Chemistry of Lignocellulosics: Current Trends

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Preface

This book is a result of a collective effort of experts working in the field of conversion of renewable sources using sustainable methods to obtain innovative products. It is reflecting the current trends of replacing the fossil-sources by renewable ones. Transformation of lignocellulosic biomass in the future will be performed within the biorefineries, which are designed to separate wood polymers, constructing the plant cell walls, from "free" molecules. These are commonly designated as extractives, since accessible by simple solvent extraction.

The first section of the book discusses the new applications of lignocellulosic fibers from alternative sources (other than wood). The transformation of hemp and hollow floss fibers will provide the access to innovative applications, while contributing to the sustainable transformation of forest resources by replacement of wood fibers.

Although this book does not provide an exhaustive overview of such alternative resources, it indicates how much the knowledge of their chemistry is important for creation of original applications. The non-destructive technique of examining the properties of lignocellulosic materials, the Near Infrared Spectroscopy, represents an interesting tool for estimating the potential of an oak wood for the specific application in wine industry.

The thermal transformation of wood and other biomass is not new, but interest in the development of biofuels has prompted the return to research on pyrolysis and a chapter of the second book section presents an original approach of combining industrial waste with the forest biomass for pyrolytic conversion into fuels. Another chapter discusses the application of thermal conversion in yet another original way, which is the wood welding. The gluing of solid wood pieces together without any adhesives is possible by simply inducing local pyrolysis by friction of wooden dowels against the wood panels. This technique is sustainable as it allows for the wood panel production without any petroleum-derived adhesives, exploiting the thermal conversion of wood constituents. The replacement of petroleum derived chemicals by those from renewable resources is explored in the chapter which describes the impregnation techniques used to densify wood, thus leading to new products with improved properties.

Finally, the third section of this book presents the current trends in application of major wood polymers: cellulose and lignins. The new applications of nanocellulose

and related materials are accessible by their chemical modification. These modified nanocelluloses are designed to improve the compatibility with various polymer matrices for production of new composite materials. In a chapter presenting an overview of organosolv pulping, a new catalytic process is described which allows for the production of a highly pure lignin which is directly transformable into carbon fiber.

The two classes of wood extractives are presented: terpenoids and polyphenols. One chapter describes the historical uses of conifer resins, along with the current therapeutical and perfumer's palette applications of volatile (essential) oils. The great potential of application of extractable polyphenols resides principally in their bioactivities, strongly related to their antioxidant capacity. The application of flavonoid-rich extracts of Mexican oaks bark is illustrating such an application for treatments of skin inflammation. Finally, the last chapter of the book describes the transformation of condensed tannins into industrial foams.

The chosen examples and discussions presented in this book confirm the need for understanding the molecular level of lignocellulosics. The good knowledge of chemical structures of both structural biopolymers and extractives is therefore essential for the design of sustainable processes leading to innovative products, a result of a multidisciplinary team work.

Contents

Part III: Structural Polymers and Extractives From Lignocellulosic Sources—Properties and New Applications