National Journal of Pharmaceutical Sciences

E-ISSN: 2788-9270
P-ISSN: 2788-9262
www.pharmajournal.net
NJPS 2022; 2(2): 115-121
Received: 06-05-2022
Accepted: 12-07-2022

Sweta Dogra
Student, Sigma Institute of Pharmacy, Ajwa-Nimeta Road, Bakrol, Vadodara, Gujarat, India

Isha Shah
Assistant Professor, Sigma Institute of Pharmacy, Ajwa-Nimeta Road, Bakrol, Vadodara, Gujarat, India

Dr. Umesh Upadhyay
Principal, Sigma Institute of Pharmacy, Ajwa-Nimeta Road, Bakrol, Vadodara, Gujarat, India

Corresponding Author:
Sweta Dogra
Student, Sigma Institute of Pharmacy, Ajwa-Nimeta Road, Bakrol, Vadodara, Gujarat, India, Karnataka, India

The most popular pharmaceutical dosage form: Tablet

Sweta Dogra, Isha Shah and Dr. Umesh Upadhyay

Abstract
The study of medicine is a science and an art. There are no compounding pills in it and dressings; it describes life's fundamental concepts, which must be understood before they may be guided. For several decades, pharmaceutical oral solid dosing forms have been used mainly since they are easy to administer and suitable for delivery for drugs delivery for systemic effects. The tablets may be made via using powders directly or by using pellets, granules, or multiple units of film coating. Now, tablets are the most popularly employed dosage forms.70% of all produced ethical pharmaceutical preparations are in this form. Tablets are solid pharmaceutical dosage forms which can be moulded or compressed and contain drug substances with or without suitable diluents. Hence, compressed tablets and moulded tablets are the two broad categories of tablets. There are three different types of compressed tablets: chewable tablets, directly compressible tablets, and tablet triturates.

Keywords: Compression, granulation, coated tablets, binders and ingredients

Introduction
Solid medications can be administered orally as tablets, powders, capsules, cachets, or capsules. Even in the case of sustained action preparations, which technically contain the equivalent of several normal doses of drug, these dosage forms are known collectively as solid unit dosage forms since they contain an amount of drugs which is given as a single unit.

The prescribing of powders and tablets had declined steadily because of the strict formulation requirements of modern medications, the various advantages of tablet and capsule medication, the growth of health services, and the commitment needed for large-scale economic manufacture. On the other hand, tablets and capsules currently help compensate well over two-third of the total number and cost of medicines produced worldwide. Tablets are a conventional solid dosage form which have many advantages over other dosage forms.

The most popular dosage form is tablets, which account for almost 70% of all medicines. Depending on the therapeutic ingredients and the intended mode of administration, tablets comes in a wide variety of shapes, sizes, and weights. This paper reviews and briefly describes some of the advantages and disadvantages of tablets, as well as some of the common ingredients, methods of preparation, and various kinds of tablets.

Definition
According to the Indian Pharmacopoeia. Pharmaceutical tablets are solid, flat or biconvex dishes which are prepared by compressing drug or drug mixture, with or without diluents,

Fig 1: Tablets

A compressed solid dosage form called a tablet that contains medicaments with or without excipients is referred to as this. Depending on the amount of medicinal substances and the intended mode of administration, they differ greatly in size, weight, and shape [1, 2].

Properties

1. A product should be delicate, distinctive, and free of defects like chips, cracks, discoloration, and contamination.
2. It must be strong enough to handle the strain and shocks that it'll undergo while production, packaging, shipping, and dispensing.
3. It must be highly stable enough to keep onto the physical properties over time.
4. Must be able to continuously and accurately transfer the therapeutic agent (s) into body.
5. The chemical stability over time should be adequate to sought protection to the pharmaceutical ingredient [3].

