

Books

THE NATURE AND REACTIONS OF LIGNIN—A NEW PARADIGM, by Kaj G. Forss and Kaj-Erik Fremer. 2003. Order from Academic Bookstore, BP 128, 00101 Helsinki, Finland. www.akateeminen.com or from TAPPI Press, www.tappi.org. 558 pp. (ISBN 952-91-4091-6).

The Nature and Reactions of Lignin—A New Paradigm is an attractive book that presents the collective experimental evidence, and many of the underlying scientific arguments, for which the authors and their lignin paradigm have become well known throughout the world during the last three decades.

The book is subdivided into eleven chapters and five appendices. The chapters deal with the formation of wood; the formation of wood components; the cell wall; lignin in retrospect; gel permeation chromatography; spruce wood lignins and their sulfonates; the repeating unit and formation of high molecular mass glycolignin sulfonic acids; solvolytic delignification; stereochemical aspects; and color and light absorption. The appendices present numerous pieces of quantitative evidence and considerations that make it easy for the involved reader to retrace the way the authors derived their structural hypothesis on the basis of primary experimental data.

The lignin paradigm described revolves around the hypothesis that lignin consists of a group of aromatic polymers, one of which (ca. 85% of the total amount of lignins in Norway spruce) is called “glycolignin.” Glycolignin is an ordered polymer that is made up of multiples of a “repeating unit” consisting of 18 phenylpropane units. The repeating unit structure of lignin has been the cornerstone of the authors’ main proposition for almost 40 years. The experimental basis for this paradigm rests on a combination of lignin isolation data (mostly as lignin sulfonates); on extensive

work involving chromatographic separations; on a vast amount of elemental analysis data; on detailed kinetic considerations; on spectroscopic (mostly UV) examinations; and on a host of (so far unpublished) computer modeling efforts in addition to many other observations, some of which are well known from past publications, but many are reported for the first time in this monograph.

Each chapter and each aspect of the paradigm and its underlying science have been carefully researched and painstakingly documented. The collection of studies and arguments presents a convincing story of the possibly regular (ordered) structure of lignin that has unfortunately received little recent attention by lignin chemists and wood scientists. The early dismissal of the possibility that lignin consists of assemblies of repeating units was based primarily on the paradigm’s incompatibility with the understanding of the biochemistry of lignin formation. This monograph makes an attempt to present the experimental evidence that produced the repeating unit hypothesis for (glyco)lignin, in its entirety.

This paradigm, although based mostly on evidence gathered with methods that are a generation or more old, is particularly thought-provoking in light of the ongoing search for the involvement of “dirigent proteins” in the process of lignification, a proposition that has produced a similar paradigm with possibly the same outcome: an ordered, regular structure of lignin in wood.

The monograph is well written and presented with many excellent illustrations, many of which are in full color. The authors have done an outstanding job of skillfully summarizing their collective evidence in a readable and understandable manner. An extensive subject index provides invaluable assistance for locating references to the numerous details collected in this book. This work challenges

the lignin community to think “outside of the box.” It is likely that the vision presented will prevail for many decades to come despite its shortcomings in modern experimental methodology. It is likely that additional evidence will emerge, with the help of more modern scientific methods, which supports and corroborates the paradigm presented.

It would be a serious shortcoming of any library, or of any bookshelf of a serious and

involved wood scientist, if the Forss-Fremer lignin paradigm were absent. This book, with its excellent illustrations, figures, and tables, will prove to be an important resource for all those asking questions regarding the structure, the behavior in pulping reactions, and the utilization of lignin.

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