

**CURRENT UPDATES ON NATURAL  
SUPERDISINTEGRANTS IN THE DEVELOPMENT OF FAST  
DISSOLVING TABLETS**

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**ABSTRACT**

Superdisintegrants are a rising example in the Pharmaceutical field. In the application oral separating tablets (ODTs), snappy dispersible tablets, holders, mouth-dissolving films superdisintegrants have seen as a noteworthy nearness especially for ODTs and fast dispersible tablets. Usage of customary superdisintegrants in the improvement of orally stalling tablets has different focal points, for instance, artificially lethargic, non-harmful, progressively reasonable, biodegradable and extensively available. Distinctive ordinary superdisintegrants utilized in the improvement of orally separating tablets have in like manner been discussed. Today, the whole world is continuously interested by trademark meds and excipients. These normal materials have advantage over fabricated ones since they are artificially inert, nontoxic, increasingly moderate, biodegradable and for the most part available. In this way these plans consistently accomplished a superior patient consistence in the event of Pediatric, Geriatric or Psychiatric patients experiencing Dysphagia as Dysphagia has grown to be a disturbing concern everywhere throughout the Globe. Right now, accentuation is given on various kinds of superdisintegrants utilized in mouth dissolving tablets, their components and applications. Manufactured crumbling specialists are accessible as a profoundly prudent and less compelling when contrasted with normal breaking down operators. Thusly regular disintegrants fill in as the best choice to beat the issues of these engineered substances. Because of their various focal points over manufactured items they are broadly utilized in the pharmaceutical field as a cover, disintegrants, gums, and adhesives.

## INTRODUCTION

Superdisintegrants are the specialists added to tablet for the most part and some embodied definitions to start the separation of the tablet and container 'slugs' into little pieces in a watery domain there by expanding the accessible surface territory and advancing an increasingly quick arrival of the medication substance. They advance dampness infiltration and scattering of the tablet matrix.<sup>[1]</sup>

Superdisintegrants are those substances, which encourage the quicker crumbling with lesser amount when contrasted with disintegrants. Superdisintegrants give snappy breaking down because of joined impact of growing and water ingestion by the definition. Because of expanding of super disintegrants, the wetted surface of the transporter increments, advancing the wettability and dispensability of the framework, therefore upgrading the breaking down and dissolution.<sup>[2]</sup> The superdisintegrants chips away at components like wicking, growing, twisting etc.<sup>[1]</sup>

Late pattern towards the utilization of plant based and normal items requests the supplanting of manufactured additives with regular ones.<sup>[3]</sup>

Diverse classes of Superdisintegrants, for example, engineered, Semi-Synthetic, common and Co-prepared mixes and so on have been utilized to create adequate mouth dissolving tablets and to defeat the confinements of ordinary tablet measurements forms.<sup>[4]</sup> They are

utilized in 1-10% by weight comparative with the complete load of the strong dose unit. These operators demonstration by the expanding system. Due to growing, either there is an expansion of expanding pressure in the external heading of tablet prompting tablet burst or more retention of water builds granules volume encouraging crumbling. With the advanced improvements in medicate conveyance framework, there is an expansion sought after for super disintegrant. So we have to get ready super disintegrant that ought to be powerful at low focus and have more viability of deterioration. Superdisintegrants influences the breaking down pace of the tablet, yet at high focus they are influencing tablet hardness, friability and mouth feel.<sup>[5]</sup>

There are 3 strategies to consolidate crumbling specialists into the tablet definition: <sup>[6, 4]</sup>

- A. Internal expansion:** In inward expansion strategy, the disintegrant is blended in with different powders before wetting the powder blends with the crushing liquid. In this way the disintegrant is joined inside the granules.
- B. External expansion:** In outer option strategy, the disintegrant is added to the size granulation with blending preceding pressure.
- C. Partly Internal and External:** Right now, of disintegrant can be included inside and part remotely. This outcome in prompt disturbance of the tablet into recently compacted granules while the deteriorating

operator inside the granules to the first powder particles.

