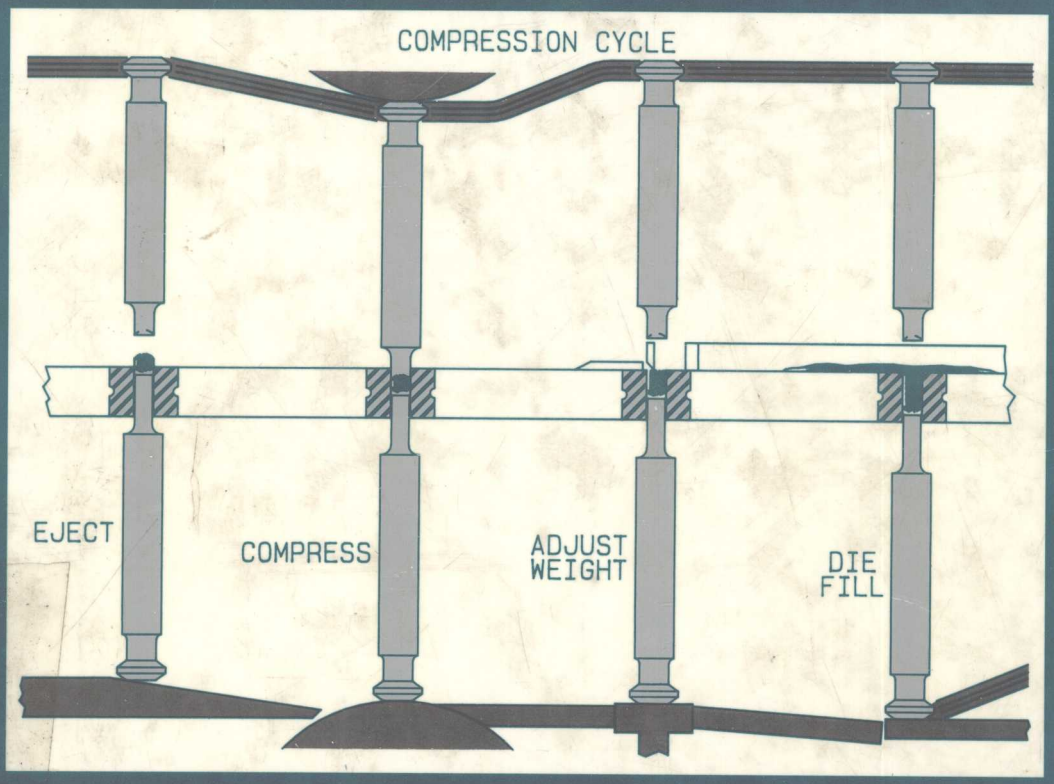
Pharmaceutical Dosage Forms: Tablets Volume 3

Second Edition, Revised and Expanded

Edited by Herbert A. Lieberman, Leon Lachman, and Joseph B. Schwartz



PHARMACEUTICAL DOSAGE FORMS

Tablets

SECOND EDITION, REVISED AND EXPANDED

In Three Volumes

VOLUME 3

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Preface

Tablets are the most commonly prescribed dosage form. The reason for this popularity is that tablets offer a convenient form of drug administration, provide dosage uniformity from tablet to tablet, are stable over extended and diverse storage conditions, and can be produced on high-speed compression, labeling, and packaging equipment. As a result, tablet production technology is constantly undergoing improvements that enhance their ability to deliver, with precision, a desired drug in a dosage form intended for immediate or extended therapeutic effect. In addition, the growth of the generic industry as well as increased competition from both foreign and domestic markets require that a tablet manufacturer have greater concern regarding the economics of tablet production by introducing less labor-intensive, higher-productivity manufacturing methods for making the increasing number of tablet products available today. The changes in the science and technology of tablet formulation, production, and quality assurance to accomplish the above are reflected in the second edition of the three-volume series *Pharmaceutical Dosage Forms: Tablets*.

The first volume in this series describes the many types of tablet products, giving specific updated examples of typical formulations and methods of manufacture. These include single- and multilayered tablets, buccal and sublingual tablets, effervescent tablets, and diverse methods for manufacturing them by wet and dry granulations and by direct compression. In addition, medicated candy products are a form of drug delivery that has appeared in the marketplace; no complete chapter on this technology has been printed in any pharmacy text other than both editions of this series on tablets.

