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IMMEDIATE RELEASE TABLETS: A REVIEW

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Immediate release, Superdisintegrant, Disintegration, Granulation

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ABSTRACT: The scenario of pharmaceutical drug delivery are expeditiously challenging, but conventional pharmaceutical dosage forms are still dominating. Immediate release dosage forms are those wherein ≥85% of labeled amount dissolves within 30 min. Superdisintegrants are used to improve the efficacy of solid dosage forms. The basic approach used in the formulation of the tablet is the use of superdisintegrants like croscarmellose, sodium starch glycolate, and crospovidone, *etc*. These superdisintegrants provide instantaneous disintegration of the tablet after administration in the stomach. Thus, decreasing the disintegration time which in turn enhances drug dissolution rate. The rapid disintegration may be due to the rapid uptake of water from the medium, swelling, burst effect and thereby promoting bioavailability. Tablets formulations are mostly preferred because of the low cost of manufacture, package, shipment, increased stability. Among various dosage forms used for oral drug delivery, tablets are one of the most successful and marketable drug delivery regimens as it provides several advantages over another form of dosage forms. This article provide an exhaustive account illustrating the significances of superdisintegrant in the immediate release of tablets and the mechanism of disintegration along with various conventional techniques and novel granulation technology used to prepare immediate-release tablets.

INTRODUCTION: The Oral route is one of the most sought after route for the systemic effect due to its ease of ingestion, simple, safest, convenient, non-invasive, versatility and most importantly, patient compliance. Solid oral delivery systems are cheaply manufactured because they don't require sterile conditions [1]. Although, increased focus and interest generated in the area of controlled release and targeted drug delivery system in recent years, tablet dosage forms that are intended to be swallowed whole, disintegrate, and release their medicaments fast and furiously in the gastrointestinal tract [2].

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An ideal dosage regimen of drug therapy is the one, which immediately nab the desired therapeutic concentration of drug in plasma (or at the site of action) and maintains it constantly for the entire duration treatment [3]. Of late, the scientists have focused their attention on the formulation immediately released tablet. The effort of developing a rapidly disintegrating tablet is accomplished by using suitable diluents and super disintegrants [4].

Definition: Immediate Release Tablets: Immediate release tablets are invented to disintegrate and release their dosage form with no special rate controlling features, such as special coatings and other techniques. Immediate release tablets are those which disintegrate swiftly and get dissolved to release the medicaments [5]. The oral bioavailability of drug dependent on disintegration, dissolution and various physiological factors [6]. An immediate release dosage form helps a manufacturer to diversify market and simultaneously offering patients a convenient dosage form or dosage regimen [7].

Essential Requirements for Immediate Release Tablets: [8]

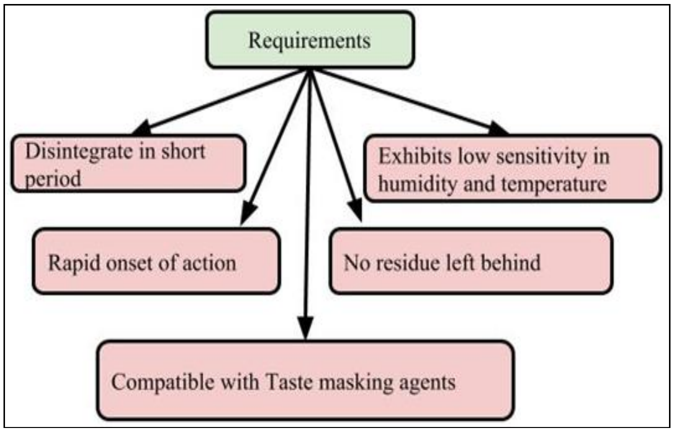

FIG. 1: ESSENTIAL REQUIREMENTS FOR IMMEDIATE RELEASE TABLETS

Advantages of Immediate Release Drug Delivery System: [9]

- Improved compliance / added convenience, solubility, stability, bioavailability.
- Allows high drug loading, cost-effective.
- Ability to provide advantages of liquid medication in the form of solid preparation.
- Adaptable and amenable to existing processing and packaging machinery.
- Decreased dissolution and disintegration times for immediate release oral dosage forms.

Disadvantage: [8]

- Frequent dosing is necessary for a drug with a short half-life.
- Drug release at a time may produce high plasma concentration which may produce toxicity.

Conventional Techniques Used for Preparation of Immediate Release Tablets: Several technologies are available to manufacture immediate-release tablets. The most common preparation methods are molding, lyophilization or freeze drying, direct compression, spray drying and sublimation [10].

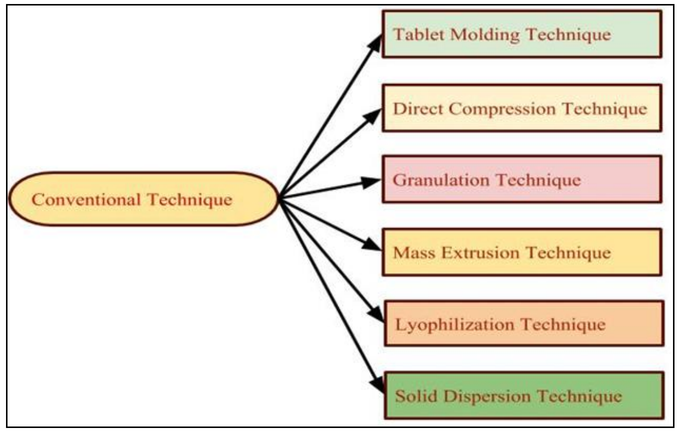

FIG. 2: TYPES OF CONVENTIONAL TECHNIQUES OF IMMEDIATE RELEASE TABLET

Tablet Molding Technique: In this technology, water-soluble ingredients are incorporated to disintegrate and dissolve the tablet more swiftly. The hydroalcoholic solvents are used to moistened powder blend and then apply compression pressure that is lower than the conventional tablets compression to mold the tablet. The solvent is then removed by air-drying. Dissolution is enhanced by a porous structure of molded tablets [11].

