and non-toxic excipient with a high swelling capacity, making it an effective disintegrant and release modifying agent **[49].** It is safe, cost-effective, compatible with most drugs and provides good patient acceptability **[50].** Toxicity is minimal with no significant acute or chronic effects; hypersensitivity is rare and mild gastrointestinal discomfort may occur only at high doses **[51].** It is used in immediate-release and fast-disintegrating tablets e.g., paracetamol, ranitidine, vitamin C herbal and nutraceutical tablets such as multivitamins, Ayurvedic tablets, matrix/sustained-release tablets metformin, theophylline and as a bulk-forming laxative like Metamucil **[52].**

Fenugreek mucilage, obtained from the seeds of *Trigonella foenum-graecum*, is a natural galactomannan-rich polysaccharide known for its high swelling and hydration capacity **(**Table1**).** It acts as an effective disintegrant by absorbing water and expanding rapidly, leading to tablet breakup **[53].** In addition to its disintegrant role, fenugreek mucilage can also serve as a binder and release-modifying agent, making it suitable for tablets, capsules and herbal pharmaceutical formulations **[24]**. Fenugreek mucilage is biodegradable, non-toxic and compatible with most drugs, making it suitable for tablets, capsules, fast-disintegrating tablets and herbal formulations, where it may also act as a binder or release-modifying agent **[33].**Although moisture sensitivity and variability can limit its use at higher levels, it remains a promising natural alternative to synthetic disintegrants and is applied in formulations such as paracetamol, ibuprofen, domperidone FDTs, capsules and oral lozenges**[56].** fenugreek mucilage offers numerous advantages such as high

water-holding capacity, excellent viscosity, safety, sustainability and economic feasibility, making it a versatile and valuable natural polymer across multiple industries **[57].**

Tragacanth is obtained from the dried gummy exudate of the stems and branches of *Astragalus gummifera* **[58] (**Table1**).** It contains tragacanthin (water-soluble) and bassorin (waterswellable) fractions **[59].** Tragacanth acts as a disintegrant by hydration and swelling and is also used as a binder, suspending agent and emulsifier. However, its high viscosity and microbial susceptibility may limit its use at higher concentrations [**60].** tragacanth is considered non-toxic and safe when used in pharmaceutical formulations at recommended concentrations **[1].**Tragacanth is odorless, non-toxic and compatible with many drugs, making it suitable for tablets, capsules, lozenges, buccal formulations and powders or granules for reconstitution, while also serving as a binder or suspending agent when required **[62].** Although its high viscosity, slower hydration and variability limit its efficiency compared to modern superdisintegrants it remains widely used in conventional, herbal, and Ayurvedic formulations such as metronidazole and sulphadiazine tablets and is officially recognized in IP, BP and USP**[63].**

Mango peel pectin is a natural polysaccharide extracted from the peel (epicarp) of mango fruit *Mangifera indica* **[64] (**Table1**).** Mango peel pectin is used in tablets**,** capsules**,** fast-disintegrating tablets (FDT) and herbal formulations as disintegrant, film forming agent and binder. It is valued for its natural origin, non-toxicity, biodegradability and biocompatibility making it ideal for herbal and green formulations **[65].**The pectin exhibits excellent swelling and water absorption capacity which promotes rapid tablet breakup upon contact with gastrointestinal fluids**[66].** Mango peel pectin has been used as an excipient in formulations of paracetamol, ibuprofen, diclofenac sodium, metformin hydrochloride, amoxicillin and colon-targeted drugs such as 5-aminosalicylic acid**[67].**

Orange peel pectin is a natural polysaccharide obtained from the peel of *Citrus sinensis* **(**Table1**).** Acts as a natural disintegrant in solid dosage forms such as tablets and capsules. Promotes rapid tablet breakup upon contact with aqueous fluids. Can also function as a binder or release modifying agent in certain formulations **[68].** Often used in herbal**,** fast-disintegrating and nutraceutical tablets **[69].** Orange peel pectin is generally regarded as safe Non-toxic and non-irritant when used in recommended concentrations **[70].** Orange peel pectin has been studied with several model and therapeutic drugs, including Commonly Used Drugs Paracetamol, Ibuprofen, Diclofenac sodium, Aspirin **[71].**