**IDEAL CHARACTERISTICS OF SUPERDISINTEGRANTS** [7, 8, 9, 10, 11]

The prerequisite put on the tablet disintegrant ought to be obviously characterized. The perfect disintegrant has-

- Poor Solubility.
- Poor gel development.
- Good hydration Capacity.
- Good embellishment and stream properties.
- No propensity to frame edifices with the drugs.
- Good Mouth Feel.
- It ought to likewise be Compatible with the different excipients and have alluring tableting properties.
- compactable to deliver less friable tablets
- Effective at low fixation
- Have more noteworthy breaking down efficiency
- Inert, Non-harmful
- Good stream properties
- Requirement of least amount
- Particle Size
- It ought to have fast breaking down, when tablet interacts with salivation in the mouth/Oral cavity.

**ADVANTAGES OF SUPER DISINTEGRANTS** [12]

- Remarkable propensity on wetting causing fast deterioration.
- No lump Formation on crumbling.
- Compatible with generally utilized helpful specialists and excipients.
- Provides great mechanical solidarity to the tablet encouraging simple pressing and transportation.
- Does not adhere to the punches and dyes.

**FACTOR AFFECTING DISINTEGRATION** [9]

Parameters	Effects
Amount of superdisintegrants	A base measure of super disintegrant is important for the improvement of adequate growing to external layer.

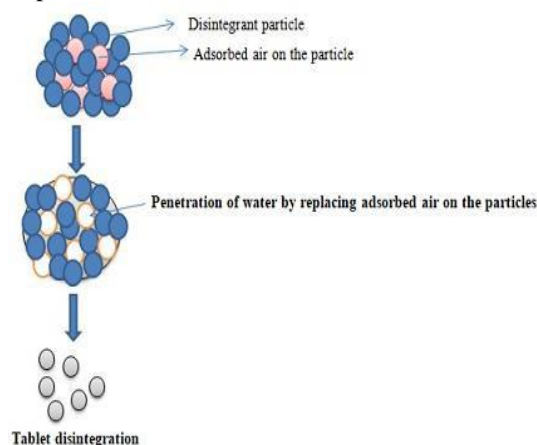
Additives (binders)	Polymeric covers can decrease expanding pressure by extraordinary detachment of super disintegrant particles or rivalry with the expectation of complimentary water
Ionic strength of the medium	Rivalry of the particles with the expectation of complimentary water
pH values	Expanding can be affected for the superdisintegrants with ionisable gatherings (e.g: Carboxylic gatherings in Croscarmellose)

**Table No. 1: Parameters influencing the swelling Behavior of Superdisintegrants**

**MECHANISM OF ACTION OF SUPERDISINTEGRANTS**

Superdisintegrants act by different mechanism of action

1. **Capillary action (Wicking):** Crumbling by slender activity is the initial step. At the point when we put the tablet into suitable Aqueous medium, the medium enters into the tablet and replaces the air adsorbed on the particles, which shortcoming the intermolecular bond and breaks the tablets into fine particles. <sup>8</sup> Water take-up by tablet relies on hydrophobicity of the medication/excipients and on tableting conditions. For these sorts of disintegrants, upkeep of permeable structure and low interfacial pressure towards watery liquid is vital which helps in crumbling by making a hydrophilic system around the medication particle. <sup>[10]</sup>



**Fig. 1: Wicking mechanism of tablet disintegration**

2. **Swelling:** Growing is the most widely recognized component of both normal and engineered superdisintegrants to cause tablet breaking down. As the tablet interacts with appropriate medium, entrance of water is the prime important advance for this instrument followed by expanding power bring about breakdown of tablet as appeared in figure 2.<sup>[11]</sup>