Direct Compression: In which tablets formulations are directly compressed from a powder blend of suitable excipients and API is called a direct compression method. Pre-treatment of blended powder by dry or wet granulation procedure is not necessary. Its provide merits mostly in terms of speedy production, as it requires less machinery, reduced number of personnel, fewer unit operations and significantly less processing time along with improved product stability [12].

Granulation Technique: It is a process of size enlargement in which small particles convert into larger agglomerates and make it physically stronger. It is beneficial to avoid segregation of the product's constituent, refine powder flow and handling and minimize the dustiness.

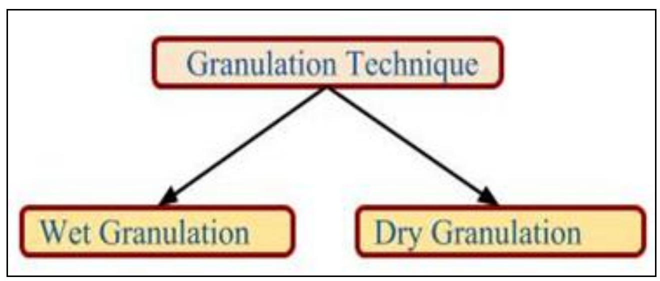

FIG. 3: TYPES OF GRANULATION TECHNIQUES

It is ideally spherical, the smaller particle size is efficiently filling the void spaces between granules. This method can also be classified as two types [13].

(A) Wet Granulation: Wet granulation process make easy fine particles run into severity-feed drug manufacturing. Usually, immediate release formulation is granulated with addition into fine particles accumulation an aqueous solution of a binding polymer. Controlled release formulation granulated with addition a binder polymer solution [14].

(B) Dry Granulation: In dry granulation process the powder mixture is compressed without the use of heat and solvent. The two basic procedures are to form a compact of material by compression and then to mill the compact to obtain granules. Below two methods are used for dry granulation [16].

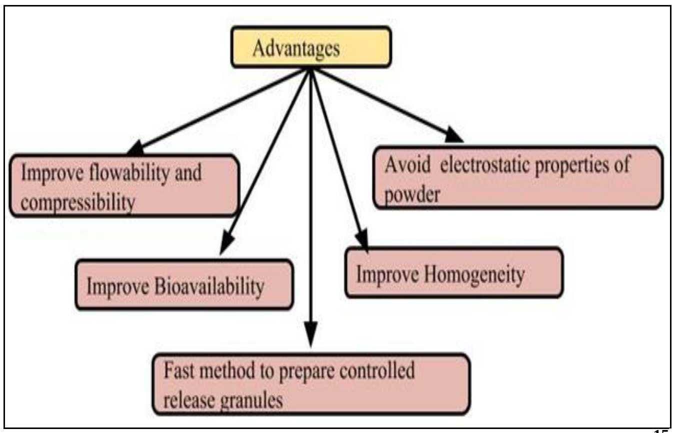

FIG. 4: ADVANTAGES OF WET GRANULATION METHOD[15]

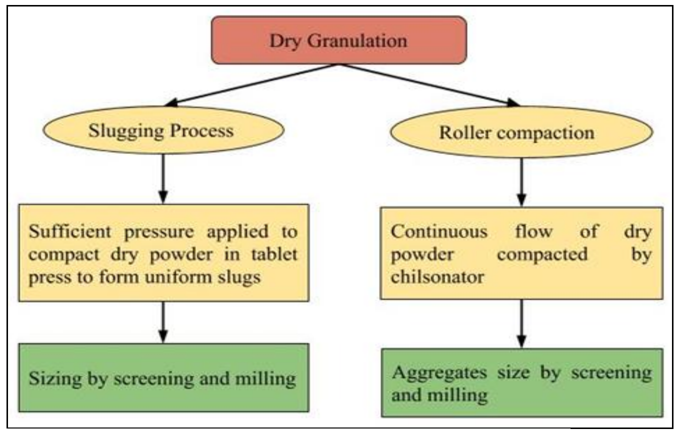

FIG. 5: PROCESS OF DRY GRANULATION

TABLE 1: STEPS INVOLVED IN THIS PROCESS OF PREPARATION OF TABLETS BY CONVENTIONAL TECHNIQUE

Direct Compression	Wet Granulation	Dry Granulation
Blending	Blending	Blending
-	Wet massing and screening	Slugging/roller compression
-	Drying	-
-	Dry screening	Screening
Blending (with lubrication)	Blending (with lubrication)	Blending (with lubrication)
Compaction	Compaction	Compaction

Mass-Extrusion: In this technology softening the blend of active drug with water-soluble solvent methanol, polyethylene glycol and softened mass put into the extruder to form a cylinder shape of the product and segmented with using the heated blade to formulate a dosage form as tablets [18].