Gum karaya, obtained from the exudates of the karaya tree (*Sterculia urens*) is a natural acidic polysaccharide marketed as Karaya gum or Sterculia gum **[72] (**Table1**).** It exhibits high water-absorption and swelling capacity in aqueous media and promotes tablet disintegration by rapid hydration and volumetric expansion **[73].** In addition to its disintegrant function gum karaya is used as a binder, stabilizer, thickening agent and release-retarding polymer in various pharmaceutical dosage forms **[74].** It is a biodegradable, non-toxic and economical excipient with good compatibility with a wide range of drugs, contributing to acceptable tablethardness and patient compliance **[24].** Toxicity is negligible, with no reported significant acute or chronic toxic effects; hypersensitivity reactions are rare and mild gastrointestinal irritation may occur only at excessive oral doses **[76].** Gum karaya has been employed in immediate-release and fast-disintegrating tablets

such as paracetamol and ibuprofen, sustained-/controlled-release matrix tablets of drugs like diclofenac sodium and metformin as well as in buccal, gastro-retentive and colon-targeted drug delivery systems **[77].** It is also widely used as bulk-forming laxative and in denture adhesives owing to its high swelling index and mucoadhesive properties **[3].**

Linseed mucilage, obtained from the seeds of flaxseed (*Linum usitatissimum*) is a natural hydrophilic polysaccharide composed mainly of arabinoxylans and rhamnogalacturonans and issued as a pharmaceutical excipient **[79] (**Table1**).** It swells rapidly in aqueous media and enhances tablet disintegration through water uptake and gel formation **[80].** In addition to its role as a disintegrant, linseed mucilage is employed as a binder, thickening agent, stabilizer and release-modifying polymer in various pharmaceutical dosage forms **[24].** It is a natural, biodegradable and non-toxic excipient with high swelling and mucoadhesive properties, making it suitable for controlled- and sustained-release formulations **[82].** It is safe, economical, compatible with most drugs and provides good patient acceptability **[83].** Toxicity is minimal with no reported significant acute or chronic effects; hypersensitivity reactions are rare and mild gastrointestinal disturbances may occur only at high oral doses **[84].**Linseed mucilage has been used in immediate-release and fast-disintegrating tablets such as paracetamol and ibuprofen, herbal and nutraceutical tablets including multivitamins and traditional formulations, matrix/sustained-release tablets of drugs like metformin and theophylline and as a bulk-forming laxative in dietary fibre preparations **[24].**

Marine-Derived Disintegrants

Agar is the dried gelatinous substance obtained from the mucilaginous extract of *Gelidium amansii* (red algae) **[86] (**Table1**).** It contains agarose and agaropectin fractions and is available in forms such as agarose and agar flakes **[87].**Agar shows high water-absorbing and gel-forming ability, which enables it to act as an effective disintegrant and gelling agent in solid and semisolid pharmaceutical formulations **[88].** Agar is not only used as disintegrant but also Thickening agent, Suspending agent. Agar is biocompatible and biodegradable, swells readily in water to promote tablet disintegration and is chemically stable, showing no significant interaction with most drugs **[35].** Agar is mainly used with low-dose, watersoluble drugs such as paracetamol, aspirin, vitamin C tablets, antacids, caffeine and some antihistamines; however, it is less commonly used in modern formulations **[4].**

Alginates derived from brown seaweeds such as *Laminaria* and *Macrocystis pyrifera*, are marketed under trade names like *Kelco Gel*® and *Protanal*®**[91] (**Table1**).** They are anionic polysaccharides with excellent gel-forming and swelling abilities, which help in tablet disintegration and controlled drug release **[92].** Alginates are widely used in oral, topical, and sustained-release pharmaceutical formulations**[93].**Alginate is safe, non-toxic, biodegradable, and non-irritant, and it swells well in water, which enhances drug dissolution and bioavailability **[94].** Its action is pH-independent, making it effective in both acidic and basic environments **[95].** It is commonly used in tablets, effervescent formulations, orally disintegrating tablets (ODTs), and sometimes in controlled-release formulations in combination with other agents **[96].** Examples of drugs that use alginate as a disintegrant include paracetamol tablets, vitamin C effervescent tablets, antacids like Gaviscon and certain cold or antihistamine tablets **[97].**

