Book/Book Chapter in the Academic year 2018-2019

Sl. No.	Name of the teacher	Title of the book/chapters published	National / International	Calendar Year of publication	Name of the publisher
1	Dr.Y.Madhusudan Rao	Advancess in Drug Delivery Sysytems Volume 4 (EDITOR)	National		BSP Publisher
2	Dr.Y.Madhusudan Rao	Expandable drug delivery System	National	2018-19	BSP Publisher
3	Dr.Y.Madhusudan Rao	Occular drug Delivery System	National	2018-19	BSP Publisher
4	Dr.Y.Madhusudan Rao	Optimization Techniques in product Development	National	2018-19	BSP Publisher
5	Dr.Y.Shravan Kumar	Lozenges	National	2018-19	BSP Publisher
6	Dr.Y.Shravan Kumar	Ungual Drug Delivery Systems	National	2018-19	BSP Publisher

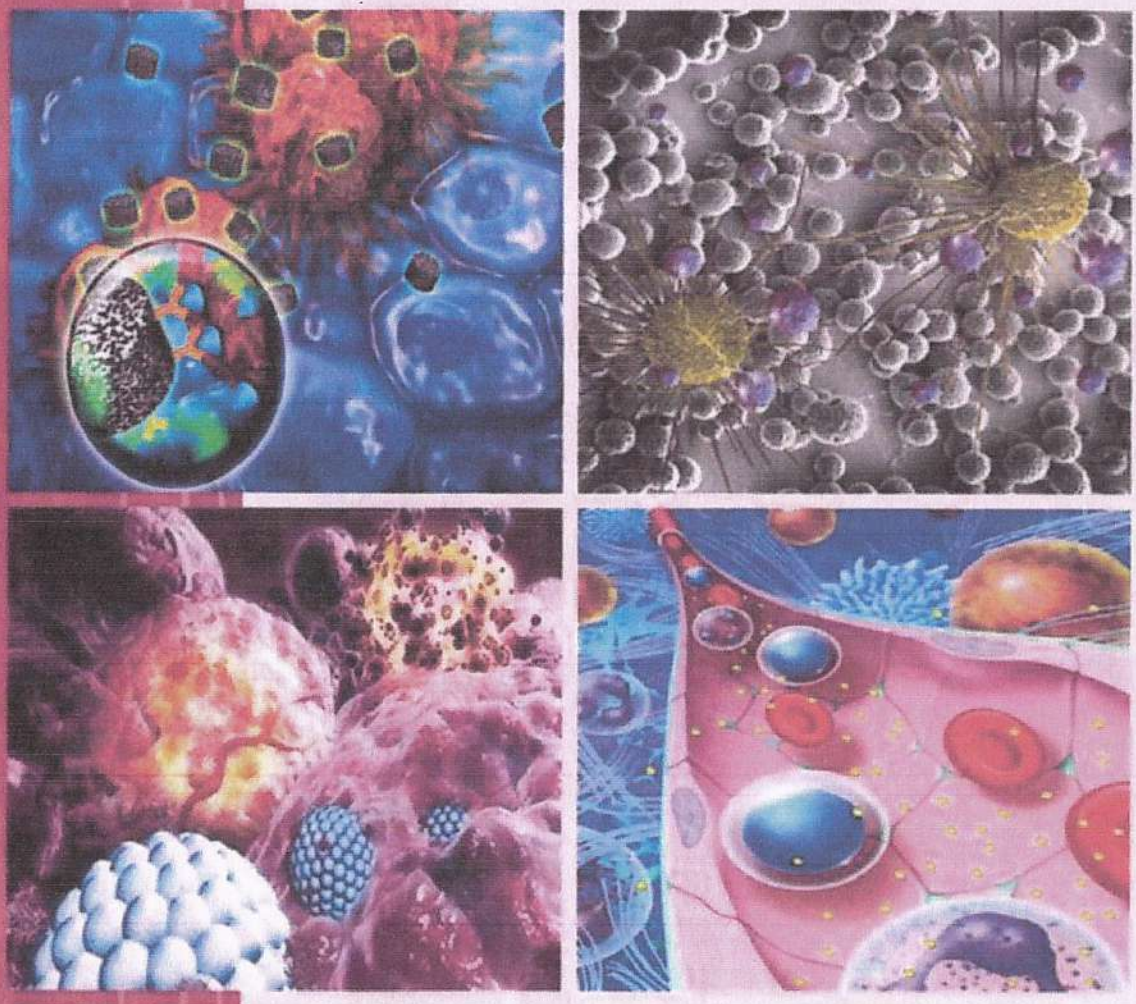
ISBN: 978-93-52300-95-2

Vaagdevi College of Pharmacy Ramnagar, Hanamkonda

Principal
Vaagdevi College of Pharmacy
Hanamkonda, Warangal-506

Advances in Drug Delivery

Volume IV



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PharmaMed PRESS

An Imprint of BSP Books Pvt. Ltd

Advances in Drug Delivery

Volume – IV

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PharmaMed Press
An imprint of BSP Books Pvt. Ltd.
4-4-309/316, Giriraj Lane,
Sultan Bazar, Hyderabad - 500 095.

Advances in Drug Delivery Volume – IV

by Y. Madhusudan Rao and A.V. Jithan

Seventh Reprint 2022

Published by

PharmaMed Press

An imprint of BSP Books Pvt. Ltd.

4-4-309/316, Giriraj Lane, Sultan Bazar, Hyderabad - 500 095.

Phone: 040-23445688; Fax: 91+40-23445611

E-mail: info@pharmamedpress.com

www.pharmamedpress.com/pharmamedpress.net

Printed at

Repro India Limited.

ISBN: 978-93-5230-095-2 (Hardbound)

PREFACE

Drug delivery is a broad term encompassing various means of achieving optimum drug reach to the target tissue, cell or the receptor. Several preformulation, formulation, biopharmaceutical targeting and pharmacokinetic principles are applied in drug delivery. The book series entitled, "Advances in Drug Delivery" incorporates latest information regarding various subjects of drug delivery.