Solid Dispersions: Solid products containing at least two different components, mainly hydrophilic matrix and a hydrophobic drug. The matrix can be either crystalline or amorphous. This method deal with the challenge of mixing a matrix and drug, preferably on a molecular level, while matrix and drug are generally poorly miscible [19]. When formulating immediate release solid dosage forms from solid amorphous dispersion for oral administration to effective use in an environment such as the GI tract of a human, it is often desirable to increase the amount of dispersion occurs in the dosage form [20].

Lyophilization: It depends on simple principle *i.e.* sublimation. The sublimation is processed in which conversion of a substance from a solid state to vapor state, without changing in the liquid phase. Lyophilisation is performed at temperature and pressure conditions below the triple point. The whole process is performed at low temperature and pressure by applying vacuum; hence it is suitable for drying of thermolabile compounds [21].

Novel Granulation Technologies:

(a) Pneumatic Dry Granulation (PDG): It is a novel technique of dry method in which the formulation of granules is carried out by automatically or semi-automatically. This techniques granule has excellent properties as compared to dry granulation, direct compression, wet granulation and granules are showing high compressibility and flowability The outcome can be attained without utilizing exotic and high-cost excipients [22].

(b) Freeze Granulation Technology (FGT): Integrated Biosystems, Inc. (California, USA) had patented freeze GT that results in spherical and free flowing granules with ideal homogeneity. Its require spraying of a suspension containing powder into liquid nitrogen where the drops were swiftly frozen to form granules which upon subsequent freeze-drying yields dry granules [23].

(c) Spray Drying Granulation: This technology facilitated to improved flow, homogeneous distribution of colors, drug and required less lubricant as compared to wet massed products. It can be co-precipitate an active pharmaceutical ingredient with a suitable polymer to form a stable amorphous solid dispersion and promote improved bioavailability and dissolution rate of many drug products [24].

(d) TOPO (TOPO Granulator) Technology: Hermes Pharma has developed a unique technology for carrying out single pot granulation, and a very small volume of liquid is required to start the chain reaction. Pure water or water-ethanol mixtures are used. TOPO Technology fabricates granules for tablets which consist of at least one solid crystalline, an organic acid and one alkaline or alkaline earth metal carbonate that reacts with the organic acid in aqueous solution to form carbon dioxide. As a result, finished products free from solvent residue and granules have excellent hardness and stability. It was employed for manufacture effervescent tablets following TOPO vacuum granulation technology, patented by Hermes Pharma. It requires granulation under vacuum to prevent uncontrolled chain reaction [25].

(e) Moisture Activated Dry Granulation (MADG): In this technology, moisture is used to activate granule formation, without the need to apply heat to dry the granules. There are two main stages in MADG [26].

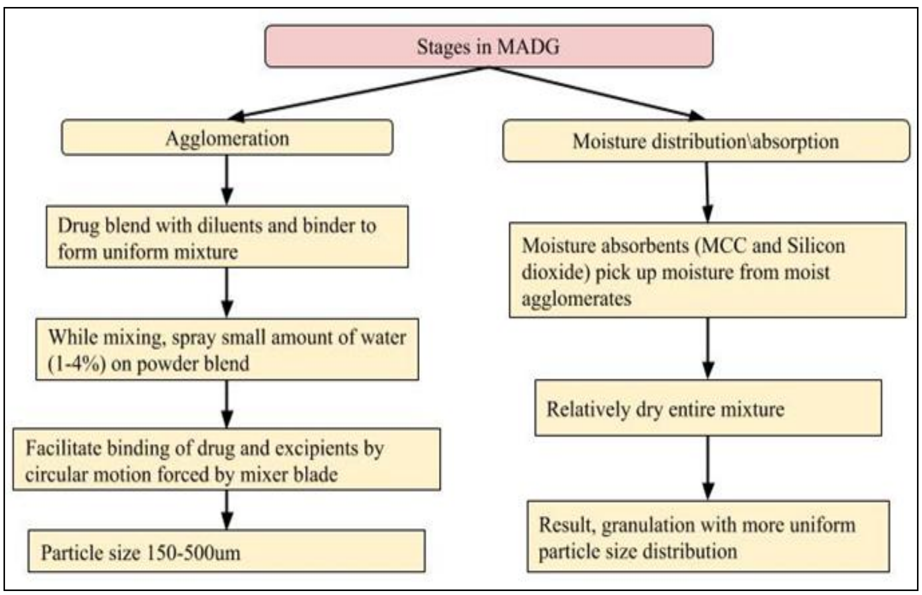

FIG. 6: STAGES OF MADG TECHNIQUE

(f) Continuous Flow Technology: This method does not use liquid to precede chain reaction.

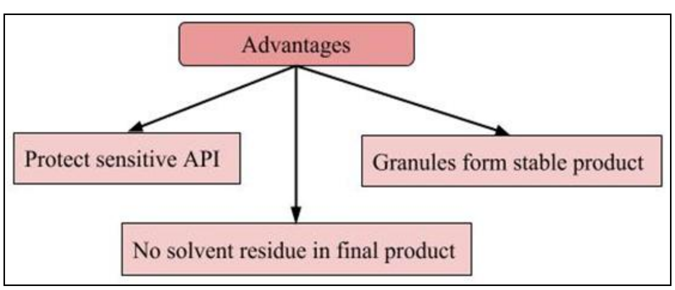

FIG. 7: ADVANTAGES OF CONTINUOUS FLOW TECHNOLOGY

Granules are formulated in the inclined drum in which powder is loaded to inlet duct and formulated granules are removed from the other side. Every day up to 12 tons of granules can produce by CF technology [27].