Chitin and chitosan is a natural obtained from the exoskeleton of crustaceans such as crabs and shrimps and from the cell walls of fungi **[98] (**Table1**).** Chitin is a structural polysaccharide, while chitosan is its deacetylated, more soluble form, marketed under names such as *Chito Clear*® and *Chito Flex*® **[99].** Chitosan exhibits swelling, wicking and mucoadhesive properties, making it a valuable disintegrant and multifunctional excipient used in tablets, capsules and advanced drug delivery systems **[100].**Chitin and chitosan are biocompatible, biodegradable, non-toxic and non-irritant, with excellent water absorption and pH-independent swelling properties and it is used as Wound Dressings and Tissue Engineering **[101].** Common drugs using chitin or chitosan as disintegrants include paracetamol tablets, vitamin C effervescent tablets, antacids and certain cold or antihistamine tablets **[102].** Chitosan is often combined with other disintegrants to improve tablet performance **[103].**

Carrageenan is the dried mucilaginous extract obtained from red algae such as *Chondrus crispus* (Irish moss)**,** *Gigartina***,** *Eucheuma* **[104] (**Table1**).** Carrageenan is a natural anionic polysaccharide obtained from red seaweeds (Rhodophyceae) such as *Chondrus crispus*, *Gigartina*, *Eucheuma* and *Kappaphycus* species**[105].** Owing to its hydrophilic nature, high swelling capacity and gel-forming ability, carrageenan is used as a natural disintegrant, gelling agent, binder, suspending agent in solid pharmaceutical dosage forms particularly tablets **[106].** It is generally considered safe, non-toxic and non-irritant when used in pharmaceutical formulations, although high amounts may rarely cause mild gastrointestinal discomfort **[107].** Carrageenan is used as a disintegrant in tablets like paracetamol, vitamin C effervescent tablets and some antacid preparations, often in combination with other disintegrants to improve efficiency and ensure rapid dissolution **[108].**

Microbial Derived Disintegrants

Xanthan gum is a microbial polysaccharide produced by fermentation using *Xanthomonas campestris* and is marketed under names such as *Keltrol*® and *Rhodigel*®**[109] as** mentioned in table1**.** It shows excellent hydration, swelling and viscosity-enhancing properties, making it useful as a disintegrant, binder and stabilizer in pharmaceutical formulations**[110].** Its consistent quality and stability over a wide pH range enhance its applicability **[111].** It is generally considered non-toxic, biocompatible, biodegradable and non-irritant, making it safe for oral administration **[112].** Drugs in which xanthan gum is used as a disintegrant include paracetamol tablets, vitamin C effervescent tablets and some antacid formulations, often in combination with other disintegrants to enhance performance **.**

Gellan gum is a natural microbial polysaccharide produced by fermentation using *Sphingomonas elodea* **[113]** as mentioned in table 1. It is an anionic, hydrophilic polymer with good biocompatibility**,** biodegradability and batch-to-batch consistency, which makes it suitable for pharmaceutical use **[114].** Although gellan gum is widely used as a gelling and stabilizing agent, as it can function effectively as a natural disintegrant in solid dosage forms **[112].** Its mechanism of action involves rapid swelling upon contact with gastrointestinal fluids, which generates internal stress within the tablet, causing it to break apart and release the drug **[116].** Gellan gum is generally considered non-toxic, biocompatible, biodegradable, and non-irritant, making it safe for oral administration **[117].** It is used as a disintegrant in paracetamol tablets, vitamin C effervescent tablets, antacids and some antihistamine tablets, often combined with other

disintegrants to enhance tablet disintegration and dissolution **[35].**

Table.1: Natural disintegrating agents of their Sources, Scientific names, Trade names