Types of tablets

Oral tablets for ingestion

a) Standard Compressed Tablets
b) Multiple Compressed Tablets
c) Compression Coated Tablets
- Sugar coated tablets
- Film coated tablets
- Gelatine coated tablets
- Enteric coated tablets
- Layered tablet
- Inlay tablet

d) Targeted Tablets
- Floating Tablet
- Colon Targeting Tablet

e) Chewable tablets
f) Dispersible tablets

Tablets used in the oral cavity

a) Lozenges and troches
b) Sublingual tables
c) Buccal tablets
d) Dental cones
e) Mouth dissolved / rapidly dissolving tablets

Tablets administered by other routes

a) Vaginal tablet
b) Rectal tablet
c) Implants

Tablets used to prepare solution

a) Effervescent tablets
b) Moulded tablets
- Hypodermic tablet
- Dispensing / soluble tablet

c) Tablet Triturate

Structure wise

a) Divisible Tablets
b) Aperture Tablet
c) Concave Convex Tablets
d) Core Tablet

Action Wise

a) Modified Release Tablet

Oral tablet for ingestion

Over 90% of manufactured tablets are ingested orally. With the exception of chewable tablets, these are designed to be swallowed completely.

Standard compressed tablets

These are standard uncoated tablets made by compression using wet granulation, double compression and direct compression. It provides rapid disintegration and drug release. The main objective in GIT is to influence local action. It usually combines water-insoluble drugs like antacids and adsorbents [4].

Multiple compressed tablets

Multiple compressed tablets are prepared by more than one compression cycle. This process is useful when two or more active ingredients need to be separate for stability reasons or when the mixing process cannot ensure an even distribution of the ingredients. This class encompasses the three subcategories of compression coated tablets, layered tablets, and inlay tablets [5, 6].

Compression coated tablets

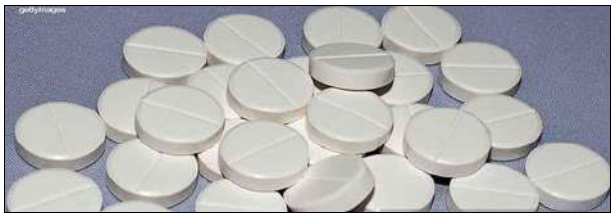

Fig 2: compression coated tablets

This tablet is most conducive to repetition. The outer layer provides the initial dose, and the inner core later releases the medicine. In view of this, it is helpful for the releases of two active pharmaceutical ingredients (APIs), one of which is an immediate release formulation which is entrapped in the coat and the other of which is a sustained release formulation that is entrapped in the core [7].

Sugar coated tablets

Fig 3: sugar coated tablets

The sugar coat protects the drug inside from the outside environment and provides as a barrier to objectionable tastes or odour. It also provides an elegant, glossy appearance.
The sweet taste of the tablets leads to the increase in patient compliance. Widely used in preparation of multivitamin mineral combination.

Film Coated Tablets

Fig 4: Film coated tablets

These coated tablets don't need to have the medicine coated. Film coating is used as an alternative to sugar coating when the tablet needs to be stronger. For this technique, polymers like Ethyl cellulose, HPC (Hydroxypropyl cellulose), and HPMC (Hydroxypropylmethyl cellulose) are used.
In contrast to the sugar coating technique, it is also a faster process. Although it has many advantages over sugar coating in in terms of durability, bulk, and application rates, it loses sugarcoating's physical elegance and attractiveness. In the desired location in the gastrointestinal tract, the coating is designed to break and expose the core tablet.

Enteric Coated Tablets

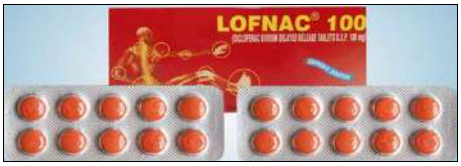

Fig 5: Enteric coated tablets

The enteric coated tablets' coating is resistant to the acidic conditions in the stomach, hence the drug cannot be released there. Even though, it easily releases the drug in the alkaline media of the intestine. Drugs therefore must pass through the stomach, prolonging the duration of their release, rise to the term "delayed action table" [8].

Chewable tablets

Fig 6: Chewable tablets

Tablets which can be chewed between the teeth must be broken before consumption. These tablets are given to adults who detest swallowing and to youngsters who have trouble swallowing. These tablets are intended to disintegrate smoothly and gently in the mouth, eitherwith or without chewing.
When an active ingredient is intended to act locally rather than systemically, chewable tablets are commonly used. They are composed of a gum core which may or may not be coated. Insoluble gum base, fillers, waxes, antioxidants, sweeteners, and flavours are the core ingredients. Gum base concentration ranges from 30% to 60% [9].

