The study of cyclodextrins which are produced by specific enzymatic action on starch, their properties, production, toxicity, modifications and applications are presented in the final chapter (Chapter 22).

In conclusion, this volume covers the chemistry of starches, the isolation processes, properties and uses of the most common starches, with particular emphasis on the applications of starch in various industries like the food, pharmaceutical and textile industries. This informative volume is an essential reference work for all researchers with interests in any areas of starch chemistry and technology.

John F. Kennedy*
Eunice Yuyun
Chembiotech Laboratories, Advanced Science & Technology Institute, 5 The Croft, Buntsford Drive, Stoke Heath, Bromsgrove, B60 4JE, Worcs, UK

* Corresponding reviewer.
Available online 31 May 2010
doi:10.1016/j.carbpol.2010.04.060

R. Jayakumar, M. Prabaharan, (Eds.) Current Research and Developments on Chitin and Chitosan in Biomaterials Science, Research Signpost, Kerala, India (2008), (iv + 228 pp, US $108.00, ISBN: 978-81-308-0271-8)

Chitin is a carbohydrate polymer and can be found in shells of beetle and other arthropods, and crabs, shrimps and other crustacea. It is also a major structural component of the cell walls of fungi and yeast. Chitin is known to be one of the most abundant natural amino polysaccharides. Chitin and its derivative, chitosan, partially deacetylated chitin, have recently become of great interest due to their properties which are: non-toxicity, biocompatibility, biodegradability, and they are also hydrating agents. Because of these characteristics chitin and chitosan are of high potential to various fields especially in the pharmaceutical and biomedical sciences.

Current Research and Developments on Chitin and Chitosan in Biomaterials contains nine Chapters and each treats different applications of chitin and chitosan in relation to their properties.

The introductory Chapter covers the preparation, physical and chemical properties of chitin and chitosan. Structural analysis of these polymers and various applications in drug metabolism and gene delivery are also covered. These polymers have properties which make them have useful applications in various industries like the pharmaceutical industry (antibacterial and antifungal activities), in the cosmetics industry (hydrating agents) and also the inhibitory activities of chitosan against fungi and bacteria encountered in foodstuffs, hence its potential use as packaging material in the food industry (Chapter 2). The preparation of chitosan interpenetrating networks are analysed and the current developments and applications of stimuli-responsive materials based on chitosan explained (Chapter 3). There is also research on the biomedical applications of chitosan like its use in wound dressings, stent coatings, and antibacterial coatings. Then various methods of chitosan deposition to substrates such as films and fibres used in tissue engineering are discussed (Chapter 4). Various techniques like X-ray fluorescence, atomic force microscopy and X-ray diffraction spectroscopy are used to study the mechanisms that occur during "in vitro" calcification of chitosan (Chapter 5).

The use of chitosan in human and veterinary medicine especially in mucosal immunisation, as an immunological adjuvant is due to its biocompatibility with most tissues and its biodegradability, (Chapter 6). Current research on chitin and chitosan into the different methods of preparation of chitosan scaffolds for various applications in tissue engineering and future demands on bio-products makes fascinating reading (Chapter 7). Different methods of chitosan microsphere preparations used in the pharmaceutical industry (drug delivery systems for vaccines, anti-cancer drugs, gene and bio-drugs) are explained in Chapter 8. The use of chitosan–calcium phosphate composites in tissue engineering are currently under investigation for use as bone graft substitutes as well as optimising its mechanical strength (Chapter 9).

In conclusion, this book is aimed at professionals doing research and development in various industrial sectors like the medical, pharmaceutical and food industries. This volume clearly shows that there are many possible applications of chitin and chitosan, most of which are currently still under investigation which means that the full potential of these applications is yet to be achieved, making the future for chitin and chitosan research and development a bright and prosperous one indeed.