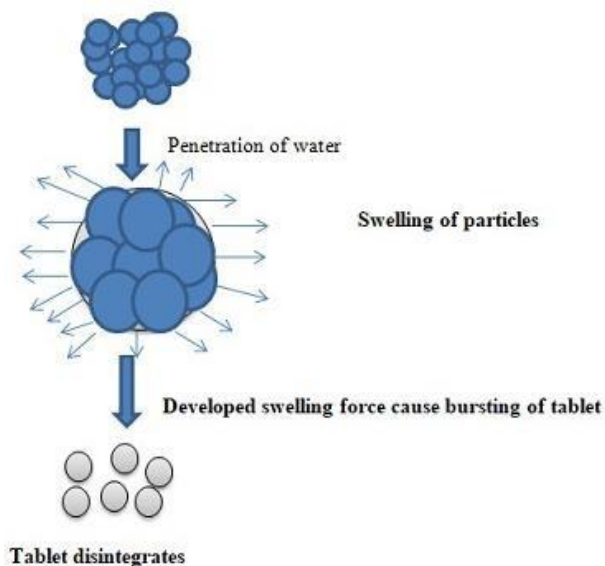


Fig. 2: Swelling mechanism of tablet disintegration

3. **Heat of wetting (air expansion):** When disintegrants with exothermic properties gets wetted, restricted pressure is created because of slim air extension, which helps in crumbling of tablet.<sup>[10, 11]</sup>

4. **Due to disintegrating Particle/Particle repulsive forces:** This is another component of crumbling that endeavors to clarify the expanding of tablet made with non swellable disintegrants. As indicated by Guyot-Hermann's molecule aversion hypothesis, water infiltrates into tablet through hydrophilic pores and a constant starch arrange is made that can pass on water starting with one molecule then onto the next, granting a noteworthy hydrostatic weight.<sup>11</sup> The water at that point enters between starch grains in light of its partiality for starch surfaces, in this manner breaking hydrogen bonds and different powers between particles are the system of deterioration and water is required for it.<sup>[13]</sup>

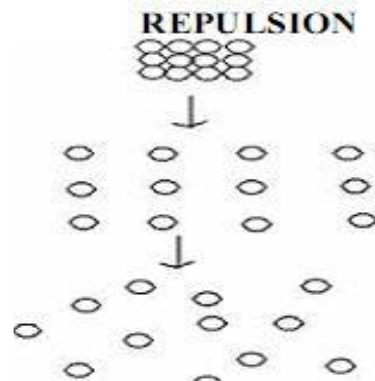


Fig. 3: Mechanism of superdisintegrants due to particle repulsive forces

5. **Due to Deformation:** During Tablet pressure, broke down particles gets twisted and in contact with fluid media comes back to ordinary structure.<sup>[13, 14]</sup> E.g: starch.

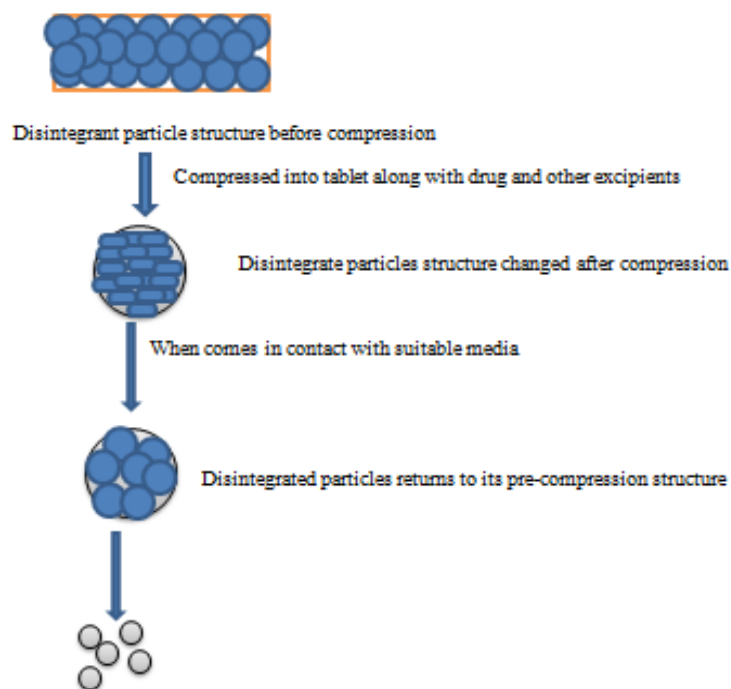
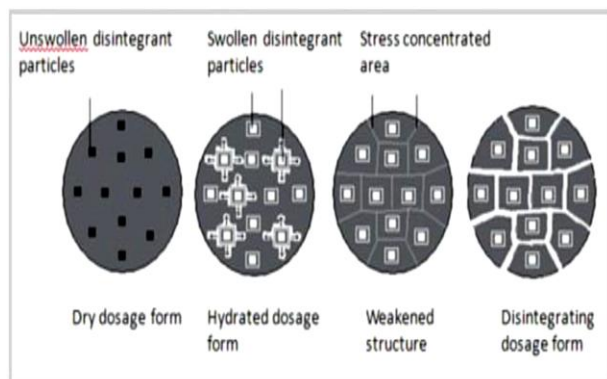