Dispersible Tablets

Fig 7: Dispersible tablets

According to the European Pharmacopoeia, dispersible tablets are uncoated or film-coated tablets intended to be dispersed in water before administration to form a homogeneous dispersion.
A dispersible tablet is typically dispersed in 5 to 15 ml of water (for eg, in a tablespoon or a glass of water), and the patient is given the resulting dispersion. Dispersible tablets should disintegrate in 3 minutes in water with a pH of 15 to 25. A sieve screen with a nominal mesh aperture of 710µ must be used to filter the dispersion produced by a dispersible tablet [10].

Sublingual Tablets
By enabling the drug to be absorbed directly through the mucosal lining of the mouth beneath the tongue, they are to be placed under the tongue and produce an immediate systemic effect. The tablets are usually small and flat and lightly compressed to keep their softness [11].

Buccal Tablets
These drugs are intended to dissolve in a buccal pouch. Tablets are not designed to break down. It is placed closer to the parotid duct opening to provide the medium required to dissolve the tablet. The most common method of therapy for replacement hormonal therapy is buccal tablets [12].

Fig 8: sublingual and buccal tablets

Effervescent Tablets

Fig 9: Effervescent tablets

Effervescent are designed to dissolve when they come into contact with liquid, likely water or juice. This results in the tablet dissolving into a solution, which is beneficial because the tablets dissolve evenly and completely. Indicating that there cannot be localised concentrations of the ingredients
This not only leads to better taste but also to a lesser risk of irritation and a more efficient means to ingest the ingredients [13, 14, 15].

Moulded Tablets
Hypodermic tablets
One kind of sterile preparations are hypodermic tablets. Before the actual injection in the hypodermic cavity, tablets are dissolved in WFI or sterile water to inject. They are intended to be combined with sterile water to form a clear solution which will be injected intravenously [16].

Dispensing or soluble tablets
These should be mixed with water or other solvents to create a solution with a specific amount of API in it. No soluble substances (such as glidants, binders, etc.) should be present because they will be converted to a clear solution [17].

Tablet Triturates
Tablet triturates are compressed or moulded small tablets that are usually cylindrical in shape. The drugs employed in these products were frequently quite potent and combined with lactose and possibly a bonder, such as powder acacia. Triturates used in tablets are most often friable and soft [18].

Action wise
Modified release tablet
After taking a single tablet, the medicine is released slowly for a long period of time. Used to target releases which are site-specific. Any adjuvant that can alter the rate at which water is absorbed, how fast things swell and gel, or how quickly things gel can change the release rate of API. By providing a healthy micro environment pH in the tablet, the drug release can be modified. The release of acidic drugs is improved by the use of alkaline polymers.

Ingredients
A number of inert materials known as additives or excipients are present in tablets in in addition to the active components [19].
Different excipients are given in Table 1

Table 1: List of Excipients in tablets

Sr. No	Ingredients	Examples
1	Diluents	Calcium Phosphate; Carboxymethyl cellulose Calcium; Cellulose; Dextrin; Lactose; Microcrystalline Cellulose; PR gelatinized starch; Sorbitol; Starch
2	Binders	Acacia, Alginic Acid, Carboxymethyl cellulose, Cellulose, Dextrin, Gelatin, Liquid Glucose, Magnesium Aluminum Silicate, Maltodextrin, Methylcellulose, Povidone, Sodium Alginate, Starch, & Zein are a few of the binders.
3	Lubricants	Sodium Benzoate, Polyvinyl Alcohol, Poloxamer, Magnesium Oxide, Calcium Stearate, Glyceryl Palmitostearate, & Sodium Lauryl Sulfate Talc, Zinc Stearate, Stearic Acid, & Sodium Stearyl Sulfate
4	Glidants	Magnesium Talc, Tribasic Calcium Phosphate, Cellulose, Starch, & Trisilicate
5	Anti –adherents	Corn Starch; Metallic Stearate; Talc
6	Disintegrants	Alginic Acid, Carboxymethyl cellulose, Cellulose, Colloidal Silicon Dioxide, Croscarmellose sodium, Potassium Polacrilin, & Povidone are the 6 disintegrants.
7	Coloring agents	FD&C or D&C Dyes or Lake Pigments
8	Flavoring agents	Ethyl Maltol; Ethyl Vanillin; Menthol; Vanillin

Diluents
When the drug dosage by itself is inadequate to produce the required bulk of the tablet, diluents are used as fillers. Moreover used to improve consistency and allow direct compression.