Natural Agent	Source	Scientific Name	Trade Name
Plants			
Starch	Maize, Potato, Rice, Wheat, Tapioca	Zea mays, Solanum tuberosum, Oryza sativa, Triticum aestivum, Manihot esculenta	Starch 1500, Sta-Rx®
Guar Gum	Guarbeans	*Cyamopsis tetragonoloba*	Jaguar®, Meypro-Guar®
Isapghula Husk (Psyllium Husk)	Seeds husk of Plantago	Plantago ovata Forssk	Ispaghula®, Metamucil®
Locust bean gum	Seeds of Carob tree	*Ceratonia siliqua*	LBG, Viscogum®
Tragacanth	Dried gum exudates	*Astragalus gummifer*	Gum tragacanth
Fenugreek	Seeds of fenugreek	*Trigonella foenum-graecum*	—
Gum karaya	exudates of the karaya tree	Sterculia urens	—
Orange peel	obtained from the peel	Citrus sinensis	—
Mango peel	extracted from the peel (epicarp) of mango fruit	*Mangifera indica*	—
Linseed mucilage	seeds of flaxseed	(*Linum usitatissimum*),	—
Marine			
Agar	Red algae	*Gelidium amansii*, *Gracilaria* spp	Agarose, Agar flakes
Sodium alginate	Brown seaweed	*Laminaria*, *Macrocystis pyrifera*	Kelco Gel®, Protanal®
Chitin and Chitosan	Shells of crab, shrimp	From *Crustaceans* exoskeleton	Chito Clear®, Chito Flex®
Carrageenan	mucilaginous extract obtained from red algae	Chondrus crispus	—
Microbes			
Xanthum gum	Fermentation	xanthomonas*campestris*	Keltrol®, Rhodigel®
Gellan gum	fermentation	Sphingomonas elodea	—

CONCLUSION

Natural disintegrating agents sourced from plants, marine organisms and microbes, play a vital role in modern pharmaceutical formulations by facilitating rapid tablet disintegration and enhancing drug dissolution and bioavailability. Their biodegradability, biocompatibility, low toxicity and cost-effectiveness make them advantageous over synthetic counterparts. These agents act through mechanisms such as swelling, wicking, elastic recovery, electrostatic repulsion and enzymatic degradation, ensuring efficient tablet breakup. Commonly used natural disintegrants include starch, gums, mucilages, pectins, alginates, carrageenan, xanthan gum and gellan gum, which are widely applied in conventional, fast disintegrating, effervescent and herbal formulations. With ongoing advances in extraction, modification and standardization techniques, natural disintegrants continue to offer a safe, sustainable and effective alternative for pharmaceutical development.

ACKNOWLEDGEMENT

We are grateful to the authors of textbooks, research articles, and review papers that provided valuable insights into pharmaceutical disintegrating agents. The authors also express their sincere thanks to Chalapathi Institute of Pharmaceutical Sciences for providing academic support, resources, and a conducive research environment. This review did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

REFERENCES

1. Aulton ME, Taylor KMG. Aulton's Pharmaceutics: The Design and Manufacture of Medicines. 4th ed. Edinburgh: Churchill Livingstone Elsevier; 2013. p. 395–412.
2. Lachman L, Lieberman HA, Kanig JL. The Theory and Practice of Industrial Pharmacy. 3rd ed. Philadelphia: Lea & Febiger; 1986. p. 293–345.
3. Rowe RC, Sheskey PJ, Quinn ME, editors. Handbook of Pharmaceutical Excipients. 6th ed. London: Pharmaceutical Press; 2009. p. 207–214.
4. Banker GS, Anderson NR. Tablets. In: Lachman L, Lieberman HA, Kanig JL, editors. The Theory and Practice of Industrial Pharmacy. 3rd ed. Philadelphia: Lea & Febiger; 1986. p. 297–314.
5. Jani GK, Shah DP, Prajapati VD, Jain VC. Gums and mucilages: versatile excipients for pharmaceutical formulations. Asian J Pharm Sci. 2009;4(5):309–323.
6. Shangraw RF, Demarest DA. A survey of current industrial practices in the formulation and manufacture of tablets and capsules. Pharm Technol. 1993;17(10):32–44.
7. Pawar HA, Lalitha KG. Natural polymers as pharmaceutical excipients. Int J Pharm Res Dev. 2014;6(2):11–18.
8. Singh I, Kumar P. Natural polymers as disintegrants in formulation of fast dissolving tablets. Int J Pharm Pharm Sci. 2012;4(4):7–12.
9. Desai PM, Liew CV, Heng PWS. Review of disintegrants and the disintegration phenomena. J Pharm Sci. 2016;105(9):2545–2555.
10. Ansel HC, Allen LV, Popovich NG. Pharmaceutical Calculations. 12th ed. Philadelphia: Lippincott Williams & Wilkins; 2010. p. 515–520.
11. Avachat AM, Dash RR, Shrotriya SN. Recent investigations of plant-based natural gums, mucilages and resins in novel drug delivery systems. Indian J Pharm Educ Res. 2011;45(1):86–99.