These volumes are prepared keeping in view of research scholars, teachers, P.G. students in pharmacy institutions and R & D personnel working in Pharmaceutical industries and Research organizations. Case studies have been incorporated based on our experiences so that young scholars may be benefited.

This volume includes 10 chapters. As promised in volume - III of our Advances in Drug Delivery, we have incorporated 10 chapters comprising Iontophoretic drug delivery, self emulsifying drug delivery systems, Taste masking cellular drug delivery, Prodrug – An approach to drug delivery, Expandable drug delivery systems, Nanosuspensions, lozenges, ungual drug delivery and optimization techniques in product development. Many of these ten chapters are quite new and the authors have worked hard to present the knowledge in writing them. We are thankful to the authors for their excellent contribution. We have also started preparing for volume - V which is going to include chapters like Medicated chewing gums, quality by design, social dispersions, programmed drug delivery systems, Nasal drug delivery, Implants etc. These chapters are under preparation and we hope to release Volume - V by Dec 2018.

We encourage constructive criticism and will be glad to receive opinions from experts, readers and users of this book so that we can bring out the coming volumes in a better way. Comments may be sent by email to yamsani123@gmail.com or ymrao123@yahoo.com. We also invite experts to contact us if they wish to contribute a chapter in our forth coming volumes. If the chapters are suitable and interesting to our readers then we will accept.

Research and development in drug delivery is increasing at a rapid pace throughout the world. The need for increased efficiency of new therapies and reduction in future public health expenses will definitely

bolster this area of research and development. In order to meet this demand, many well known and efficiently applied drugs will be reformulated in new drug delivery systems that can be value-added for optimized therapeutic activity.