Fig. 4: Tablet disintegration due to deformation

6. **Chemical Reaction (Acid-base reaction):** The tablet is immediately broken separated by inner freedom of CO<sub>2</sub> in water because of connection between tartaric corrosive and citrus extract [acids] with salt metal carbonates or bicarbonates [bases] in nearness of water.<sup>14</sup> The tablet deteriorates because of age of weight inside the tablet.

Because of freedom in CO<sub>2</sub> gas, the disintegration of dynamic pharmaceutical fixings in water just as taste covering impact is upgraded. As these disintegrants are profoundly delicate to little changes in stickiness level and temperature, severe control of condition is required during readiness of the tablets. The bubbly mix is either added quickly before pressure or can be included two separate part of definition coming about electrical force.<sup>[15]</sup>

**7. Enzymatic Reaction:** A few proteins present in the body likewise go about as disintegrants. These Enzymes decrease the coupling capacity of cover and aides in crumbling. Because of expanding, pressure is applied in the external course that makes the tablet burst or upgrade ingestion of water prompts a huge increment in the volume of granules to improve disintegration.<sup>[15, 16]</sup>



**Fig. 5: Enzymatic Reaction**

**Enzymes acts as a disintegrants**

Sr. No.	Enzymes
1	Amylase
2	Protease
3	Cellulase
4	Invertase

**Table No. 2: Example of enzymes acts as a disintegrants**

**8. Combination Action:** Right now, blend of both wicking and expanding activity encourage disintegration.<sup>[17]</sup>

**SYNTHETIC SUPER DISINTEGRANTS:<sup>[18]</sup>**

Manufactured and semi-engineered super disintegrant are set up from a compound treatment which increments there cost and at last

makes the plan exorbitant. In this way, there is an essential need of such superdisintegrants which are practical and have great super disintegrant capabilities.

**DISADVANTAGES OF SYNTHETIC SUPERDISINTEGRANT:<sup>[19]</sup>**

- Hygroscopic in nature and may cause issues with water touchy drug.
- Toxicity
- Poor understanding consistence
- High cost
- Synthesis of such polymer may influence condition during their blend.
- Skin disturbance, Eye irritation

Example of Synthetic Super disintegrant

- Croscarmellose sodium
- Crospovidone
- Sodium starch glycolate
- Pregelatinized starch

**NATURAL SUPER DISINTEGRANTS**

• These super disintegrating specialists are normal in inception and favored over manufactured substances since they are moderately less expensive, lavishly accessible, non-bothering and non-lethal in nature. The characteristic materials like gums and adhesives have been broadly utilized in the field of medication conveyance for their simple chance, Eco benevolence and cost large number of substance alterations, conceivably degradable and perfect because of normal cause. Case of a few gums and adhesives are accessible which have super disintegrating activity.<sup>[11]</sup>

- *Plantago ovate* seed mucilage
- Guar gum
- Mango peel pectin Gum karaya
- Agar, Aloe Vera, Chitosan
- *Ocimum americanum* seed mucilage

**ADVANTAGES:<sup>[13, 19]</sup>**

- Local available
- Eco-accommodating and bio-adequate
- Low cost when contrasted with manufactured and inexhaustible source

- Natural gum having no unfavorable consequences for person or on general condition
- They are extraordinarily biocompatible and non-harmful in nature
- They show better patient tolerance

