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Book review

Analytical Pyrolysis of Natural Organic Polymers by S.C. Moldoveanu, Elsevier, Amsterdam, Lausanne, New York, 1998, XI+496 pp., price NLG 495, ISBN 0-444-82203-8

The work forms Volume 20 of the series *Techniques and Instrumentation in Analytical Chemistry*. The analytical pyrolysis of synthetic polymers has been the subject of a number of monographs, but naturally occurring organic polymers have received much less attention.

The work consists of 3 parts made up of 18 chapters. The first part concerns an introduction to analytical pyrolysis and consists of 5 chapters, the second part consisting of 9 chapters is entitled Analytical Pyrolysis of Organic Biopolymers, and the final part of 3 chapters concerns applications.

Following a short introductory chapter, the Chemistry of the Pyrolytic Process is well treated, the considerable number of complex and often competing reactions being detailed. Chapter 3, entitled Physico-Chemical Aspects of the Pyrolytic Process, follows and the thermodynamic and kinetic factors which are often ignored are detailed and some comparison with combustion and ion fragmentation in mass spectrometry are made.

Instrumentation used for Pyrolysis forms Chapter 4, a small chapter as the few available modes of pyrolysis have been reported in many works. A comparison of the results of examination using the various procedures is shown in tabular form and as is well known the particular advantages and disadvantages of each system are shown.

Chapter 5, entitled Analytical Techniques used with Pyrolysis, forms a fifth of the work. It is almost exclusively treatment of chromatographic theory, of gas chromatographic and mass spectrometric operation, most material which has been treated many times in university texts. Part 2 details the major natural polymers and commences with Chapter 6, entitled Analytical Pyrolysis of Polyterpenes, which in its entirety concerns the pyrolysis of natural and vulcanised rubber. This short chapter summarises elegantly the pyrolysis of these well known and complex polymers.

The subsequent chapter on Polymeric Carbohydrates is much longer and considers first monosaccharides which pyrolise to form monomer units, which also form from polysaccharides. The polysaccharides considered, cellulose and hemicellulose, chemically modified celluloses and the starches, amylose and amylopectin all complex materials producing a vast number of pyrolysis products, gums, mucilages, fungal-, microbial-, algal- and liposaccharides are included together with glycogen, proteoglycan and chitan. In most cases an extensive number of main pyrolysis products are listed although it would be helpful to have the relative abundances indicated. Pyrolysis of lipid materials forms Chapter 8, a small chapter identifying many materials generally used, within the classifications of simple and complex lipids. Lignins, because of their commercial importance, have been extensively studied and form Chapter 9. The pyrolysis reactions and major pyrolysis products of lignin, lignocellulose and chemically modified lignins derived from a number of species of timber are shown.

Polymer tannins form a 2-page Chapter 10, while Chapter 11 considers the analytical pyrolysis of caramel colours and of Maillard Browning Polymers.

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Caramels are produced by chemical reaction of saccharides but occur in foods and are classified into 4 types.

Analytical Pyrolysis of Proteins forms Chapter 12 and commences with a discussion of protein structure followed by the pyrolysis of amino acids, the amino acids in various proteins and then peptides with finally proteins being classified as simple or complex proteins.

Nucleic Acids is the title of Chapter 13 and the format repeats that of earlier chapters. The classification of nucleic acids is followed by the pyrolysis of oligonucleotides and nucleic acids, and mentions complexes of platinum with DNA.

Chapters 14 and 15 concern the analytical pyrolysis of the geopolymers, humin, humic acid, fulvene, peat, coal, kerogens and other natural polymers. In each case the pyrolysis products are shown from sources of differing origins. The final part of the work concerns the application of analytical pyrolysis to composite natural organic polymers. Chapter 16, entitled Analytical Pyrolysis of Plant Materials, considers composites partly of materials previously treated and commences with wood followed by leaves and other plant materials and then pine needles, tobacco and cigarette smoke.

The Analytical Pyrolysis of Microorganisms forms Chapter 17 and in this small chapter a tabulation shows nearly 90 microorganisms that have been subjected to analysis by pyrolysis. The final chapter is again small and considers Other Applications of Analytical Pyrolysis, these largely being areas that have been treated in considerable detail elsewhere. The treatments are so brief that the scope of the application is only possible.

The work is well written, comprehensive and extensively referenced, containing approximately 600 citations. This is almost certainly the most detailed work on the analytical pyrolysis of natural polymers that has appeared and as such fills a void in the available literature. It complements the many works that have been available on the examination of synthetic polymers and is a worthy addition to the collections on pyrolysis.

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