- Editors

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Expandable Drug Delivery Systems

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6.1 Introduction

Oral ingestion is the predominant and most preferable route for drug delivery. Importantly, it allows unassisted administration by the patient without the need for trained personnel (as this is the case with most parenterally administered dosage forms). Oral drug delivery systems (DDS) are divided into immediate release and modified release systems. Modified release systems offer several advantages over immediate release dosage forms, including the minimization of fluctuations in drug concentrations in the plasma and at the site of action over prolonged periods of time, resulting in optimized therapeutic efficiencies and reduced side effects, a reduction of the total dose administered (while providing similar therapeutic effects), and a reduction of the administration frequency, leading to improved patient compliance[1].

However, Modified release systems offer only limited advantage for drugs that have an absorption window in the upper small intestine [e.g., levodopa[2], furosemide[3] and riboflavin[4]]. The passage of the drugs through this region is rapid, thus limiting the extent of absorption at this site. In order to increase the bioavailability of this type of drug, the residence time of the controlled-release dosage forms in the upper gastrointestinal tract needs to be prolonged. Hence Absorption windows in the proximal gut can limit the bioavailability of orally administered

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Ocular Drug Delivery System

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4.1 Introduction

Ocular drug delivery is an interesting and challenging to the Pharmaceutical scientist, because of the specific and critical pharmacokinetics that exists in the eye. The anatomy and physiology render this organ exquisitely impervious to foreign substances including drugs.

The eye is characterized by its complex structure and exhibits high resistance to foreign substances including drugs. The anterior and posterior segments of the eye, although in juxtaposition to each other and very different in their anatomical and physiological facets, function both independently and tandem upon the application of an ocular formulation. In clinical practice, the anterior segment of the eye (comprising of the cornea, conjunctiva, sclera and uvea) can be treated with topical eye drops, the most commonly used dosage form in ocular treatment. Unfortunately, the bioavailability of ocular drugs after topical instillation of eye drops is very poor due to the defensive mechanisms of the eye[1,2].

Blinking, baseline and reflex lacrimation rapidly remove foreign substances, including drugs, from the surface of the eye. Another surface of non productive drug removal from its systemic absorption either directly from the conjunctiva sac via the blood capillaries or through naso lacrimal drainage. Moreover, the anatomy, physiology and barrier function of the cornea compromise the rapid absorption of drugs. The

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Optimization Techniques in Product Development

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10.1 Introduction

The development of pharmaceutical formulation consists of use of critical components that affect the properties of formulations. Similarly, the process for the manufacturing of formulations or active pharmaceutical ingredients consists of numerous steps. The formulations include from conventional dosage forms (e.g., tablets, capsules, disperse systems or topical dosage forms) to novel drug delivery systems (e.g., liposomes, nanoparticles, Transdermal drug delivery systems). For the simplification of terminology henceforth, all the pharmaceutical products are referred as formulations. The development of such formulations invariably involves incorporation of diverse drugs, polymers, functional and non-functional excipients and processes. Over the past years the traditional approach was used for the optimization of variables, where the influence of variables on the attributes was studied by varying one factor at a time and keeping remaining factors constant. The approach is referred as One Variable at a Time (OVAT) or One Factor at a Time (OFAT). Second is using design of experiments (DoE) based on statistical designs.

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Lozenges

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8.1 Introduction

Lozenges, or troches, are experiencing a renewed popularity as a means of delivering many different drug products. They are used for patients who cannot swallow solid oral dosage forms as well as for medications designed to be released slowly to yield a constant level of drug in the oral cavity or to bathe the throat tissues in a solution of the drug. [Vikas Jain et al].

8.2 Advantages [Vikas Jain et al, Lieberman HA, Lachman L]

1. Being. easy to administer to pediatric and geriatric patients.
2. Having formulas that are easy to change and can be patient specific.
3. Keeping the drug in contact with the oral cavity for an extended period of time.
4. Can be given to those patients who have difficulty in swallowing.
5. Has a pleasant taste.
6. Easy to prepare, with minimum amount of equipment and time.
7. Do not require water intake for administration.
8. Technique is non invasive, as is the case with parenterals.