To manufacture tablets a number of unit processes are required, such as mixing, drying, size reduction, and compression. The economics of tablet production today require an update of the technologies for each of these pharmaceutical operations. The granulations and tablets produced

have particular characteristics that must be analyzed and understood in order to produce superior tablets, particularly when new and sometimes faster methods of manufacture are introduced. No drug dosage form would be meaningful to the patient without the drug being bioavailable. The chapter on bioavailability in tablet technology is updated in the second edition of Volume 2. Finally, many advances in the specifications and care of tablet tooling and problem solving caused by faulty compression tools are expertly covered in the second volume.

Volume 3 in the series on tablets updates the special characteristics that should be considered for optimizing tablet production. Particular emphasis is given to design methods that should be considered when formulating a tablet product. Discussions of specialized granule and tablet-coating equipment are presented, discussing improvements or presenting new equipment developed since the publication of the first edition. Aqueous film coating is now firmly established in pharmaceutical coating processes, and thus, a shift in emphasis on coating procedures has been made in the revised chapter on coating. New coating pans and automation of aqueous film- and sugar-coating methods are covered. Fluid-bed processes and particle-coating methods, including theoretical considerations, are updated to reflect current practices.

No text on tablet technology could be considered complete without a full theoretical and practical updated description of current methods for formulating, manufacturing, and controlling the release of drug from sustained-release tablet and particle dosage forms. A chapter on sustained drug release through coating provides an updated and authoritative discussion of this popular form of drug delivery. There is an enhanced emphasis on the various polymers and their combinations used to attain sustained drug activity. Pilot operations must reflect production methods in order to minimize difficulties in transferring a product from preproduction to production. Granules prepared by precompression, wet and dry granulation, fluidized-bed granulation, and spray drying are compared. A new method for preparing a granulation, namely the moisture-activated dry granulation (MADG), is also suggested for more widespread pilot evaluation.

With the increasing emphasis on product uniformity from one tablet to another, or from one batch to another, whether the product is made sequentially or with long lag periods between batches, or whether the raw material source is from several different manufacturers, the concept of process validation is essential. An extensive chapter describing the essential considerations that should be evaluated in process validation has been added to the revised edition of this volume. Although the chapter presents a complete detailed description of many validation methods, it also shows how less detailed approaches, some of which are commonly used in the industry, are useful. Current tablet production methods are described with sample control charts to help the readers improve their tablet production methods. The importance of the several different functions of production departments, their particular skills, and the need for coordinated and cooperative work relationships are stressed in the chapter "Tablet Production" so that the combined, partnership efforts of all production personnel can lead to superior tablet production. Automation of tablet compression and coating is also part of the chapter concerned with the production of tablets.

In the discussion of stability, updated stability protocols to comply with recent FDA guidelines are presented. A new covariance analysis and

statistical method for expiration date prediction are described. The chapter "Quality Assurance" upgrades tablet testing for uniformity, dissolution, assay limit, test methods, and compendial requirements for tablets to comply with current USP/NF requirements. Included are instructive figures for new schematic sampling plans, an update of the restrictions on the use of colors, and a recommended sampling method for raw materials. Thus, with this third volume on tablets, all the parameters currently concerned with the production of superior tablets are made current and discussed extensively.

An updated and full coverage of the many topics concerned with tablets requires highly knowledgeable authors for each of the many areas that must be covered. To compile and update the pertinent information needed for the various chapters in this book required a multiauthored text of technologists with specific expertise and experience in their chosen subject matter. Each of the authors was charged with teaching their subject in such a fashion that the novice as well as the experienced reader will profit. They were to offer basic scientific facts and practical information so that *all* readers can learn theory and apply it toward the knowledge that each needs to formulate, produce, and control tablet operations in a scientific rather than an empirical manner.

With this third volume, the editors have finished their task of updating the second edition on tablets. The editors are grateful to the authors for their fine contributions and, particularly, their patient response to the editors' suggestions for changes. The choice of the chapter topics, the authors, and the format are the responsibilities of the editors. It is hoped that these choices will prove fruitful to our readers by helping them solve their tablet technology problems and thereby advance industrial pharmacy's contribution toward improving both quality and efficiency in the manufacture of tablets.

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edited by Herbert A. Lieberman, Leon Lachman, and Joseph B. Schwartz

VOLUME 1

VOLUME 2

Contents of Pharmaceutical Dosage Forms: Parenteral Medications, Volumes 1 and 2

edited by Kenneth E. Avis, Leon Lachman, and Herbert A. Lieberman

VOLUME 1

VOLUME 2

Contents of Pharmaceutical Dosage Forms: Disperse Systems, Volumes 1 and 2

edited by Herbert A. Lieberman, Martin M. Rieger, and Gilbert S. Banker

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