(g) Thermal Adhesion Granulation Process: It is an alternate to moist granulation and requires a small quantity of binder liquid and heat to produce agglomeration. Moreover, the granulation process is facilitating by the use of heat. The mixture of excipient and API is heated at 30-130 °C temperature in a closed chamber that is set for tumble rotation to produce the agglomeration process of the powder particle. This technique terminates the drying process because less amount of liquid is used and that is consumed during agglomeration of powder particles. After cooling and sieving required particle size of granules can be obtained [28].

(h) Granurex Technology: This technology consistently and precisely accomplishes the powder layering processes, single coating, and multiple coating processes and powder layers that manifest the accuracy and better drug release mechanism [29].

(i) Foamed Binder Technologies: It assists in achieving an improved wet granulation product, by using with methocel polymers and homogenous distribution of binder solution to drug mixture. It decreases the need for water and provides reproducibility [30].

Superdisintegrants: Disintegrants are substances or a mixture of substances incorporated to the drug formulations, which assist dispersion or breakup of tablets and contents of capsules into smaller fragments for rapid dissolution [31].

The rationale for Using Superdisintegrant: Several patients require immediate onset of action in particular therapeutic condition, and consequently immediate release of medicament is required. It is anticipated that 50% of the population is affected by this problem, which results in an elevated incidence of ineffective therapy [32]. So, pharmacist desires to formulate disintegrants, *i.e.* super-disintegrants are used to provide the fastest disintegration and dissolution rate for achieving an optimal bioavailability. While rapidly disintegrating tablets do not necessarily ensure fast bioavailability, slowly disintegrating tablets almost always assure slow bioavailability. The objectives behind the addition of disintegrants are to enlarge the surface area of the tablet fragments and to conquer cohesive forces that keep particles together in a tablet. When superdisintegrant contact with water they expand, swell, hydrate, dissolve, change volume or form and produce a disruptive transform in the tablet and rupture apart in the digestive, releasing the active ingredients for absorption.

Of use, superdisintegrants provide improved compressibility, compatibility and have no negative impact on the mechanical strength of formulations containing high-dose drugs. But have one disadvantage that it is hygroscopic nature, thus not used with moisture sensitive drugs. Super-disintegrants act by swelling, and due to swelling pressure exerted in the outer direction or radial direction, it causes the tablet to burst or the accelerated absorption of water foremost to a massive increase in the volume of granules to prop up disintegration.

Because of the extensive demands for faster dissolution requirements, there are now accessible, a new invention of "Super Disintegrants" in addition to the disintegrants [33]. Formulation scientist generally uses Superdisintegrants for developing FDTs or for improvement of solubility of drugs [34]. Crospovidone (XPVP), croscarmellose sodium (CCS) and sodium starch glycolate (SSG) are synthetic polymers most extensively used as disintegrants.

TABLE 2: LIST OF SOME SUPERDISINTEGRANTS [36]

Superdisintegrants	Brand name	Concentration	Special comment
Sodium Starch Glycolate	Explotab, primogel	2-8%	Swells 7-12 folds in < 30 sec
Croscarmellose	Ac-Di-Sol® Nymce ZSX® Primellose® Solutab® Vivasol® L-HP	1-3% direct compression, 2-4% wet granulation	Swells 4-8 folds in < 10 sec. Both swelling and wicking
Cross-linked Povidone	crospovidone, Kollidone, Polyplasdone®	2-5%	Water wicking, swelling and possibly some deformation recovery
Low-substituted hydroxyl propyl cellulose	L-HPC, LH-11 LH-21	1-5%	Rapidly swells in water

Given that in immediate-release tablets disintegration is an essential requirement for dissolution and disintegration performance has a direct impact on the therapeutic effect of the medication and must be assessed and ideally quantified, using specifically designed disintegration tests. The disintegration process is an integral step in ensuring, and indeed maximizing, the bioavailability of the API from the majority of solid dosage forms [35] — some examples of super disintegrants mentioned in **Table 2**. Superdisintegrants are generally used at low levels in solid dosage forms, typically 1-10 % of mass relative to the total mass of the dosage unit [37]. The choice of superdisintegrant for a tablet formulation depends largely on the nature of the drug being used. For example, the rate and mechanism of tablet disintegration could be affected by the solubility of the drug component. Water-soluble materials tend to dissolve rather than disintegrate, while insoluble materials generally tend to disintegrate if an appropriate amount of disintegrant is incorporated in the formulation [38].

Mode of Disintegration Addition: There are three methods of comprising disintegrating agents into the tablet: A. Internal Addition (Intragranular) B. External Addition (Extragranular) C. Partly Internal and External. The genuine choice of a disintegrant or a superdisintegrant and it consists performance are of critical importance to the formulation development of capsule and tablets [39].

