

# Pharmaceutical Technology Perspectives

---

Muhammad Taher



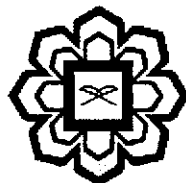
IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

# **Pharmaceutical Technology Perspectives**

*Editor*

*Muhammad Taher*



**IIUM Press**

Published by:  
IIUM Press  
International Islamic University Malaysia

First Edition, 2011  
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia      Cataloguing-in-Publication Data

Muhammad Taher  
Pharmaceutical Technology Perspectives  
Muhammad Taher  
Include index  
Bibliography: p. 149

ISBN: 978-967-418-075-1

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM  
(Malaysian Scholarly Publishing Council)

Printed by :  
**IIUM PRINTING SDN. BHD.**  
No. 1, Jalan Industri Batu Caves 1/3  
Taman Perindustrian Batu Caves  
Batu Caves Centre Point  
68100 Batu Caves  
Selangor Darul Ehsan

# Table of Content

<b>1. Small Active Molecules with Insulin Mimetic Activity</b>	12
<i>Muhammad Taher</i>	
<b>2. Liver and Kidney Protective Effects of the Polyphenols, Tocopherols and Carotenoids</b>	25
<i>Juliana bt Md. Jaffri</i>	
<b>3. Potential Surface Active Properties of <i>Nigella sativa</i></b>	37
<i>Siti Nurfajariah bt Said and Kausar bt Ahmad</i>	
<b>4. Pufa in Fish: Extraction and Fractionation Methods</b>	51
<i>Sahena Ferdosh and Md. Zaidul Islam Sarker</i>	
<b>5. Polypyrrole-Peg Composite Film for Drug Delivery</b>	64
<i>Khadijah bt Edueng</i>	
<b>6. Co-Encapsulation of Cyclophosphamide and Mesna into Double-Walled Microspheres</b>	77
<i>Farahidah bt Mohamed and Christopher van der Wallle</i>	
<b>7. A Recent Updates of Polysaccharide Based Nanoparticulate Oral Preparation of Insulin with Special Emphasis on <i>In Vivo</i> Application</b>	97
<i>Uttam Kumar Mandal</i>	
<b>8. Development of an Appropriate and Robust Dissolution Method for Solid Dosage Forms</b>	116
<i>Uttam Kumar Mandal</i>	
<b>9. Use of Cyclodextrin in the Production of Biomedical Nano Particles</b>	126
<i>Omar El-Hadad</i>	
<b>10. The Role of Pharmacogenetic Variation in Metoprolol CYP2D6 Genotypes Polymorphism</b>	133
<i>Wan Mohd Azizi Wan Sulaiman, Tariq Abdul Razak, Lay Kek Teh and Rusli Ismail</i>	
<b>11. Polymorphic Crystals and Their Characterisation</b>	163
<i>Mohd Rushdi Abu Bakar, Zoltan Kalman Nagy and Christopher David Rielly</i>	

## CHAPTER 6

### CO-ENCAPSULATION OF CYCLOSPHOSPHAMIDE AND MESNA INTO DOUBLE-WALLED MICROSPHERES

Farahidah Mohamed<sup>1</sup> and Christopher van der Walle<sup>2</sup>

<sup>1</sup>Kulliyyah of Pharmacy, International Islamic University Malaysia

<sup>2</sup>Strathclyde Institute of Pharmacy and Biomedical Sciences (SIPBS), University of Strathclyde,  
Glasgow

*Versatility of the 'solvent evaporation method' and polyesters (poly(D,L-lactic-co-glycolic) (PLGA) and poly(lactic acid) (PLA)) in microencapsulation were explored in the fabrication of double-walled microspheres co-encapsulating hydrophobic cyclophosphamide and hydrophilic mesna, envisaged for subcutaneous administration. This was supported by phase separation characterisation for binary blends of various high and low MW PLGA and PLA. It was found that co-encapsulation disrupted phase separation of the polymers and proper formation of the core-shell architecture as revealed by SEM. However, results from Differential Scanning Calorimetry (DSC) did not reveal any glass transition temperature thought to be due to poor resolution of DSC scan. The study demonstrated that solvent-evaporation is a highly versatile and robust technique for microencapsulation of small drug molecules, feasibly yielded perfect spherical, micron-sized particles. The technique when coupled with the highly utilised, FDA-approved for use in human, the biodegradable polyesters, can be tailored to generate wide arrays of drug delivery systems depending on the intended administration and regimen.*

#### 6.1. Introduction

Co-encapsulation of drugs into a Drug Delivery System (DDS) can facilitate sequential or simultaneous drug release, potentially simplifying two otherwise individual drug dosage regimens. Recently, a novel lipid-based nano-DDS, known as polymer-lipid hybrid nanoparticle