

Preface

Chitin and chitosan are known for their excellent biological properties, among which the biocompatibility with human cells, the ordered regeneration of wounded tissues, the immunoenhancing activity, the induction of immediate hemostasis, the radical scavenging activity, and the antimicrobial activity. Recent studies indicate that chitin and chitosan are most versatile in drug and gene delivery, elaborated diagnostics, devices for selective recognition of tumor cells, and surgical aids ranging from anti-adhesion gels to coated sterile stents.

The present volumes entitled “Chitosan for Biomaterials I and II” were conceived to provide broad and thorough knowledge for highly advanced applications of chitosan and its derivatives in the form of micro- and nanoparticles, nanocomposites, membranes, and scaffolds. The books consist of 15 chapters written in a manner that meets the expectations of scientists in various disciplines.

Chapter 1 deals with the use of chitosan and its derivatives in gene therapy. The effect of several parameters on transfection efficiency of DNA (or gene silencing of siRNA) has been discussed. Moreover, specific ligand and pH-sensitive modifications of chitosan for improvement of cell specificity and transfection efficiency (or gene silencing) are explained. Chapter 2 discusses the recent applications of chitosan nano/microparticles in oral/buccal delivery, stomach-specific drug delivery, intestinal delivery, colon-specific drug delivery, and gene delivery. Chapter 3 is focused on the recent developments of chitosan nanoparticles in bladder, breast, colon, lung, melanoma, prostate, pancreatic, and ovarian cancer therapy. Chapter 4 reviews the design of chitosan-based thiomers and their mechanism of adhesion. In addition, delivery systems comprising of thiolated chitosans and their in vivo performance are discussed. The importance of chitosan in particulate systems for vaccine delivery is emphasized in Chap. 5 according to administration routes, particularly the noninvasive routes involving the oral and pulmonary mucosae. Chapter 6 explains various multifunctional chitosan nanoparticles and their recent applications in tumor diagnosis and therapy. Chapter 7 discusses the current advances and challenges in the synthesis of chitosan-coated iron oxide nanoparticles, and their subsequent surface modifications for applications in cancer diagnosis and therapy. Chapter 8 reviews the recent updates of chemical modifications of

chitosan matrices using the cross-linking agents and their applications as drug-eluting devices such as vascular stents, artificial skin, bone grafts, and nerve guidance conduits. Chapter 9 discusses current efforts and key research challenges in the development of chitosan and other polymeric bio-nanocomposite materials for use in drug delivery applications. Chapter 10 provides an overview of chitosan and its derivatives as drug delivery carriers. Here, a special emphasis has been given on the chemical modifications of chitosan in order to achieve a specific application in biomedical fields. Chapter 11 highlights different fabrication methods to produce chitosan-based scaffolds. Moreover, the suitability of chitosan-based scaffolds for bone, cartilage, skin, liver, cornea, and nerve tissue engineering applications is discussed in this chapter. Chapter 12 discusses about chitosan and its derivatives as biomaterials for tissue repair and regeneration. In addition, integration with cell growth factors, genes, and stem cells, applications of the chitosan-based biomaterials in the repair of skin, cartilage, bone, and other tissues are dealt with. Chapter 13 examines the different mechanisms and bond strengths of chitosan coatings to implant alloys, coating composition and physiochemical properties, degradation, delivery of therapeutic agents such as growth factors and antibiotics, and in vitro and in vivo compatibilities. Chapter 14 highlights the beneficial activities of chitosan, and then it directs attention to the important developments of certain technologies capable to expand the surface area of chitosans, with impressive performance improvements in various applications such as drug delivery and orthopedic scaffolds. Finally, Chap. 15 discusses production, properties, and applications of fungal cell wall polysaccharides such as chitosan and glucan.

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