**RECENT WRITING ON QUICK DISSOLVING TABLETS ARRANGED BY EXPANSION OF SYNTHETIC SUPERDISINTEGRANTS**

Sr. No.	Name of Drug	Category	Reason for formulation into fast dissolving system	Superdisintegrants used	Results	Ref
1.	Aceclofenac	Non-steroidal anti-inflammatory drug	To assess starch xanthate, another super disintegrant in the plan of quick dissolving tablets of ineffectively solvent medication.	Starch xanthate, Croscarmellose, sodium starch glycolate	Detailing containing 10% of starch xanthate in blend with 5% of Croscarmellose sodium can be utilized in the definition of quick dissolving tablets.	[20]
2.	Amisulphide	Anti-psychotic	To expand patients consistence by giving quick activity by means of deterioration without trouble in gulping.	Crospovidone, croscarmellose sodium	Plan containing 9% Crospovidone and 9% Croscarmellose sodium in mix shows quick breaking down gave quick beginning of activity.	[21]
3.	Bauhinia Veriagata Linn	Anti-diabetic, Anti-infective, anti-leprosy	To design speedy dissolving tablets with satisfactory mechanical dependability and snappy disintegration without need of water.	Crospovidone, sodium starch glycolate and mixture of crospovidone and sodium starch glycolate	Specifying containing 3% Crospovidone demonstrated better results for normal fast dissolving tablets qualifying all criteria and authority limits.	[22]
4.	Bambuterol Hydrochloride	Anti-asthamatic	To improve tolerant consistence by planning quick dissolving tablet with upgraded disintegration rate.	Pregelatinized starch, croscarmellose sodium, Sodium starch glycolate, crospovidone	Solicitation of addition in breaking down rate with different super disintegrant are: Crospovidone>Croscarmellose sodium> Sodium starch glycolate>Pregelatinized starch	[23]
5.	Clove	Analgesic	To get ready quick dissolving neutraceutical pain relieving tablet which gives fast beginning of activity.	Crospovidone	The plan containing super disintegrant in more sum indicated better disintegration profile contrasted with different definitions.	[24]
6.	Domperidone	Anti-emetic	To get ready quick dissolving tablets of Domperidone.	Sodium starch glycolate, crospovidone	Definition containing 3.3% w/w of Crospovidone shows preferable breaking down outcomes over sodium starch glycolate.	[25]
7.	Doxazosin mesylate	Used in hypertension	To detail and quick dissolving tablet of Doxazosinmesylate	Physical blend of Crospovidone and Croscarmellose, coprocessedsuperdisinte grants, Crospovidone, Croscarmellosesodium [mixture of Crospovidone and Croscarmellose sodium in centralization of 2% and 5%.]	Plan having coprocessed blend of Crospovidone and Croscarmellose sodium in grouping of 5% Helps in essentially decreased te deterioration time and improved the medication discharge.	[26]
8.	Ergotamine	Vasoconstrictor	To configuration quick	Crospovidone and	Detailing containing 62.5% of	

	Tartrate		dissolving tablets of ergotamine tartrate with manufactured superdisintegrants	Croscarmellose sodium	Crospovidone as a disintegrant indicated better crumbling drug discharge contrasted with others.	[27]
9.	Etoricoxib	Non-steroidal anti-inflammatory	To get ready mouth dissolving tablets of Etoricoxib have improved patient's consistence.	Crospovidone and Croscarmellose sodium	Plan containing strong scattering of beta cyclodextrin and Etoricoxib in the proportion of 1:3 gives preferable outcomes over different details.	[28]