12. British Pharmacopoeia Commission. British Pharmacopoeia. London: The Stationery Office; 2018. p. A159–A164.
13. United States Pharmacopeial Convention. USP–NF 41. Rockville (MD): USP Convention; 2018. p. 1234–1241.
14. Bolhuis GK, Chowhan ZT. Materials for direct compaction. In: Alderborn G, Nyström C, editors. Pharmaceutical Powder Compaction Technology. New York: Marcel Dekker; 1996. p. 419–500.
15. Caramella C, Colombo P, Conte U, La Manna A. Swelling of polymeric matrices: mechanisms and kinetics. Drug Dev Ind Pharm. 1988;14(1):1–10.
16. Lowenthal W. Mechanism of action of starch as a tablet disintegrant. J Pharm Sci. 1973;62(4):634–637.
17. Bi YX, Sunada H, Yonezawa Y, Danjo K, Otsuka A, Iida K. Preparation and evaluation of compressed tablets rapidly disintegrating in the oral cavity. Chem Pharm Bull (Tokyo). 1996;44(11):2121–2127.
18. Shangraw RF, Mitrevej A, Shah M. A new era of tablet disintegrants. Pharm Technol. 1980;4(10):49–57.
19. Stamm A, Mathis C. Microcrystalline cellulose as a tablet disintegrant. Drug Dev Ind Pharm. 1976;2(1):51–63.
20. Nogami H, Nagai T, Fukuoka E. Disintegration of tablets containing starch. Chem Pharm Bull. 1969;17(7):1450–1456.
21. Gordon MS, Rudraraju VS, Dani K, Chowhan ZT. Effect of the mode of superdisintegrant incorporation on dissolution in wet granulated tablets. J Pharm Sci. 1993;82(2):220–226.
22. Kassem AA, El-Bary AA. Heat of wetting and its role in tablet disintegration. Drug Dev Ind Pharm. 2002;28(8):951–957.
23. Kulkarni GT, Gowthamarajan K, Rao BG, Suresh B. Evaluation of binding properties of Plantago ovata and Trigonella foenum-graecum mucilages. Indian J Pharm Sci. 2002;64(5):493–496.
24. Hoover R. Composition, molecular structure, and physicochemical properties of tuber and root starches. Carbohydr Polym. 2001;45(3):253–267.
25. BeMiller JN, Whistler RL. Starch: Chemistry and Technology. 3rd ed. London: Academic Press; 2009. p. 245–280.
26. Gohel MC, Patel MM, Amin AF, Agrawal R, Dave R, Bariya N. Formulation design and optimization of mouth dissolving tablets of nimesulide using vacuum drying technique. AAPS PharmSciTech. 2004;5(3):1–6.
27. Hiremath JG, Srinath MS. Preparation and evaluation of orally disintegrating tablets of paracetamol using natural disintegrants. Int J Pharm Sci Rev Res. 2011;6(2):35–40.
28. Allen LV. Effervescent tablets and granules. Pharm Technol. 2003;27(4):48–56.
29. Kalia A, Poddar M. Solid dispersions: an approach towards enhancing dissolution rate. Int J Pharm Pharm Sci. 2011;3(2):9–19.
30. Osol A, Hoover JE. Remington's Pharmaceutical Sciences. 20th ed. Philadelphia: Lippincott Williams & Wilkins; 2000. p. 889–894.
31. Malviya R, Srivastava P, Kulkarni GT. Applications of mucilages in drug delivery – a review. Adv Biol Res. 2011;5(1):1–7.
32. Thombare N, Jha U, Mishra S, Siddiqui MZ. Guar gum as a promising starting material for diverse applications: a review. Int J Biol Macromol. 2016;88:361–372.
33. Prajapati VD, Jani GK, Moradiya NG, Randeria NP. Pharmaceutical applications of various natural gums, mucilages and their modified forms. Carbohydr Polym. 2013;92(2):1685–1699.
34. Varshosaz J. Natural gums and polysaccharides as pharmaceutical excipients. Pharm Technol. 2008;32(2):64–76.