Binders
To produce cohesive compacts for tablet which are instantly compressed.

Lubricants
Lubricants used to reduce friction among particles, prevent adherence of tablet materials to die and punch surface, and they can help accelerate up the process of tablet granulation.

Glidants
By reducing the friction between the particles, gliders are designed to improve the flow of granules or powder material.

Anti-adherents
To stop the material from sticking to the tablet press walls, anti-adherents are added to the formulations of the tablets.

Disintegrates
A substance added to a tablet formulation to helps it break or dissolves when it comes in contact with fluid in the gastrointestinal tract.

Colouring Agents
A tablet can contain dyes and colours for one of the 3 reasons:
- Masking of drugs with an unwanted colour.
- Product identification.
- The production of a more elegant product.

Flavouring Agents
For chewable tablets, flavouring oils are recommended. Usually, the oil is added in a dry form, such spray-dried bead lets.

Absorbents
If a product contains a substance with a high affinity for water, absorbents must be included in the formulation of the tablet. If hygroscopic components are present, the blend becomes moist and difficult to manage throughout production

Preparation of Tablets
Tablets are prepared by three methods
- Wet granulation method
- Dry granulation method
- Direct compression

Wet Granulation Method

It is the most common and frequently employed method. This process involves a number of steps, including weighing the components, mixing, granulating, and screening damp pass, as well as drying, lubricating, and compressing the tablets. Mixing together the main active ingredient, diluent, and disintegrate, it is then allowed to flow through the sieve (sifting). The initial mixture is stirred as the binding agent solution is added. To avoid over wetting of the tablet, the amount of binding agent added should be appropriate. If the powder is improperly moistened, the granules will be excessively soft and it may break down during lubrication, making tablet compression problematic.

Tray drying is the most common method of drying tablet granules. In the past, tray drying was the most popular way of drying tablet granulations, but fluid-bed dryers may probably replace it. The Granules are allowed to flow through the screen after drying; typically, nylon cloth with a mesh size between 60 to 100 is utilised. Lubricant is applied as fine powder after dry granulation in order to effectively fill the die cavity (Figure 10).

Dry Granulation Method

This method is used to prepare tablets when the ingredients are highly sensitive to moisture or cannot withstand high drying temperatures. Slugging may be used to form the granules in the tablet preparation process if the tablet ingredients are extremely moisture-sensitive or cannot withstand high drying temperatures. Several steps, including slugging of the powder bulk, are usually eliminated by dry granulation or double compression. To make the slug, the active ingredient, diluent, and lubricant are combined. In order to produce the tablets, the remaining lubricant is added to the granulation, appropriately blended, and compressed before the compressed slug is sent through the mesh or through the mill (Figure 10).

The powder combination is compressed during dry granulation process without the use of heat or solvent. The two basic steps are to compress the material into a compact, and then to mill the compact to produce granules. There are two approaches to dry granulation.

- **Slugging process**

Granulation by slugging is the compressing of dry powder used in tablet formulation with a tablet press that has a die chamber with a large enough diameter to fill it quickly.

- **Roller compaction**

A device known as a chilsonator can also be used to condense powder applying pressure rolls. The Chilsonator develops a compressed mass in a constant, continuous flow, unlike a tablet machine.

Direct compression

The powdered ingredient is directly compressed into tablets during direct compression. Using direct compression when the medication makes up the majority of the tablet's total weight (Figure 10). It is possible to produce tablets with a suitable diluent that serves as a carrier or vehicle for the medication and has a drug substance concentration of no more than 25%. Tablets made using the above mentioned technique are compressed using a single station or multiple stations of a machine [20, 21].

