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Book reviews

Rheology of Industrial Polysaccharides. Theory and Applications, Edited by Romano Lapasin and Sabrina Pricl, Blackie Academic and Professional, London 1995. ISBN 0-7514-0211-7, 620 pp, £99.00.

This is a significant piece of work. The title however does not really do the book justice in that, not only does the book provide an excellent comprehensive state-of-the-art survey of rheological methodology applied to polysaccharides and covers (with one noteable omission) most of the techniques which give complementary information, it gives also the most comprehensive up-to-date review of polysaccharide structure, properties and applications: perhaps "Industrial polysaccharides and their rheological properties" might have been more appropriate. It provides a similar depth of treatment to that which A. Gottschalk's (Ed.) classical two-part volume provided on Glycoproteins (Biochimica Biophysica Acta Library, Vol 5) nearly a quarter of a century ago.

The book divides into five parts or large chapters followed by four highly useful appendices:

Chapter 1. The polysaccharides: sources and structures, with sections on "an overview on polysaccharides" (sizes, shapes etc.), "polysaccharides: biopolymers from renewable sources" (i.e., plants, marine, microbial and animal sources), "synthesis and modifications of polysaccharides" (chemical, enzymatic and molecular biological) and "secondary and tertiary structure of polysaccharides in solutions and gels" (polymer chains, order/disorder, gels, liquid crystals and experimental techniques). This chapter is as comprehensive as can be, with 547 references, and just about everything is covered. One disappointment however was the complete omission of the analytical ultracentrifuge in the experimental techniques section, especially in view of the increasing contribution it is making to our understanding of not only dilute solution properties but also properties in gels (swelling, pressures etc.) providing closely parallel information to which the classical rheological methods can provide.

Chapter 2. Industrial applications of polysaccharides (189 references), with a section on "polysaccharides as speciality chemicals" (in foods, in pharmaceutical and medical uses, in biotechnology and in other areas such as oil recovery) and a section on rheology in general industrial research (quality control, optimization etc.). This chapter provides arguably the most comprehensive and up-to-date account available on polysaccharide applications.

Chapter 3. Rheology (83 references). The introductory section takes us through the origin of the term "rheology" (from Bingham in 1929) to the Deborah number which helps us distinguish between liquid, solid and intermediate states. There then follows quite a rigorous excursion into rheological theory—helped by the four Appendices (matrix, vector and tensor algebra; rate of deformation tensor; the CEF equation and the relaxation modulus) for those that don't come from a physics or maths background. Sections follow on basic concepts (tensional/ deformation states), the constitutive equation approach and rheological characterization, kinematic classification of flows (shear/elongational/linear viscoelastic models/corotational models and molecular models).

Chapter 4. Rheology of polysaccharide systems. This is the cornerstone of the book, with 227 pp and 680 references. The introduction indicates how, besides concentration, their size, shape, polydispersity and interaction properties strongly affect the behaviour of dispersed systems, from dilute solution to gel. The section on dilute solution properties takes us through the shear dependence behaviour and zero shear properties, leading to the next section on "infinite dilution" behaviour (namely, the intrinsic viscosity and Huggins/Kraemer representations). The treatment is comprehensive apart from two minor details: the apparent mistakes in the Simha treatment for ellipsoids sorted out by N. Saito and others should have been at least mentioned; also the point could have been made that with the Mark–Houwink (termed by others as "Mark–Houwink–Kuhn–Sakurada") relation given linking the molecular weight with intrinsic viscosity for conformation types (via the exponent parameter, "a"), similar relations/exponents link the molecular weight with other transport properties such as the sedimentation coefficient (exponent "b"), diffusion coefficient ("$-\epsilon$") and, also, with the radius of gyration ("c"). These coefficients could have been included to make Table 4.3 even more comprehensive. There follows sections on temperature dependence (of particular interest to the oil industry where many polysaccharides are being used/considered in well bore technology), the transformation from dilute solution to concentrated solution behaviour (and the "critical overlap concentration", c^*) the behaviour of concentrated solutions (49 pp), the transition from solution to gel and finally gels. The chapter finishes with the behaviour of mixed gels where there is currently considerable interest (synergistic effects etc.), liquid crystals (contact lens wearers take note) and polysaccharides in real systems (including mixtures with other materials and other impure forms).

Chapter 5. Rheometry (75 references). This covers instrumentation, data capture and analysis. The introduction covers really the philosophy behind rheological measurement and identifies the three "partialized" objectives and the three types of "single-point" tests: fundamental, empirical and approximate or imitative. Then follows sections on "Qualitative" (i.e. approximate) rheometry (including the falling ball and Brookfield viscometers) and "Quantitative" rheometry leading to two extended sections on capilliary viscometry (and creeping flow) which include a useful and comprehensive description of sources of error. There follows an equally comprehensive treatment of rotational viscometers and sources of error, dynamic tests and extensional rheometry. The chapter/book finishes with a consideration of commercially available viscometers and rheometers.

All researchers/workers in the field of polysaccharide technology should have at least access to a copy of this book: a truly useful and scholarly text.

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Enzymes in Synthetic Organic Chemistry. Edited by Chi-Huey Wong and George M. Whitesides, Tetrahedron Organic Chemistry Series, Vol 12, Pergamon, Oxford, 1994, 346 pp and subject index. ISBN 0-08-035941-8, $38.00.

With this book, G. Whitesides and C.-H. Wong provide chemists interested in using enzymes with an essential reference work. Although these authors have already published several reviews on the subject, this comprehensive book, containing more than 1200 references covers the literature up to the end of 1993.

The book begins with a brief general chapter on enzymes (enzymatic kinetics, enzyme inhibition, specificity, enantioselectivity, stabilization, catalysis in organic solvents, rational design of new enzymatic catalysts), which provides a summary of information regarding the application of enzymes in organic chemistry.

The subsequent five chapters are organized on the basis of reaction types. Each chapter deals with a group of enzymes carrying out the same type of transformations. The first topic covered is the large group of hydrolytic enzymes including amidases, proteases, esterases, lipases, nitrilases, epoxide hydrolases, and phosphatases. A large section is devoted to protease-catalysed peptide synthesis, but also covers the esterase activity of proteases. The broad range of enantio- and regio-selective reactions catalysed by esterases and lipases in organic solvents is discussed in detail as a function of enzyme source. This chapter is extremely well documented, with 361 references. Of special interest to carbohydrate chemists is the discussion of the regioselective acylation of sugars using subtilisin, protease N or porcine pancreatic lipase, or on the contrary the regioselective removal of acyl groups in sugars catalysed by different lipases.

The next chapter turns to oxidoreduction reactions. Regeneration systems for NAD(P)H and NAD(P) cofactors are presented. The stereochemistry and stereoselectivity of the dehydrogenases are very clearly discussed. Four tables list the oxidation or reduction reactions catalysed by horse liver alcohol dehydrogenase, the most useful enzyme, particularly for the preparation of cyclic chiral lactones or alcohols. In addition to other alcohol dehydrogenases, especially yeast enzymes and the thermostable enzyme from *Thermobacterium brockii*, other specific dehydrogenases with more limited applications are also reviewed. This chapter ends with metalloenzymes such as galactose oxidase, lipooxygenase, monooxygenases catalysing Baeyer–Villiger reactions, other monooxygenases and peroxidases. This chapter is once again very well referenced.

Both of the next two chapters are particularly useful to carbohydrate chemists: the first dealing with C–C bond formation and mainly utilizing the aldolases and transketolase involved in sugar metabolism and the second with the synthesis of glycosidic bonds.