35. Patel DM, Prajapati DG, Patel NM. Seed mucilage from Ocimum americanum Linn. as disintegrant in tablets. AAPS PharmSciTech. 2007;8(2):E1–E7.
36. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Ghaziabad: IPC; 2018. p. 1743–1746.
37. Fischer MH, Yu N, Gray GR, Ralph J, Anderson L, Marlett JA. The gel-forming polysaccharide of psyllium husk (Plantago ovata Forsk). Carbohydr Res. 2004;339(11):2009–2017.
38. Srinivas KR, Prakash K, Kiran HR, Reddy KR. Natural polysaccharides as disintegrants in tablet formulation. J Pharm Res. 2010;3(9):2195–2199.
39. Choudhary PD, Pawar HA. Recently investigated natural gums and mucilages as pharmaceutical excipients: an overview. J Pharm. 2014;2014:204849.
40. Patel H, Patel P, Gohel M, Tiwari S. Dissolution rate enhancement of glipizide using psyllium husk. Int J Pharm Sci Nanotechnol. 2011;4(1):1245–1252.
41. Shirsand SB, Suresh S, Para MS, Swamy PV. Formulation design and optimization of fast dissolving tablets of prochlorperazine maleate by novel co-processed excipients. Indian J Pharm Sci. 2009;71(6):653–657.
42. Mishra DN, Bindal M, Singh SK, Kumar SGV. Spray dried excipient base: a novel technique for the formulation of orally disintegrating tablets. Chem Pharm Bull. 2006;54(1):99–102.
43. Dionísio M, Grenha A. Locust bean gum: exploring its potential for biopharmaceutical applications. J Pharm Bioallied Sci. 2012;4(3):175–185.
44. Martínez-Ruvalcaba A, Chornet E, Rodrigue D. Viscoelastic properties of locust bean gum solutions. Carbohydr Polym. 2007;67(4):586–595.
45. Vendruscolo CW, Ferrero C, Pineda EAG, Silveira JLM. Physicochemical and mechanical characterization of galactomannan from Mimosa scabrella. Carbohydr Polym. 2009;76(1):86–93.
46. Baveja SK, Rao KV, Arora J. Examination of natural gums and mucilages as sustaining materials in tablet dosage forms. Indian J Pharm Sci. 1989;51(3):115–118.
47. WHO. Evaluation of Certain Food Additives and Contaminants. Geneva: World Health Organization; 2007. p. 45–52.
48. Deogade UM, Deshmukh VN, Sakarkar DM. Natural gums and mucilages in NDDS: applications and recent approaches. Int J PharmTech Res. 2012;4(2):799–814.
49. Liberman HA, Lachman L, Schwartz JB. Pharmaceutical Dosage Forms: Tablets. 2nd ed. New York: Marcel Dekker; 1989. p. 173–196.
50. Balaji A, Subhashini NJP. Fenugreek seed mucilage as a novel superdisintegrant for fast dissolving tablets. Int J Pharm Sci Rev Res. 2013;21(2):152–157.
51. Kulkarni GT, Kumar PB, Gowthamarajan K, Suresh B. Evaluation of disintegrant properties of fenugreek seed mucilage. Indian Drugs. 2003;40(7):422–425.
52. Shirwaikar A, Prabu SL, Kumar GA. Herbal excipients in novel drug delivery systems. Indian J Pharm Sci. 2008;70(4):415–422.
53. Kirthi R, Kumar G. Fenugreek mucilage: properties and pharmaceutical applications. Int J Biol Macromol. 2018;112:718–726.
54. Glicksman M. Gum Technology in the Food Industry. New York: Academic Press; 1969. p. 147–161.
55. Anderson DMW. The structure of tragacanth gum. Carbohydr Res. 1983;123(1):87–97.
56. Rinaudo M. Main properties and current applications of some polysaccharides as biomaterials. Polym Int. 2008;57(3):397–430.