**Table No. 3: Recent writing on quick dissolving tablets arranged by expansion of synthetic superdisintegrants**

**LITERATURE ON QUICK DISSOLVING TABLETS ARRANGED BY EXPANSION OF NATURAL SUPERDISINTEGRANTS**

Sr. No.	Name of Drug	Category	Reason for formulation into fast dissolving system	Superdisintegrants used	Results	Ref
1.	Cetirizine Hydrochloride	Antihistamine	To figure and enhance cetirizine hydrochloride oral breaking down tablets utilizing focal composite structure with joined impact of regular or manufactured polymers.	Hibiscus rosasinesis mucilage, croscarmellose	This focal composite structure can be utilized in the detailing of quick dissolving tablets with qualifying all parameters.	[29]
2.	Furosemide	Diuretics	To enhance patient's compliance and minimize the side effects.	Pectin of mango peel, crospovidone	Plan containing 8%w/w gelatin of mango strip [Mangiferaindica] is the best plan among all detailing regarding breaking down time and medication discharge.	[30]
3.	Irbesartan	Anti-hypertensive, diabetic nephropathy or kidney disease	To structure and detail quick dissolving tablets by utilizing starch from jackfruit seeds as a novel superdisintegrant	Jackfruit seed separate as a novel superdisintegrant[JFS 1-Jackfruit starch extricated utilizing water and JFS2: Jackfruit starch removed utilizing 0.1 N NaOH, croscarmellose sodium	Plan containing JFS2 5%w/w and Croscarmellose sodium demonstrated comparative and better medication discharge when contrasted with other detailing. Kind of starch additionally decides its super disintegrant property.	[31]
4	Ketorolac Tromethamine	Non-steroidal, anti-inflammatory	To enhance patients compliance	Fenugreek mucilage, linseed mucilage, crospovidone	The detailing containing 8% Crospovidone as super disintegrant show best outcome contrasted with every other plan.	[32]
5.	Ibuprofen	Non-steroidal anti-inflammatory	Examination on novel bio-folio detached from aegle marmelos utilized in ibuprofen tablets	Aeglemarmelos gum	Tablets containing disintegrant centralization of 2% shows better crumbling time and with a high level of medication discharge.	[33]
6.	Metronidazole	Antibiotic	Evaluation of callinectes chitosan as a super disintegrant in metronidazole tablet	Chitosan	No unfriendly collaboration among chitosan and metronidazole was watched. The deterioration time of tablets containing 2,4 and 8% chitosan	[34]

					were 12.2, 10.4 and 9.3 min individually.	
7.	Telmisartan	Used in Hypertension, Kidney problem	Near investigation and assessment of the breaking down property of starch got from <i>cucurbita maxima</i> mash and authority starch in telmisartan tablet.	<i>Cucurbita maxima</i> pulp	The outcomes demonstrated that a lesser measure of <i>Cucurbita maxima</i> starch is required as disintegrant [10%] w/w than corn starch to show the best breaking down action.	[35]
8.	Metformin	Biguanides	Isolation and evaluation of disintegrating property of fenugreek seed mucilage.	Fenugreek seed mucilage	Fenugreek adhesive in the convergence of 4% gives shorter breaking down in 15 sec and shows 100% medication discharge inside 18 minutes.	[36]
9.	Aceclofenac	Non-steroidal anti-inflammatory	Studies on mucilage from <i>Hibiscus Rosasinensis</i> linn as oral disintegrant.	<i>Hibiscus rosasinensis</i>	The examination uncovered that hibiscus rosasinensis adhesive powder was successful as a disintegrant in low centralization of 4%, The adhesive was seen as an unrivaled breaking down specialist than Ac-di-Sol.	[37]
10.	Clopidogrel bisulfate	antiplatelet drug	Definition and Evaluation of Orodispersible Tablets of Clopidogrel Bisulfate Using Natural Superdisintegrants	Moringaoleifera, <i>PlantagoOvata</i>	Moringaoleifera 8% and PlantagoOvata 6% on a very basic level improved the separating and breaking down which may add to improve bioavailability of the drug.	[38]
11.	Telmisartan	Antihypertensive	To present and assess characteristic excipient (banana powder) that has flexible property in the orally crumbling tablets utilizing Telmisartan as model medication.	Banana powder	Banana powder was having phenomenal super disintegrant property which can be very much used for creating ODTs.	[39]

**Table No. 4: Literature on quick dissolving tablets arranged by expansion of Natural superdisintegrants**

**CONCLUSION**

Disintegrants, a significant excipient of the tablet detailing, are constantly added to tablet to prompt separation of tablet when it interacts with watery liquid and this procedure of integration of constituent particles before the medication disintegration happens, is known as deterioration process and excipients which instigate this procedure are known as disintegrants. The targets behind option of disintegrants are to expand surface territory of the tablet sections and to defeat firm powers that keep particles together in a tablet. Disintegrants grow and disintegrate when wet making the tablet break separated in the stomach related,

discharging the dynamic elements for assimilation. They guarantee that when the tablet is in contact with water, it quickly separates into little pieces. Superdisintegrants assumes a basic job in the plan of mouth dissolving tablets. These operators help and encourage tablets to scatter into its littler sections.

