

Green Chemistry and Sustainable Technology

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Aims and Scope

The series *Green Chemistry and Sustainable Technology* aims to present cutting-edge research and important advances in green chemistry, green chemical engineering and sustainable industrial technology. The scope of coverage includes (but is not limited to):

- Environmentally benign chemical synthesis and processes (green catalysis, green solvents and reagents, atom-economy synthetic methods etc.)
- Green chemicals and energy produced from renewable resources (biomass, carbon dioxide etc.)
- Novel materials and technologies for energy production and storage (bio-fuels and bioenergies, hydrogen, fuel cells, solar cells, lithium-ion batteries etc.)
- Green chemical engineering processes (process integration, materials diversity, energy saving, waste minimization, efficient separation processes etc.)
- Green technologies for environmental sustainability (carbon dioxide capture, waste and harmful chemicals treatment, pollution prevention, environmental redemption etc.)

The series *Green Chemistry and Sustainable Technology* is intended to provide an accessible reference resource for postgraduate students, academic researchers and industrial professionals who are interested in green chemistry and technologies for sustainable development.

More information about this series at <http://www.springer.com/series/11661>

Chunbao Xu · Fatemeh Ferdosian

Conversion of Lignin into Bio-Based Chemicals and Materials

 Springer

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Preface

Lignin is the second most abundant natural renewable polymer after cellulose. Natural lignin is a phenolic polymer formed by radical coupling polymerization of three monolignols, and it has amorphous macromolecular structure. Lignin is currently produced as waste or by-product streams from paper pulping and lignocellulosic ethanol processes, with limited applications for heat and power generation. Many studies have been conducted on value-added utilization of lignin. The availability, the presence of various functional groups (aromatic and hydroxyl) on lignin, lyophobic structure, biodegradability, antioxidant and reinforcing capability make it a potential candidate for the production of bioaromatic chemicals (such as vanillin and phenols), bio-based polymeric materials (resins and polymers), and carbon fibers or for consumption as reinforcement fillers in thermoplastic polymers or dispersants. The reactivity of lignin could be enhanced through some chemical modifications and thermochemical depolymerization processes. Thus, lignin has great promise for production of biochemicals and biopolymers.

Although there are some books on the lignin chemistry and properties, the unique feature of this book is that it focuses on utilization of modified (e.g., via depolymerization and liquefaction) or non-modified lignins for high-value bio-based chemicals and materials.

This book consists of eight chapters, as detailed below. Chapter 1 introduces the fundamentals of chemical structure and properties of lignin and various delignification processes to extract lignin from lignocellulosic biomasses. Chapter 2 describes fast pyrolysis of lignin, the lignin pyrolysis mechanism, and the composition of lignin-derived pyrolytic products, as well as the influence of operation parameters and reactor design on the yields and composition of the pyrolytic products from lignin. Chapter 3 overviews depolymerization of lignin through various thermochemical processes including hydrolytic, reductive, and oxidative depolymerization to reduce the molecular weight of lignin with improved reactivity. Chapter 4 focuses on the performance of lignin (modified or non-modified lignin) as a reinforcement filler for thermoplastic polymers as well as its potential as a precursor or a starting material for production of carbon fibers. Chapter 5 describes the application of lignosulfonate as effective surfactants and dispersants in various

industries. Chapter 6 presents a comprehensive overview on the production of lignin-based phenol formaldehyde resins, and analyzes the effects of lignin type, synthesis conditions and pre-treatment of lignin on the substitution ratio of lignin and its performance as a wood adhesive for different engineering wood composites. Chapter 7 provides an overview on chemistry, properties and applications of epoxy resin, as well as the production, curing kinetics and physiochemical properties of lignin-based epoxy resins. Chapter 8 presents the potential of lignin as a bioreplacement for polyol in the production of lignin-based PU for various applications including elastomers, coatings/adhesives/sealants, flexible foams, and semirigid or rigid foams.

This book covers a wide range of scientific and technical aspects on utilization of modified (e.g., via depolymerization and liquefaction) or non-modified lignins for high-value bio-based chemicals and materials. It is expected that the text would be of interest to students, researchers, academicians, and industrialists in the areas of valorization of lignin for the production of high-value bio-based chemicals and materials with industrial applications.