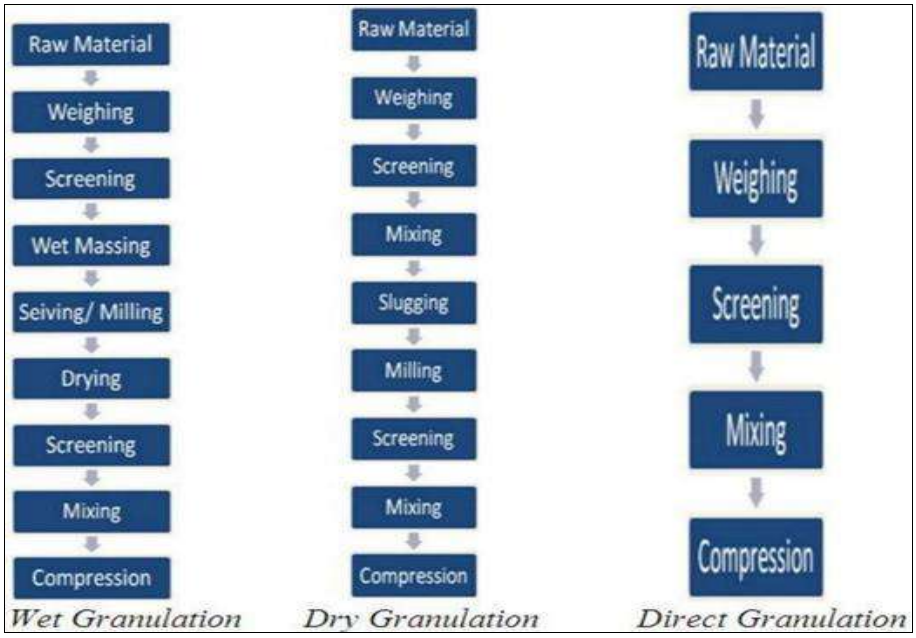

Fig 10: processing steps in wet granulation, dry granulation and direct compression

Problems in tablet manufacturing

Any visual or functional defects should not appear in an ideal tablet. The advancements and innovations in tablet production have not decreased the problems which are often encountered in production; instead, they have increased problems, mainly because of the complexity of tablet presses and/or the increased demands of quality. During manufacturing, an industrial pharmacist usually runs along a number of problems. The majority of visual defects are caused either by inadequate fines or moisture in the granules that are ready for compression, or by inadequate machine setting. Poor formulation is the source of functional defects. Many of the issues require in-depth knowledge of tablet presses and granulation processing, which can only be acquired by exhaustive study and rich experience [22].

Following are the defects that are found during tablet manufacturing

1. Weight variations
2. capping
3. laminating
4. cracking
5. Picking / sticking
6. Chipping
7. Mottling
8. Double impression

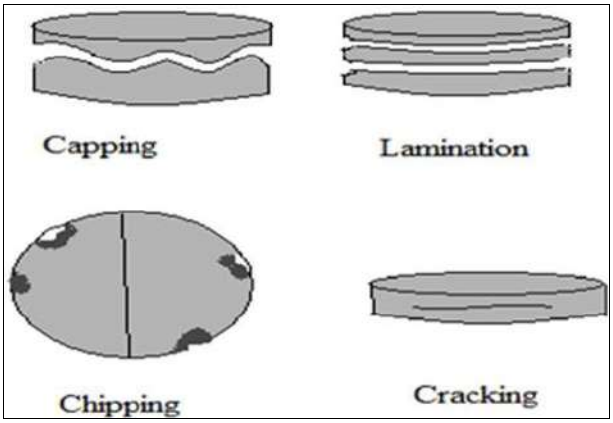

Fig 11: Defects in tablets

Advantages of tablets over other formulations

- Makes use of a low concentration of the therapeutic agent.
- Reduces segregation of formulation components during storage and processing, which reduces intra- and inter-batch variability.
- Not dependent on the inclusion of subscription excipients of any sort.
- Operation of post-processing unit is responsive on tablets.
- Both slugging and roller compaction require relatively conventional excipient grades.
- No heat or solvent is required.
- Not associated with changes in drug morphology.
- Cost - effective due to fewer steps
- Does not require any solvents, negating any threat from therapeutic agents that aren't stabilized.
- As lubrication and powder mixing are carried in the same vessel, transfer losses and contamination threats are minimized [23].

Conclusion

Tablets are a popular solid dosage form as they provide for self-administration which can be used by between patients and healthcare professionals. A tablet's formulation contains several components in addition to the API to ensure proper API delivery to the patient. Newer and more efficient tablet dosage forms are being developed as a result of advancements in technology and rise in awareness about the need to modify the standard tablet to achieve better acceptability and bioavailability.

The top reasons behind the formulation of different tablet types are to develop a delivery system that is relatively easy and inexpensive to manufacture. Provide the dosage form that is convenient for the patient and utilizing an approach that won't complicate the regulatory approval process. To understand each dosage form, tablets here are classified by their route of administration and by the type of drug delivery system they represent within that route.