**REFERENCES**

1. Dass S, Mazumdar AS. 2013. An updated precise review on superdisintegrants. Indo American Jour. of Pharma Res. 3, 5342-5355.
2. Pahwa R, Sharma S, Singh A, Garg A, Singh I. 2016. Emergence of natural superdisintegrants in the development of orally disintegrating tablets. Indo American Journal of Pharma Sci. 3, 777-787.



3. Naga VK, Kulkarni PK., Dixit M, Lavnya D, Ravii PK. 2011. Brief introduction of natural gums, mucilages and their applications in novel drug delivery systems- A review. Intern Journal of Drug Formulation and Research. 2, 54-71.
4. Gupta N, Pahwa R. 2011. Superdisintegrants in the development of orally disintegrating Tablets: A review. Int. Journal of P<sup>h</sup>ceutical Sci and Research. 2, 2767-2780.
5. Kumar S, Kumari A. 2019. Fast dissolving tablets: waterless patient compliance dosage forms. Journal of Drug Delivery and Therapeutic. 9, 303-317.
6. Ramya KB, Madhulika SV. 2019. A review on natural and synthetic polymers employed in the formulation of oral disintegrating tablets. Journal of Drug Delivery and Therapeutic. 9, 652-658.
7. Mahajan BU, Prashar B. 2012. An overview on superdisintegrants. Research Journal of Pharm and Tech. 5, 466-473.
8. Gandhi L, Akhtar S. 2019. Comparative study on effect of natural and synthetic superdisintegrants in the formulation of orodispersible tablets. Journal of Drug Deliv and Therapeutic. 9, 507-513.
9. Roy D, Bhowmik D, Kumar S. 2014. A Comprehensive review on super disintegrants used in orodispersible tablets. Indian Journal of Research in Pharm and Biotech. 2, 1297-1303.
10. Khairnar D, Anantwar S, Chaudhari C, Shelke P. 2014. Superdisintegrants: an emerging paradigm in Orodispersible tablets. Int. Jour. of Biopharm. 5, 119-128.
11. Kumar P, Nayyar P, Sharma P, 2014. Super disintegrants Current approach. Journal of Drug Delivery and Therapeutics. 4, 37-44.
12. Kaur V, Mehara N. 2016. A Review on: Importance of super disintegrants on immediate release tablets. Int. Journal of Research and Sci Innovat. 3, 39-43.
13. Kumar S, Kumari A. 2019. Super disintegrant: crucial elements for mouth dissolving tablets. Journal of Drug Delivery and Therapeutic. 9, 461-468.
14. Mane S, Bathe R. 2019. A review on- Fast disintegrating drug delivery system. International Journal of Scientific Research in Sci and Tech. 6, 291-303.
15. Arora P, Arora V. 2013. Orodispersible tablets: A comprehensive review. Int. Journal of Research and Develop in Pharm and Life Sci. 2, 270-284.
16. Bala R, Khanna S, Pawar P. 2012. Polymers in fast disintegrating tablets-A review. Asian Jou. of Pharma and clinical Res.. 5, 8-14.
17. Rawat S, Derle DV, Fukte S, Shinde P, Parve B. 2014. Super disintegrants: An overview. World Journal of Pharmacy and Pharma Sci. 3, 263-278.
18. Malik K, Arora G, Singh I. 2012. Ocimum sanctum seeds, a natural super disintegrant: Formulation & evaluation on fast melt tablet of nimesulide. Polim Med. 42, 49-59.
19. Bhosle R, Gangadharappa HV, Moin A, Gowda DV, Ali R, Osmani M. 2015. Grafting technique with special emphasis on natural gums: Application and preservatives in drug delivery. The Natural products Journal. 5, 124-139.
20. Kumar S, Kumar G, Yagnesh NS. 2017. Design, optimization and evaluation of aceclofenac fast dissolving tablets employing starch xanthate-A new super disintegrants. International Journal of Chem Tech Research. 10, 32-48.
21. Gunda RK, Kumar S. 2018. Formulation development and evaluation of amisulpride fast dissolving tablet. Fabad Journal of Pharma Sci. 43, 15-25.
22. Kagalkar A, Nanjwade B, Srichana T. 2017. Development and evaluation of fast dissolving tablets of Bauhenia Veriagata Linn. World Journal of Pharmacy and Pharma Sci. 6, 1027-1039.
23. Gohil DY, Savaliya RP, Desai SD, Patel DJ. 2014. Formulation and characterization of Bambuterol Hydrochloride fast dissolving tablet using various super disintegrants.

