



GUANGHUI MA
ZHIGUO SU

Design, Preparation, and Applications

Microspheres and Microcapsules in Biotechnology



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PAN STANFORD  PUBLISHING

Published by

Pan Stanford Publishing Pte. Ltd.
Penthouse Level, Suntec Tower 3
8 Temasek Boulevard
Singapore 038988

Email: editorial@panstanford.com
Web: www.panstanford.com

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library.

**Microspheres and Microcapsules in Biotechnology: Design,
Preparation, and Applications**

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ISBN 978-981-4316-47-7 (Hardcover)
ISBN 978-981-4364-62-1 (eBook)

Printed in the USA

A black and white electron micrograph showing several spherical particles of varying sizes. Some particles are solid black, while others have a textured, granular surface. There are also some irregular, elongated structures. The particles are scattered across the right side of the image.

Microspheres and Microcapsules in Biotechnology

Preface

Microspheres and microcapsules are spherical materials having diameters in nano- to micro-size range, with or without active materials encapsulated or on the surface. These spherical materials have very important applications in biotechnology, a rapidly developing field in the 21st century. Various bio-applications require the supply of high-quality microspheres and microcapsules that have controlled sizes, structures, and properties and are made of biocompatible materials.

The available books on polymer microsphere materials usually lack in presenting the role of polymer microsphere materials in bio-applications. On the other hand, numerous biotechnology books have been published that mention the use of microspheres or microcapsules but lack description on how these materials are made and how to improve their performance.

This situation gave us an idea to prepare a book that can provide the knowledge and information about how to design and prepare microspheres and microcapsules specifically for bio-applications and to build up a bridge between the fields of biotechnology and advanced material technology, so that the scientists and students working in both these fields may be benefitted.

Therefore, this book focuses on design, preparation, and application of new microspheres and new microcapsules in biotechnology, including bio-reaction, bio-separation, bio-formulation, and bio-detection. In bio-reaction, new microspheres or microcapsules are introduced for enzyme immobilization, cell culture, and transplantation. The section on bio-separation discusses chromatographic media for purification of proteins and small bioactive compounds. It also contains information on microspheres for protein refolding and PEG-modified protein separation. As related to both bio-reaction and bio-separation, the solid-phase synthesis of peptides, oligonucleotides, other chemicals, and biomolecules and solid-phase modification of proteins are described. In bio-formulation, new microspheres and microcapsules are designed, synthesized, and used for peptide/protein drug delivery, DNA

drug delivery, targeting drug delivery of anti-cancer agents, and brain-targeting drug delivery. The bio-detection section focuses on microspheres for diagnosis and medical imaging.

We have tried to give the knowledge and information about the principles of design, preparation methods, and application results of new microspheres and microcapsules for each bio-application area and also tried to identify problems that need to be studied further.

Contributions to this book have been made by researchers of the State Key Laboratory of Biochemical Engineering, China, and distinguished professors like Jan-Christer Janson of Uppsala University, Sweden; Haruma Kawaguchi *et al.* of Kanagawa University, Japan; Chen Jiang and Xiguo Jiang *et al.* of Fudan University; Xiaojun Ma *et al.* of Dalian Institute of Chemical Physics, Chinese Academy of Sciences; and Chunyin Chen *et al.* of National Center for Nanoscience and Technology, China. We thank all these authors who updated the theory and methodology, discussed deeply, and cooperated to successfully build up a link between the design, preparation, and applications of microspheres and microcapsules.

We hope this book will be helpful to researchers and students who work or will work in the field of material design and preparation and application of microspheres and microcapsules.

Guanghui Ma and Zhiguo Su
Winter 2012

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