57. Wade A, Weller PJ. Handbook of Pharmaceutical Excipients. 5th ed. Washington (DC): American Pharmaceutical Association; 2003. p. 667–670.
58. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Ghaziabad: IPC; 2014. p. 1125–1128.
59. May CD. Industrial pectins: sources, production and applications. Carbohydr Polym. 1990;12(1):79–99.
60. Sriamornsak P. Chemistry of pectin and its pharmaceutical uses: a review. Silpakorn Univ Int J. 2003;3(1–2):206–228.
61. Thakur BR, Singh RK, Handa AK. Chemistry and uses of pectin — a review. Crit Rev Food Sci Nutr. 1997;37(1):47–73.
62. Sandeep K, Rao MEB, Reddy BSR. Extraction and evaluation of mango peel pectin as pharmaceutical excipient. Int J Pharm Sci Res. 2014;5(6):2474–2480.
63. Voragen AGJ, Coenen GJ, Verhoef RP, Schols HA. Pectin, a versatile polysaccharide present in plant cell walls. Struct Chem. 2009;20(2):263–275.
64. Sharma BR, Naresh L, Dhuldhoya NC, Merchant SU, Merchant UC. An overview on pectins. Times Food Process J. 2006;23(2):44–51.
65. FAO/WHO. Compendium of Food Additive Specifications. Rome: FAO; 2016. p. 1–5.
66. Patil SV, Bhat PJ, Joshi PU. Formulation and evaluation of fast disintegrating tablets using natural pectin. Int J Pharm Sci Rev Res. 2012;13(2):25–30.
67. Whistler RL, BeMiller JN. Industrial Gums: Polysaccharides and Their Derivatives. 3rd ed. New York: Academic Press; 1993. p. 117–124.
68. Goyal P, Kumar V, Sharma P. Gum karaya as a novel natural excipient for controlled drug delivery. Int J Pharm Sci Rev Res. 2010;3(1):1–6.
69. Deshmukh VN, Jadhav JK, Sakarkar DM. Gum karaya: a natural polymer for pharmaceutical applications. Int J Pharm Sci Rev Res. 2012;12(2):1–9.
70. Choudhary PD, Pawar HA. Recently investigated natural gums and mucilages as pharmaceutical excipients. J Pharm. 2014;2014:204849.
71. Rao MRP, Prasad YVR, Krishnaiah YSR. Development and evaluation of controlled release formulations using gum karaya. AAPS PharmSciTech. 2003;4(4):E1–E9.
72. Fedeniuk RW, Biliaderis CG. Composition and physicochemical properties of linseed mucilage. J Agric Food Chem. 1994;42(2):240–247.
73. Ramesh KV, Shirwaikar A, Prabu SL. Evaluation of disintegrant properties of linseed mucilage. Indian J Pharm Sci. 2007;69(3):431–435.
74. Rinaudo M. Polysaccharides as drug delivery systems. Polym Int. 2008;57(3):397–430.
75. Mishra A, Jain NK. Mucoadhesive polymers in controlled drug delivery. Drug Dev Ind Pharm. 2001;27(7):701–710.
76. WHO. Safety Evaluation of Certain Food Additives. Geneva: World Health Organization; 2005. p. 112–118.
77. Armisen R, Galatas F. Agar. In: Imeson A, editor. Food Stabilisers, Thickeners and Gelling Agents. Oxford: Wiley-Blackwell; 2009. p. 82–107.
78. Lahaye M, Rochas C. Chemical structure and physicochemical properties of agar. Hydrobiologia. 1991;221(1):137–148.
79. Phillips GO, Williams PA. Handbook of Hydrocolloids. 2nd ed. Cambridge: Woodhead Publishing; 2009. p. 25–30.
80. Draget KI, Smidsrød O, Skjåk-Bræk G. Alginates from algae. In: Steinbüchel A, editor. Biopolymers. Vol 6. Weinheim: Wiley-VCH; 2002. p. 215–235.