John F. Kennedy*
Eunice Yuyun
Chembiotech Laboratories, Advanced Science & Technology Institute, 5 The Croft, Buntsford Drive, Stoke Heath, Bromsgrove, B60 4JE, Worcs, UK

* Corresponding reviewer.
E-mail address: admin@advscitec.co.uk
(J.F. Kennedy)

Available online 31 May 2010
doi:10.1016/j.carbpol.2010.04.059

Carbohydrates: The Essential Molecules of Life, R.V. Stick, S.J. Williams., 2nd edn., Elsevier Ltd., Amsterdam, The Netherlands (2009). xxi + 474 pp, £54.99, ISBN: 978-0-240-52118-3

Carbohydrates are relatively simple organic compounds that are aldehydes or ketones with many hydroxyl groups. They have a molecular formula of $(CH_2O)_n$, n being equal to or more than three and are the most abundant of the four major classes of biomolecules. Carbohydrates play numerous rules in living organisms such as transport and storage of energy (starch) and as structural components (e.g. cellulose in plants, chitin and chondroitin in animals). Carbohydrates and their derivatives also play major roles in the immune system, fertilization, blood clotting, and development. They are an ideal source of energy for the body because they can be converted more readily into glucose which is the primary form of sugar that is transported and used by the body. Carbohydrates are made up of monosaccharides which are the basic carbohydrate units and are the major source of fuel for metabolism, and in biosynthesis. Examples of monosaccharides are glucose, galactose and fructose. Disaccharides are the simplest oligosaccharides, examples include sucrose and lactose. They are composed of two monosaccharide units bound together by a covalent bond known as a glycosidic linkage formed via a dehydration reaction resulting in the loss of a hydrogen atom from one monosaccharide and a hydroxyl group from the other. Polysaccharides and oligosaccharides are composed of longer chains of monosaccharide units bound together by glycosidic bonds. The distinction between these two is based upon the number of monosaccharide units present in the chain. Oligosaccharides contain between two and nine monosaccharide units, and polysaccharides contain greater than ten monosaccharide units. Polysaccharides represent an important class of biological polymers.

Carbohydrates: *The essential molecules of life* consists of twelve chapters. The introductory chapter deals with the early research

done with carbohydrates. The composition and structure of carbohydrates, oxidation–reduction reactions, the constitution of glucose and other sugars and their stereochemistry are covered in the first chapter.

This is followed by the study of carbohydrate chemistry including their synthesis using protecting groups like esters, acetates, benzoates, borates and sulfonates (Chapter 2). Then the study of the reactions of monosaccharides including the various oxidizing agents like pyridinium chromate and reduction reactions (Chapter 3), and more reactions of carbohydrates including the formation of glycosidic linkages. The following chapter provides a more detailed look at the different forms of glycosidic linkages with emphasis on the orientation of the hydroxyl (OH) group at the C_2 of the glucosyl donor (Chapter 4). This is followed by information on the synthesis of oligosaccharides, specifically the different reactions and mechanisms of reactions in the synthesis and also the different types of polymers (Chapter 5). The study of the different pathways involved in monosaccharide metabolism focusing on the vertebrate and bacterial pathways of carbohydrate metabolism and various intermediates involved is covered in Chapter 6, followed by enzymes involved in the cleavage of glycosides, their mechanisms and synthetic applications (Chapter 7). Mechanism of action of glycosyl transferases (enzymes involved in the formation of glycosydic bonds) and their synthetic applications are dealt with in (Chapter 8), followed by the study of common disaccharides, trisaccharides, oligomers and polymers derived from single carbohydrate monomers (Chapter 9). The last three chapters of this volume involve the study of more complex oligosaccharides and polysaccharides with more than one type of monomer and bearing various functional groups. Specifically, the modification of glycans and glycoconjugates involving the occurrence, function and biosynthesis of the co- and post-glycosylationally modified carbohydrates (Chapter 10), the major types of protein glycosylation in higher organisms with particular emphasis on mammals (Chapter 11), and finally the development of carbohydrate-based therapeutics using interdisciplinary research with particular emphasis in synthetic chemistry (Chapter 12).

In conclusion, this volume gives a complete background of carbohydrate chemistry. It explains the different types of carbohydrates and the various mechanisms of their biosynthesis, and is aimed at researchers studying the chemistry, reactions and applications of carbohydrates.

John F. Kennedy *
Eunice Yuyun
Chembiotech Laboratories, Advanced Science & Technology Institute, 5 The Croft, Buntsford Drive, Stoke Heath, Bromsgrove B60 4JE, Worcs, UK

* Corresponding reviewer.
Available online 31 May 2010
doi:10.1016/j.carbpol.2010.04.058