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Ungual Drug Delivery

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9.1 Introduction

9.1.1 Structure of Human Nail

A nail is a horn-like envelope covering the dorsal aspect of the terminal phalanges of fingers and toes in humans, most primates and a few other mammals. Nails are similar to claws, which are found on numerous other animals. In common usage, the word *nail* often refers to the nail plate only. Finger nails and toe nails are made of a tough protein called keratin, as are animal's hooves and horns. Along with hair they are an appendage of the skin.

The nail consists of the nail plate, the nail matrix and the nail bed below it and the grooves surrounding it.

9.1.2 Parts of the Nail

The matrix is sometimes called the *matrix unguis*, keratogenous membrane, nail matrix, or onychostroma. It is the tissue (or germinal matrix) which the nail protects. It is the part of the nail bed that is beneath the nail and contains nerves, lymph and blood vessels. The matrix is responsible for producing cells that become the nail plate. The width and thickness of the nail plate is determined by the size, length and thickness of the matrix, while the shape of the fingertip itself shows if the nail plate is flat, arched or hooked. The matrix will continue to grow as long as it receives nutrition and remains in a healthy condition. As new nail plate cells are made, they push older nail plate cells forward; and in this way older cells become

Advances in Drug Delivery Volume IV

Advances in drug delivery is a very specialized area of pharmaceutics where in the principles and technologies applied in the formulation and development, are emerging and progressing.

Advances in Drug Delivery incorporates latest information regarding various subjects of drug delivery. Drug delivery is a broad term encompassing various means of achieving optimum drug reach to the target tissue, cell or the receptor. Several preformulation, formulation, biopharmaceutical, targeting and pharmacokinetic principles are applied in drug delivery.

Research and development in drug delivery is increasing at a rapid pace throughout the world. The need for increased efficiency of new therapies and reduction in future public health expenses will definitely bolster this area of research and development. In order to meet this demand, many well known and efficiently applied drugs will be reformulated in new drug delivery systems that can be value-added for optimized therapeutic activity. Further, several new molecules are being generated by medicinal chemists and their formulation is not any more empirical but it is now very systematic. The aim of book is to enlighten pharmaceutical scientists all around the world with latest information on the topics which are involved in cutting edge growth of pharma research and industry.

Highlights

- A chapter on hot melt extrusion is included
- Included a chapter on oral disintegrating tablets - a value addition product
- Caters to all those who aim to achieve higher objectives in drug delivery

About the Editors

Y. Madhusudan Rao, M Pharm, Ph D is currently working as senior Professor in University College of Pharmaceutical Sciences, Kakatiya University, Warangal. 26 candidates obtained their Ph D under his supervision and eight are currently working. He has published more than 150 research papers mostly in referred international journals and has got 5 national & 1 international patent and authored 3 books.

He is the Principal Investigator of several projects funded by UGC & AICTE. Currently he is a Member of Scientific Committee of Indian Pharmacopeial Commission.

He acted as a member expert in National Board of Accreditation (NBA) of AICTE and NAAC of UGC. He was the first Chief Coordinator of QIP and EFIP for teachers in pharmaceutical sciences organised by AICTE.

A. V. Jithan Ph D is currently working as Principal and Professor at Mother Teresa College of Pharmacy, Hyderabad. He is a recipient of several awards and medals in his entire academic career. He has authored a textbook for M.Pharm. students with the title: Oral Drug Delivery Technology published by PharmaMed Press, Hyderabad. He has guided number of M.Pharm students and currently guiding Ph.D. candidates. He has 50 peer reviewed publications. He is a recipient of SERC-Fast track grant from DST India.

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An Imprint of BSP Books Pvt. Ltd.
4-4-309/316, Giriraj Lane, Sultan Bazar, Hyderabad - 500 095
Phone: 040 - 23445688, Fax: 91+40-23445611
E-mail: info@pharmamedpress.net
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ISBN: 978-93-52300-95-2