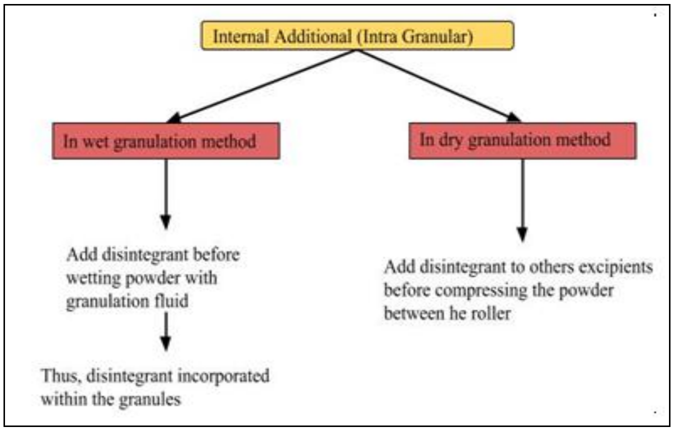

FIG. 8: FLOW CHART OF INTERNAL ADDITION

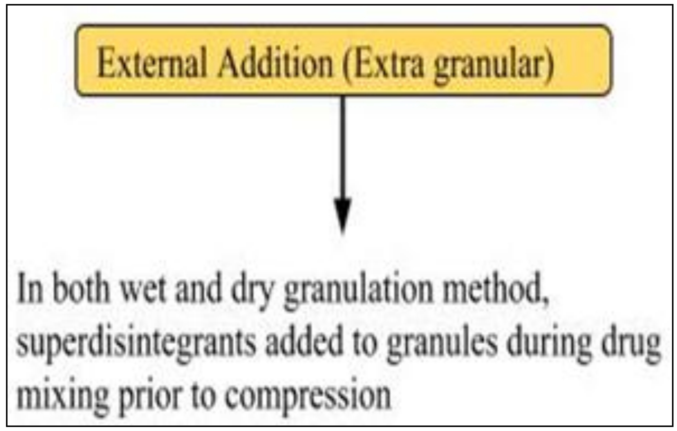

FIG. 9: FLOW CHART OF EXTERNAL ADDITION

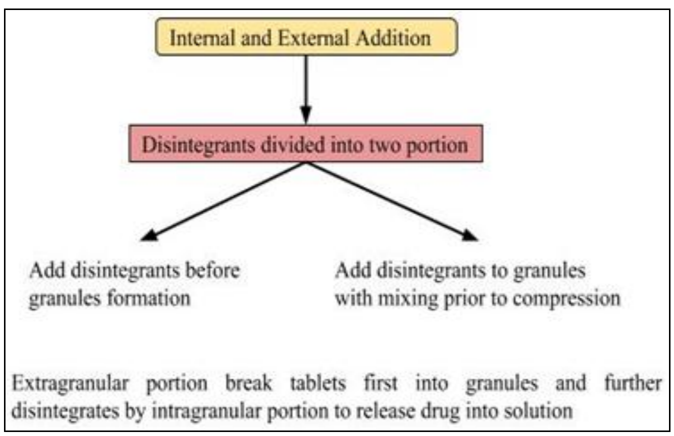

FIG. 10: FLOW CHART OF INTERNAL AND EXTERNAL ADDITION

Mechanism of Disintegration: Disintegrants are agents added to tablet and sin various encapsulated formulations to increase the breakup of the tablet and capsule "slugs' into smaller fragments in an aqueous environment thereby enhancing the accessible surface area and promoting a more rapid release of the drug substance. They trigger moisture penetration and dispersion of the tablet matrix. Tablet disintegration has received considerable attention as an imperative step in achieving fast drug release [43]. There are four major mechanisms for tablets disintegration as follows:

Swelling: The most commonly accepted general mechanism of action for tablet disintegration is swelling. Tablets with high porosity show weak disintegration due to lack of adequate swelling force.

On the flip side, sufficient swelling force is exerted in the tablet with low porosity. It is worthwhile to note that if the packing fraction is very high, fluid is not able to penetrate in the tablet and disintegration is again slows down [44].

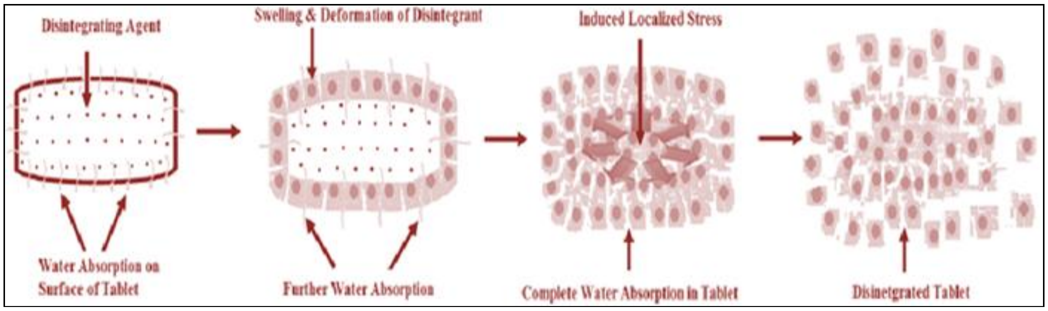

FIG. 11: SWELLING TABLET DISINTEGRATION MECHANISM

Capillary Action / Wicking: Those disintegrating agents do not get swells so they acted by the mechanism of capillary action and porosity. Tablet's porosity provides a direction to penetrate the fluid into the dosage form. The disintegrating particles those having low compressibility and cohesiveness they facilitate the high porosity and provide a pathway to wicked and drawn up liquid in the tablets drawn through capillary action and break the bonding of inter particles which leads the tablet to break apart showed in **Fig. 12**. [45]

Chemical Reaction (Acid-Base Reaction): The tablet is quickly ruptured apart by the internal release of CO_2 in water due to the interaction between tartaric acid and citric acid (acids) with alkali metal carbonates or bicarbonates (bases) in the presence of water. Due to the generation of pressure tablet disintegrates. The dissolution of API in water and taste masking influence due to liberation in CO_2 gas. During preparation of the tablets, the strict control environment is necessitated for these disintegrants are highly sensitive to small change in humidity level and temperature. The effervescent blend is either added instantly before compression or can be added in two discrete fractions of formulation [46].