- International Journal of Pharmaceutical Science and Research. 2, 84-89.
24. Tiwari RK, Singh L, Sharma V, Singh P. 2018. Formulation development of fast dissolving tablet of clove- The best nutraceutical analgesic tablet. Asian Food Sci Journal. 1, 1-7.
  25. Verma NK, Singh SP, Singh AP, Rai P, Singh R. 2015. Formulation & characterization of fast dissolving tablet of domperidone. Der Pharmacia Sinica. 6, 21-28.
  26. Preethi GB, Banerjee S, Shivakumar HN, Kumar R. 2017. Formulation of fast dissolving tablets of Doxazosin Mesylate drug by direct compression method. Int. Journal of Applied pharma. 9, 22-28.
  27. Singh J, Choubey N, Sharma HK, Budholiya P, Parkhe Geeta, 2019. Formulation development and evaluation of fast dissolving tablets of pregabalin. Journal of Medical Pharmaceutical and Allied Sciences, V 8 - I 5, 860, 2347-2358.
  28. Nagendra kumar D, Shetti E, Mogale P, Bhalke N. 2015. Design and evaluation of fast dissolving tablets of Ergotamine Tartarate. Internatinal Journal of Current Pharma Research. 7, 101-104.
  29. Gholve S, Todkar G, Bhusnure O, Jadhav A, Rajurkar R, Thonte S. 2015. Formulation and evaluation of fast dissolving tablets of Etoricoxib. World Journal of Pharmacy and Pharma Sci. 4, 1357-1376.
  30. Patro CS, Sahu PK. 2017. Combined effect of synthetic & natural polymes in preparation of Cetrizine HCl oral disintegrating tablets Optimiz. by central composite design. Journal of pharma. 1-12.
  31. Shirsand SB, Jonathan V, Gumate RT. 2015. Mangifera Indica pectin as a disintegrant in design of fast dissolving tablets. Indo American Jour. of Pharma Sci. 3, 275-282.
  32. Kale G, Chemate SZ. 2017. Formulation and evaluation of fast dissolving tablet of Irbesartan and Atorvastatin Calcium. World Journal of Pharma Research. 6, 845-854.
  33. Kumar N, Anuradha, Begum A, Shetti K. 2013. Design and evaluation of fast dissolving tablets of Ketorolac Tromethamine using natural super disintegrant. Int. Journal of Universal Pharm and Bio Sciences. 2, 462-473
  34. Ain S, Ain Q, Kumar B. 2015. Investigation on novel bio-binder isolated from aegle marmelos used in ibuprofen tablets. International Journal of pharmacy and Pharma Sci. 7, 414:415.
  35. Emmanuel O, Musiliu OA, Ekaetel IA. 2017. Evaluation of callinectes chitosan as a super disintegrant in metronidazole tablet. International Journal of pharmacy and Pharma Sci. 9, 111-118.
  36. Jaganadan SK, Varghese N, Marimutho J, Sudagar D. 2016. Comparative study and evaluation of the disintegrating property of starch derived from *cucurbita maxima* pulp and official starch in Telmisartan tablet. Int. jour. of P'cology and pharma sci. 3, 49-61.
  37. Kumar R, Patil S, Patil MB, Patil S, Paschapur M. 2009. Isolation and evaluation of disintegrating property of fenugreek seed mucilage. Intern Journal of Pharm Tech Research. 1, 982-996.
  38. Shah V, Patel R. 2010. Studies on mucilage from *Hibiscus Rosa sinensis* linn as oral disintegrant. Intern Journal of appl Pharma. 2, 18-21.
  39. Patil I, Patil O, Bilaskar V. 2018. Formulation and evaluation of oro-dispersible tablets of Clopidogrel Bisulfate using natural super disintegrants. Indian Journal of Novel Drug Delivery. 10, 17-23.
  40. A B Khaleel, 2014. Formulation and evaluation of Telmisartan orodispersible tablets by using banana powder. Indian Journal of Research in Pharma and Biotech. 2, 982-987.