Preface

Hydrogels are considered as the most promising types of polymers being used for mankind. Hydrogels are three-dimensional, hydrophilic, polymeric networks that can absorb, swell, and retain large quantities of water or aqueous fluids. Natural polysaccharides are biodegradable, nontoxic, low cost, and renewable and can potentially be used as key ingredients for the production of biomaterials for mankind. Metal nanoparticles, nanofibrils, or nanowhiskers embedded polymeric hydrogels are a new class of materials and have attracted great attention due to their unique properties and applications in various fields including pharmaceutics and biomedicine. Conducting polymer hydrogels are materials with added advantages such as electrical conductivity. In recent years, considerable attention has been paid to the modification of crosslinked hydrogels with conducting polymers since this offers a facile methodology to combine the superior properties of conducting polymers with the highly crosslinked hydrogels. Conducting polymeric hydrogels can be used in many applications like electro-sensors, capacitors to electromechanical actuators and artificial muscles. Antimicrobial polymeric hydrogels loaded with antibiotics, antimicrobial polymers, or metal nanoparticles are very useful for mankind. Polysaccharide-based hydrogels have found extensive application in various fields, including agriculture, wastewater treatment, electronics, pharmaceutical, and biomedical applications.

The various chapters in this volume have been contributed by prominent researchers from industry, academia, and research laboratories across the world. The chapter "Polymeric Hydrogels: A Review of Recent Developments" of this book deals with the recent research done in the area of hydrogels, modified hydrogels, hydrogel composites, and nanocomposites. This chapter also provides comprehensive details of research studies of natural and synthetic hydrogels. Fabrication of electroconductive hydrogels from conducting polymers either as a single component or as an additive to conventional hydrogel networks are reviewed in the chapter "Conductive Polymer Hydrogels". Applications of conducting polymer hydrogels are also reported in this chapter. The chapter "Polysaccharide-Based Hydrogels as Biomaterials" covers the recent developments and advances in

hydrogels derived from natural polysaccharides as biomaterials. Chitosan, seaweed, hyaluronic acid, and dextran polysaccharide-based hydrogels are discussed in this chapter. Applications of polysaccharide-based biomaterials as scaffold, cell encapsulation, and wound dressing are also reported here. The chapter "Protein-Based Hydrogels" reports on protein-based hydrogels. Emerging applications and technologies for protein-based hydrogels are also briefly mentioned here. The role of sterculia gum as a promising biodegradable material in the development of various biomedical applications including drug delivery applications, wound dressing applications, etc., are discussed in the chapter "Sterculia Gum-Based Hydrogels for Drug Delivery Applications."

The chapter "Antimicrobial Polymeric Hydrogels" deals with natural and synthetic antimicrobial hydrogels loaded with antibiotics, antimicrobial polymers or peptides, and metal nanoparticles. This chapter summarizes the significant and recent progress in the manufacture and application of antimicrobial hydrogels. The chapter "Biopolymer-Based Hydrogels for Decontamination for Organic Waste" highlights the role of biopolymer-based hydrogels for decontamination of organic waste. Synthesis of chitosan and starch-based hydrogels via graft copolymerization is reported in the chapter "Chitosan and Starch-Based Hydrogels Via Graft Copolymerization." This chapter also includes the concept and methods of graft copolymerization. Applications of these hydrogels as adsorbent, ion exchangers, superabsorbent polymers, and in the pharmaceutical and medical fields are also reviewed in this chapter.

This book covers scientific, technological, and practical concepts concerning the research, development, and realization of polymeric hydrogels as smart biomaterials. This book will be a very useful tool for scientists, academicians, research scholars, biomaterial engineers, and for pharmaceutical industries. This book can also be supportive for undergraduate and postgraduate students at various pharmaceutical institutes and researchers from R&D polymer laboratories working in this area.

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