Deformation: The elastic nature of starch grains are easily deformed under pressure and return to their native position and shape when the pressure is removed. But when compression forces are applied to the tableting process, these grains are get deformed permanently and called as "energy-rich" and this is energy released while come to contact with water showed in **Fig. 13**. [47]

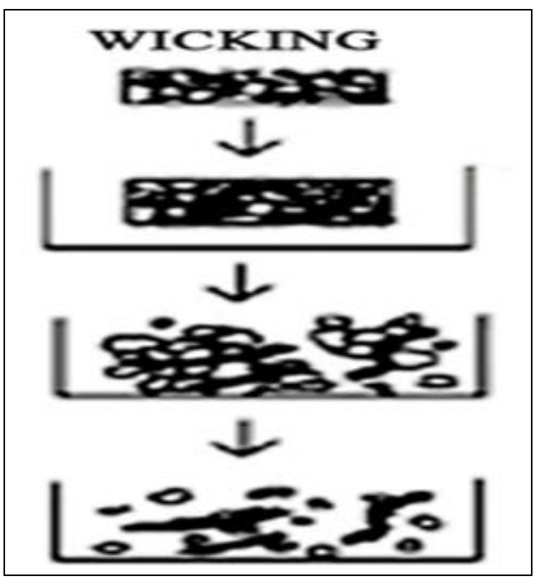

FIG. 12: WICKING MECHANISM

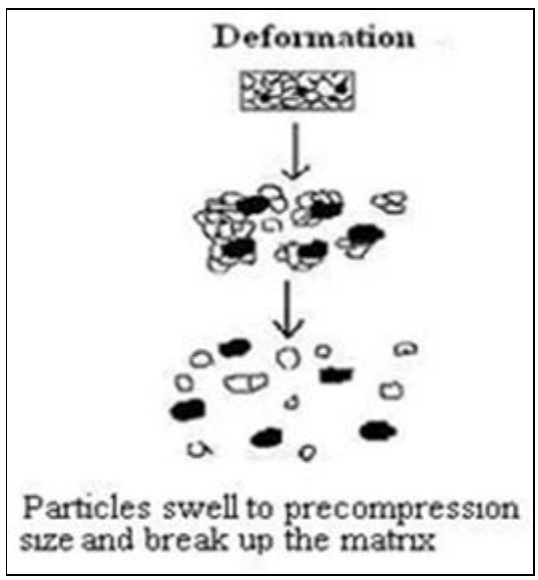

FIG. 13: DEFORMATION OF PARTICLES

Particle Repulsive Forces Due to Disintegrating Particle: According to Guyot-Hermann's particle-particle repulsion theory, water penetrates tablet *via* hydrophilic pores, and persistently starch network is fabricated that can transfer water from one particle to the next, imparting a significant hydrostatic pressure. Water is necessary for this mechanism of disintegration by repulsive electric forces between particles [48].

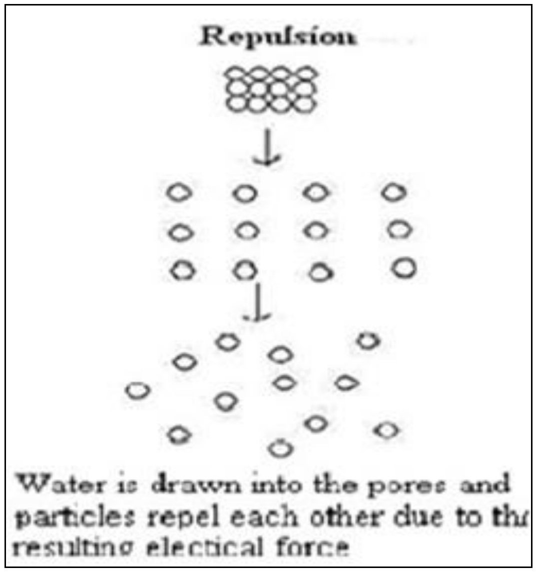

FIG. 14: DISINTEGRATION OF PARTICLES DUE TO HYDROSTATIC PRESSURE

Enzymatic-Reaction: Enzymes also act as disintegrants that are present in the body. These enzymes have a deficiency of binding action of binder and assist in disintegration. Due to swelling, the pressure is applied in the outer direction that the reason for the tablet to burst or the accelerated absorption of water leads to a vast increase in the volume of granules to stimulate disintegration [49].