81. Lee KY, Mooney DJ. Alginate: properties and biomedical applications. Prog Polym Sci. 2012;37(1):106–126.
82. Tonnesen HH, Karlsen J. Alginate in drug delivery systems. Drug Dev Ind Pharm. 2002;28(6):621–630.
83. Augst AD, Kong HJ, Mooney DJ. Alginate hydrogels as biomaterials. Macromol Biosci. 2006;6(8):623–633.
84. Sriamornsak P, Nunthanid J, Luangtana-anan M, Weerapol Y. Alginate-based formulations for oral drug delivery. Eur J Pharm Biopharm. 2007;67(3):423–431.
85. Ching SH, Bansal N, Bhandari B. Alginate gel particles—A review of production techniques and physical properties. Crit Rev Food Sci Nutr. 2017;57(6):1133–1152.
86. Cook MT, Tzortzis G, Charalampopoulos D, Khutoryanskiy VV. Microencapsulation of probiotics for gastrointestinal delivery. J Control Release. 2012;162(1):56–67.
87. Kurita K. Chitin and chitosan: functional biopolymers from marine crustaceans. Mar Biotechnol. 2006;8(3):203–226.
88. Ravi Kumar MNV. A review of chitin and chitosan applications. React Funct Polym. 2000;46(1):1–27.
89. Tharanathan RN, Kittur FS. Chitin—The undisputed biomolecule of great potential. Crit Rev Food Sci Nutr. 2003;43(1):61–87.
90. Dash M, Chiellini F, Ottenbrite RM, Chiellini E. Chitosan—A versatile semi-synthetic polymer. Prog Polym Sci. 2011;36(8):981–1014.
91. Illum L. Chitosan and its use as a pharmaceutical excipient. Pharm Res. 1998;15(9):1326–1331.
92. Sogias IA, Williams AC, Khutoryanskiy VV. Why is chitosan mucoadhesive? Biomacromolecules. 2008;9(7):1837–1842.
93. Campo VL, Kawano DF, da Silva DB, Carvalho I. Carrageenans: biological properties and chemical modifications. Carbohydr Polym. 2009;77(2):167–180.
94. Necas J, Bartosikova L. Carrageenan: a review. Vet Med. 2013;58(4):187–205.
95. Imeson AP. Carrageenan and furcellaran. In: Phillips GO, Williams PA, editors. Handbook of Hydrocolloids. 2nd ed. Cambridge: Woodhead Publishing; 2009. p. 164–185.
96. Weiner ML. Toxicological properties of carrageenan. Carcinogenesis. 2001;22(5):673–679.
97. Stanley NF. Carrageenans. In: Whistler RL, BeMiller JN, editors. Industrial Gums. 3rd ed. New York: Academic Press; 1993. p. 217–243.
98. García-Ochoa F, Santos VE, Casas JA, Gómez E. Xanthan gum: production, recovery, and properties. Biotechnol Adv. 2000;18(7):549–579.
99. Katzbauer B. Properties and applications of xanthan gum. Polym Degrad Stab. 1998;59(1–3):81–84.
100. Sworn G. Xanthan gum. In: Phillips GO, Williams PA, editors. Handbook of Hydrocolloids. 2nd ed. Cambridge: Woodhead Publishing; 2009. p. 186–203.
101. Morris ER. Rheology of hydrocolloids. Carbohydr Polym. 1991;16(1):37–41.
102. Kang KS, Veeder GT, Mirrasoul PJ, Kaneko T, Cottrell IW. Agar-like polysaccharide produced by Sphingomonas species. Appl Environ Microbiol. 1982;43(5):1086–1091.
103. Bajaj IB, Survase SA, Saudagar PS, Singhal RS. Gellan gum: fermentative production, downstream processing, and applications. Food Technol Biotechnol. 2007;45(4):341–354.
104. Miyoshi E, Takaya T, Nishinari K. Rheological and thermal studies of gel–sol transition in gellan gum aqueous solutions. Carbohydr Polym. 1996;30(2–3):109–119.

105. FDA. GRAS Notice Inventory: Gellan Gum. Silver Spring (MD): US Food and Drug Administration; 2017. p. 1–6.

HOW TO CITE: S.T.V. Raghavamma, K. Hemavarshini, G. Naga Sai Sandeepthi, M. Pavani, P. Suma Sri, A Review on Natural Disintegrating Agents, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 6, 7162-7175. https://doi.org/ 10.5281/zenodo.21024002