Book Reviews

W.G. Glasser and S. Sarkanen (Eds.): Lignin: Properties and Materials. ACS Symposium Series 397. 545 pages. Hardcover. 1989. American Chemical Society, Washington D.C.
ISBN 0-8412-1631-2.

Though lignin is second in natural abundance only to cellulose and its global production in pulp mills amounts to some 50 million tons per year, it remains practically unused as a chemical feed stock, at a time when tax payers are spending ever increasing amounts of research money in order to replace crude oil by renewable organic raw materials. Generations of wood chemists have been attracted by the 'great potentials' of organic raw materials occurring in the spent liquors of pulp mills. However, up until now they have failed in their endeavour to earn money from lignin mainly for two reasons: the irregular macromolecular lignin structure and the fact that lignin is used as an energy source for operating the pulp mill.

Furthermore, the structure of lignin is heavily changed by conventional pulping conditions, in order to render the hydrophobic lignin soluble in the aqueous pulping medium, and the combustion of the spent liquor is also necessary for the recovery of the inorganic pulping chemicals. How can this situation be changed? The first prerequisite – the availability of lignin in large quantities in an uncondensed, structurally relatively unchanged state, free of sulfur and inorganic pulping chemicals and which does not have to be burnt for operating the pulp mill – is not the topic of the present book. The 41 chapters of this book, presented at the Third Chemical Congress of North America by the Cellulose, Paper and Textile Division of the American Chemical Society, in Toronto, June 5-11, 1988, deal with the second problem, namely the structure of lignin and its possible changes in encountering technological properties of plastic materials, mainly by grafting with well defined monomers. The first section, covering 13 papers (chapters) on the macromolecular structure and properties of lignin, deals with some contradictions in the ultrastructure (D.A.J. Goring), lignin carbohydrate complexes (T. Koshijima et al.), dissolution and supercritical fluid extraction, molecular weight determination of lignin and lignin derivatives and association effect of kraft lignins.

In the 'General materials' section, six papers deal with specialty polymers from lignin, modification of lignin to electrically conducting polymers (J.J. Lindberg et al.), depolymerization of lignin, modification of lignin to materials with thermal stability, fire resistance and carriers for controlled release of herbicides as well as application of computational methods to the chemistry of lignin.

In the section entitled 'Phenolic compounds', five papers are presented mainly dealing with the phenolic properties of lignin. The ALCELL process (J.H. Lora et al.) produces hardwood lignins that are not so heavily condensed, are rich in phenolic groups and are of low molecular weight (Mn 1000). These lignins may be better candidates for grafting or as substitutes for phenolic resins in wood adhesives. Unfortunately, only hardwoods may be pulped by ethanol without additional chemicals, and hardwood lignins are inferior to softwood lignins in their condensation capabilities with formaldehyde, phenols etc. In this respect, the findings of G.H. van der Klarshorst are of importance that in acidic media, the condensation site of the aromatic nuclei in lignin are mainly the meta positions, carbon atoms 2 and 6, which are mainly unsubstituted in lignin, and thus offer a higher potential for cross linking in condensation reactions.

The section 'Polyols, polyurethanes, polyblends and grafts' comprises 10 papers dealing with partial replacement of PF binders Kraft lignin as well as lignins from steam exploded wood and barks (N. Cyr and R.G.S. Ritchie), polyurethanes obtained from solvolyses (cresol) lignin, Kraft lignin and others with polyethylene glycol and diisocyanates (T. and H. Hatakeyama et al., K. Kringstad et al., W. Glasser et al.), hydroxypropyl lignins (W. Glasser et al., J. Hyatt) as well as lignopolystyrenes (Helena Chum et al.). The last section on 'Epoxies and acrylics' with four papers adds to the broad spectrum of lignin modification by grafting, leading to lignin copolymers with tailored technological properties as well as compatibilities. Of special interest in this section is the paper by S. Hosoya et al., showing that the reactivity of lignin towards epoxides is greatly enhanced by treatment with ozone, creating muconic acid groups in lignin. Another possibility of reactivity enhancement of lignin by epichlorohydrin is hydroxypropylation with propelene oxide (W. Glasser and W.L.-S. Nieh). The book concludes with a valuable record of firms offering industrial lignin and lignin derivative products.

'Lignin: Properties and Materials' will be of interest to both polymer and wood chemists, graduate students and technical personnel in engineering and polymer science. It constitutes a valuable compilation of lignin based raw materials as potential substitutes and extenders for polymeric materials based on petrochemicals.

H.H. Nimz (Hamburg)

National Particleboard Association (Ed.): Proceedings of the NPA Resin and Blending Seminar. May 3-4, 1990, Irving, Texas. 115 pages. 1990. Available through the Forest Products Society, Madison, WI, U.S.A.

In 1990, the National Particleboard Association (NPA) in the U.S.A. sponsored a seminar on resins and blending in the particle- and fibreboard industry. The main objective of the seminar was to improve the technical skills of those who work in the particle- and fibreboard industry in the U.S.A.

The presentations during the seminar which was attended by more than 200 representatives from industry alongside many others from different research institutes, centred on three different subjects. In the first session of the seminar, the raw materials used such as wood species, resins, scavengers, hardeners and wax were the main focus of the presentations. This part was led by A. Lamberth, a well-known resin chemist in the U.S.A. In the second session, led by T. Maloney from the Washington State University, the history of blending in the particleboard and medium density fibreboard production variables in the blow-line and alternative blending systems were addressed. In the last session of the seminar, papers were given on process and quality control systems, as seen from the perspective of mill management. All presentations at the seminar were made by highly qualified persons in the industry of the United States and led, as already mentioned, by well-know experts in their fields. After each session, the presented papers were discussed in detail and a question and answer session was held.

The proceedings are of special interest to all who work in the field of particle- and fibreboard and related industries and want to keep abreast of the latest developments.

E. Roffael (Braunschweig)

R.A. Blanchette and A.R. Biggs (Eds.): Defense Mechanisms of Woody Plants Against Fungi. Springer Series in Wood Science (Ed. T.E. Timell). XX, 458 pages, 209 figures. Hardcover. Springer Verlag, Berlin/Heidelberg. 1992. DM 388,–
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The book provides in 19 chapters, written by 27 contributors, an overview of how living roots, stems and leaves of woody plants respond to fungal pathogens. Numerous illustrations demonstrate the anatomical and physiological changes that occur when trees are attacked by fungi. Each of them also includes 2 to 5 pages of full references covering older and newer citations of the pertinent literature up to 1990.