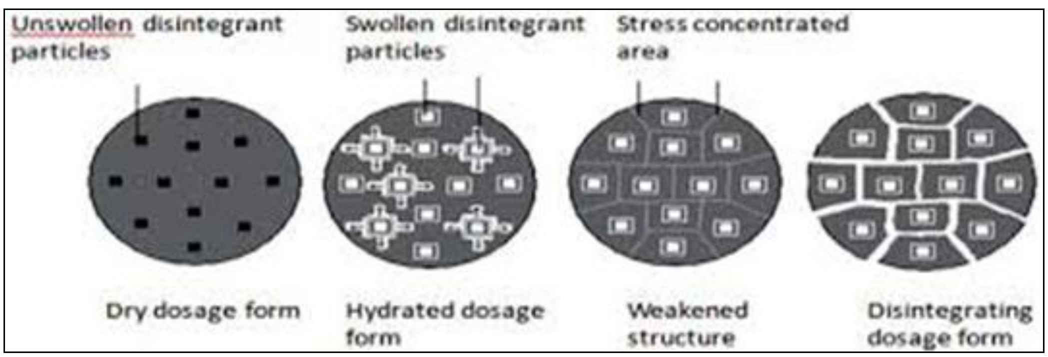

FIG. 15: DISINTEGRATION BY ENZYMATIC REACTION

Recent Developments in Immediate Release Tablets:

Miniaturized Approach for Excipient Selection: As stated by International Pharmaceutical Excipient Council, excipient is defined as "These are the substance(s) other than the API which has been appropriately evaluated for safety and is involved in a drug delivery system to aid processing of the system during manufacturing, protect, support, enhance stability, patients compliances, bio-availability or assist in product identification and enhance safety and effectiveness of drug product during storage or use [50].

Excipient selection choice mainly based on the desirable characteristics of excipients such as functionality, material consistency, regulatory acceptance, cost, availability, and sources [51].

Meticulous Research Experiments on Super-disintegrants: The percent drug release of norfloxacin fast dissolving tablets using croscar-mellose sodium as superdisintegrants showed 91 percent release in 15 min at 6 percent concentration [52]. The fibrous nature of croscarmellose at lower concentration is more pronounced and smoothens gradually with time. A probability of wicking and swelling occurs simultaneously at high concentration thus, smoothen the particles and the width of the pore decreases, so thus decreases the disintegration time [53]. Tablets employing with three combinations of superdisintegrants like crospovidone, croscarmellose and sodium starch glycolate manifest complete drug release within 20 min and rapid dissolution when collating to other formulations [54].

At 20 °C, liquid transport through the entire tablet takes place over a 6 sec to disintegrant that contains 5% CCS [55]. The taste-masked orally disintegrating tablets of ondansetron, a bitter drug using different superdisintegrants and the optimized formulation compressed with 15% polyplasdone XL-10 released more than 90% of drug within 5 min and disintegrated in the oral cavity within 12 sec [56].

TABLE 3: SUCCINCT LITERATURE CITATIONS OF IMMEDIATE RELEASE TABLETS

S. no.	Drug	Super-disintegrants	Method	Evaluation Parameter	Remarks
1	Metoclopramide HCl	Ac-Di-Sol (8%), Polyplasdone XL (8%), Explotab (8%), Gellan gum (8%) Treated gellan gum (8%), Agar (8%) and Treated agar (8%) used in different formulations	DC	DS, DT,WT, and Hydration capacity	Formulation containing Polyplasdone XL (8%) showed maximum dissolution rate 101.4%, WT (35.3 s) and hydration capacity (238.3) and Formulation containing Ac-Di-Sol (8%) showed highest DT (32.3 s) [57]
2	Zolpidem tartrate	Ac-Di-Sol (10 %), CP XL (10 %), and SSG (10 %) used in different formulations	DC	DS, DT, WT and Water absorption ratio.	Formulation containing Ac-Di-Sol (10%) batch showed maximum DT (35 sec) and WT (24 ± 0.32 sec) and hydration time (120 ± 0.025) [58]
3	Ondansetron HCl	CCS (5%), SSG (5%) and CP (5%) used in different formulations	DC	DT, WT, DS	Formulation containing CP (5%) was optimized as best batch showed less WT (24 s), WT (35 s) & maximum drug release 102.2% within 45 min [59]
4	Amlodipine and Atorvastain	CCS (2-4%) used in different formulations	WC	DS, DT	Formulation containing CCS (4%) showed a marked increase in drug release of 99.04% and rapidly disintegrate within 6.5 min and binder solution polysorbate 80 does not hinder the release profile of drug [60]
5	Venlafaxine HCl	CCS (6%), CP (6%) and SSG (6%) used in different formulations	DC	DT, WT, Water absorption ratio and DS	Formulation containing CP (6%) was best-optimized batch its showed DT (19 s) and wetting time 19 s), water absorption ratio (85.5±0.9) and highest drug released at 7 min (96.0%) [61]
6	Carvedilol	CCS (10%), CPD (10%) and SSG (10%) used in different formulations	DC	DS,DT and WT	Maximum 97.75 % drug release was found in the batch containing CP (10%), swiftly disintegrate within 250 (s) and wetting time was found 68.33 (s) [62]
7	Salbutamol sulphate	CCS (7.5%) CP (7.5%) and SSG (7.5%) used in different formulations	DC	DT, DS, WT and water absorption ratio	Maximum drug release 98.58% showed by CCS (7.5%) and formulation containing CP (7.5%) batch showed highest DT (16.17 s), WT (18.33 s) and water absorption ratio (1.03±0.04) than other batches [63]
8	Fexofenadine Hcl	SSG (8%), CCS (8%), Kollidone CL (8%), LD (8%) and Xanthan Gum (8%) used in different formulations	DC	DS, DT	Formulation containing CCS (8%) showed less DT in (9 s), F3 and highest drug released 99% within 30 min. Also noticed that XG act as a binder instead of superdisintegrant, hence decreased drug released [64]
9	Metoprolol tartrate	CP (7.5%), CCS (7.5%), SSG (7.5%)	DC and sublimation	WT, DT, Dispersion time and DDS	CP (7.5%) containing formulation showed less WT (24 s), dispersion time (31 s), DT (28 s) and highest drug released (98.20% at 10 min) [65]
10	Metformin HCl	SSG (5%), Collidon CL (5%), CCS (5%) used in different formulations	WG	DT, DS	SSG (5%) containing formulation showed less DT (1.9 s) and highest drug released rate at 60 min (93.81%) [66]
11	Cefixime Trihydrate	CP and SSG (6%) in a same formulation	DC	DS, DT, WT and water absorption ratio	CP and SSG (6%) showed the highest drug released 91.03% at 10 min and less DT (24 s), WT (20 s) and max water absorption ratio (64.58) [67]
12	Irbesartan	CCS (6.6%), SSG (6.6%) and CP (6.6%) used in different formulations	WG	DS, DT, WT and water absorption ratio	Formulation containing SSG (6.6%) showed highest drug release 99.82%. at 30 min and DT (12 s), WT (8 s) and water absorption ratio (16.82) [68]
13	Divalproex sodium	CCS (6.6%), SSG (6.6%) and CP (6.6%) used in different formulations	WG	DS, DT, WT and water absorption ratio	Formulation containing SSG (6.6%) showed highest drug release 99.82%. at 30 min and DT (12 s), WT (8 s) and water absorption ratio (16.82) [69]
14	Acyclovir	CCS (5%), SSG (5%), CP (5%) used in different formulation	WG	DS, DT	SSG (5%) containing batch showed maximum drug release (97.4 %) in 30 min and DT (0.47 min) [70]
15	Fexofenadine hCl	CCS (8%) and CP (8%) used in different formulation	DC	Dispersion time, WT, water absorption ratio and drug release	Formulation containing CP (8%) showed maximum dispersion time (30 s), WT (32 s), and less absorption ratio was found (2.80) and also showed highest drug released at 45 min (99.983%) [71]
16	Rosuvastatin	CP (4.5%), SSG (4.5%) and Kyron T-314 (4.5%) used in different formulation	DC	DT, DS	Formulation containing CP (4.5%) showed less DT (3 min) and showed maximum drug released profile (102.4%) [72]
17	Almotriptan	CP (10%), CCS (10%) and SSG (10%) used in different formulation	DC	DT, DS	CCS (10%) was optimized as best formulation its showed maximum (99%) drug released at 20 min and less DT (20 s) [73]
18	Cinnarizine and	SSG (5%), CCS (5%) and CP (5%)	DC	DT, WT, DC	Observed that CP (5%) batch showed lowest DT