References

1. Leon Lachman, Herbert A. Lieberman, Joseph L. Kanig: The theory and Practice of industrial Pharmacy, Varghese publication house, 3rd edition; c1990. p. 293-373.
2. Rukaiya Shirohiwala, Dr. Jigar Vyas, *et al*. Milestone for journey of medicine through oral route: A brief review. National Journal of Pharmaceutical Sciences. 2021;1(2):30-37.
3. Kaur Harbir. International Research Journal of Pharmacy, 2012, 3(7).
4. Rudnic EM, Schwartz JD. Oral Dosage Forms Remington: The Science and Practice of Pharmacy Gennaro AR(Eds.), Lippincott Williams and Wilkins, USA, p. 858
5. Jariwala DM, Patel HP, Desai CT, Shah SA, Shah DR. A Review on Multiple Compressed Tablets. Journal of pharmaceutical sciences and bio scientific research. 2016;6(3):371-379.
6. Wardrop J, Jaber AB, James W, Ayres JW. Multiple-layer compression coated tablets: formulation and humidity studies of novel chewable amoxicillin/clavulanate tablet formulations. Drug Dev Ind Pharm. 1998;24(8):729-736.
7. Purushottam R Patil, Vaibhav D Bobade, Pankaj L Sawant, Rajendra P. Marathe. Emerging Trends in Compression Coated Tablet Dosage Forms: A Review. International journal of pharmaceutical sciences and Research. 2016;7(3):930-938.
8. Reno Jyoti Dahiya, Pawan Jalwal, Balvinder Singh. The Pharma Innovation Journal. 2015;4(5):100-105.
9. Nilesh Lahanu Gawade, Raosaheb Sopanrao Shendge. A Review on Chewable Tablet. Journal of Emerging Technologies and Innovative Research (JETIR), 2020 Mar, 7(3).
10. Nandhini J, Rajalakshm AN. Dispersible Tablets: A review. Journal of Pharmaceutical Advanced Research. 2018;1(3):148-155.
11. Ruchita Jaiswani, Ashutosh Prakash, Dinesh K Mishra, Jain DK. Sublingual Tablets: An Overview. Journal of Drug Delivery Research; c2014.
12. Lachman L, Herbert A, Lieberman J, Kanig L. The theory and Practice of Industrial Pharmacy, Third Indian Edition, Varghese Publishing house Hind Rajasthan Building, Dadar Bombay 400014; c1987. p. 313-315.
13. Leman Birdane, NiyaziAlt›ntoprak, Nuray Bayar Muluk, DesiderioPassali, Andrey Lopatin, Luisa Bellussi, *et al*. Effervescent tablets: a safe and practical delivery system for drug administration. ENT Updates. 2016;6(1):46-50.
14. Singh LP, Rajesh KS, Umalkar DG, Chauhan VK, Rana VK, Vasava KS, *et al*. Floating Effervescent Tablet: A Review, Journal of pharmaceutical and biomedical sciences. 2011;5(11):1-6.
15. Harald S, Effervescent Dosage. Pharmaceutical Technology Europe. 2003;15(4):25-28.

16. Al-Achi A. Tablets: A Brief Overview. Journal of Pharm Practice and Pharmaceutical Science. 2019(1):49-52.
17. Nagashree K. Solid dosage forms: Tablets. Research and Reviews: Journal of Pharmaceutical Analysis; c2015.
18. Mohrle R, Liberman L, Schwartz L. Pharmaceutical Dosage Form, Marcel Decker Inc., New York, 2005;1:285-292.
19. Gohel MC, Jogani PD. A review of co-processed directly compressible excipients. J Pharm Pharm Sci. 2005 Apr 16;8(1):76-93.
20. Lachman L, Liberman HA, Kanig JL. The theory and practice of industrial pharmacy. 3rd ed. Philadelphia: lea and febiger; c1986.
21. Meeus L. Direct Compression Versus Granulation, In Pharmaceutical technology Europe, 2011, 23(3).
22. Bose S, Bogner RH. Solvent less pharmaceutical coating processes: a review. Pharm Dev Technol. 2007;12:115-131.
23. Larry LA, Stephan WH. Pharmaceutical Dosage Form: Tablets 3rd edition, 1, 465.