	Dimenhydrinate	used in different formulation			(6 s), WT (10 s), drug content was found for Cinnarizine (97.84-109.125%) and Dimenhydrinate (90.83-103.14%) [74]
19	Repaglinide	CCS (6%) and CP (6%) used in different formulation	Hot-melt extrusion	DS, DT	Formulation containing CCS (6%) was found as ideal formulation showed maximum drug released (95%) within 45 min and DT (11 min) [75]
20	Telmisartan	CP (20%), CCS (20%) and SSG (20%) used in different formulation	DC	DS, DT	Formulation containing CP (20%) showed less DT (35 s) and maximum drug released (99.9%) in 35 min [76]
21	Levonorgestrel	CP (7.5%) and SSG (7.5%) used in same formulation	DC	DT,WT, water absorption ratio and DS	Formulation containing both CP (7.5%) and SSG (7.5%) was found as best formulation, and it showed less DT (45 s), WT (15 s), water absorption ratio (22.88) and maximum drug released within 60 min (93.13%) [77]
22	Atorvastatin calcium and Bisoprolol fumarate	SSG (1.3%)	DC	DT, DS	SSG (1.3%) showed highest drug released (96.29%) for atorvastatin calcium and (92.01%) for bisoprolol fumarate and DT (5 min) [78]
23	Fexofenadine HCl	SSG used in different conc. (14, 18, 22, 26 and 30%) used in different formulation	DC	DS, DT	SSG (26%) batch showed maximum drug released (99.85%) within 60 min. and less DT (38 s) [79]

CCS: Croscarmellose, CP: Crospovidone, SSG: Sodium starch glycolate, LD: Ludiflash, DC: Direct compression, WG: Wet granulation, DS: Dissolution studies, DT: Disintegration time, WT: Wetting time, s: second, min: minutes.

CONCLUSION: Most of the patients need quick therapeutic action of the drug, resulting in poor compliance with conventional drug therapy which leads to reduced overall therapy effectiveness. Immediate release tablets are designed to release the medicaments with an enhanced rate. As highlighted above current technologies, there is an unmet need for improved manufacturing processes for immediate release pharmaceutical form that are mechanically strong, allowing ease of handling and packaging and with production price comparable to that of conventional tablets. An addendum of market exclusivity, which can be provided by immediate release dosage form, leads to increased earning and also targeting underserved and under-treated patient populations. A modern dosage format, the immediate release pharmaceutical form has been developed which provide combined advantages of ease of dosing and convenience of dosing. These tablets are fabricated to release enhance medicaments from the dosage form. To fulfill these medical needs, formulators have devoted considerable effort to developing a novel type of tablet dosage form that disintegrates and dissolves rapidly with enhanced dissolution.

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