London, Canada

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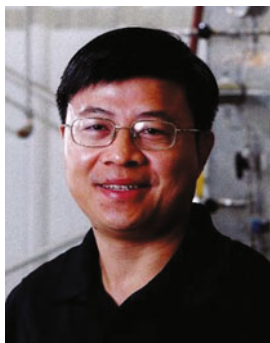
Contents

1	Structure and Properties of Lignin	1
1.1	Lignin	1
1.2	Types of Lignin	4
1.3	Utilization of Lignin	7
1.4	Summary	8
	References	9
2	Degradation of Lignin by Pyrolysis	13
2.1	Pyrolysis Technology	13
2.2	Fast Pyrolysis of Lignin	14
2.2.1	Lignin Pyrolysis Mechanism	14
2.2.2	Effects of Types of Lignin	17
2.2.3	Effects of Temperature	22
2.2.4	Effects of Catalyst	24
2.2.5	Pyrolysis Reactors	27
2.3	Summary	30
	References	31
3	Degradation of Lignin by Depolymerization	35
3.1	General Introduction on Lignin Depolymerization	35
3.2	Hydrolytic Depolymerization of Lignin	36
3.3	Reductive Depolymerization of Lignin	40
3.3.1	Reductive Lignin Depolymerization in Hydrogen Donating Solvents or Reductive Agents	40
3.3.2	Reductive Lignin Depolymerization in Gaseous Hydrogen	43
3.4	Oxidative Depolymerization of Lignin	46
3.5	Summary	50
	References	51

4 Utilizations of Lignin for Polymer Reinforcement and Carbon Fibers	55
4.1 Lignin for Polymer Reinforcement	55
4.1.1 Natural Rubber (NR)/Lignin Composites	56
4.1.2 Polyethylene (PE)/Lignin Composites	58
4.1.3 Polypropylene (PP)/Lignin Composites	58
4.1.4 Styrene-Butadiene Rubber (SBR)/Lignin Composites	62
4.1.5 Poly (Vinyl Chloride) (PVC)/Lignin Composites	63
4.1.6 Polystyrene/Lignin Composites	63
4.1.7 Others Polymers/Lignin Composites	64
4.2 Lignin for Carbon Fibers	65
4.2.1 Carbon Fiber from Raw Lignin	68
4.2.2 Carbon Fibers from Lignin/Polymer Blends	69
4.2.3 Carbon Fibers from Chemically Modified Lignin	72
4.3 Summary	74
References.	75
5 Utilization of Lignosulfonate as Dispersants or Surfactants	81
5.1 Lignosulfonate and Structure	81
5.2 Lignosulfonate Applications	82
5.2.1 Oil Well Dispersants	83
5.2.2 Coal–Water Slurry (CWS) Dispersants	86
5.2.3 Dispersants in Other Applications	86
5.3 Summary	88
References.	88
6 Lignin-Based Phenol–Formaldehyde (LPF) Resins/Adhesives	91
6.1 Introduction	91
6.2 LPF Resins from Lignosulfonates	93
6.3 LPF Resins from Kraft Lignin	95
6.4 LPF Resins from Organosolv Lignin	99
6.5 LPF Resins from Hydrolysis Lignin	101
6.6 LPF Resins from Soda Lignin (Alkali Lignin)	102
6.7 LPF Resins from Biorefinery Residues	104
6.8 Summary	106
References.	107
7 Lignin-Based Epoxy Resins	111
7.1 Epoxy Resins and Its Synthesis	111
7.2 Curing and Applications of Epoxy Resins	114
7.3 Synthesis of Lignin-Based Epoxy Resins	115
7.3.1 Physical Blending of Lignin and Epoxy Resin	116
7.3.2 Epoxidation of Lignin After Pretreatment	117
7.3.3 Direct Epoxidation of Lignin	120

7.4	Curing Kinetics of Lignin-Based Epoxy Resins	122
7.5	Thermal Properties of Lignin-Based Epoxy Resins.	125
7.6	Summary	126
	References.	127
8	Lignin-Based Polyurethane (PU) Resins and Foams.	133
8.1	Polyurethane.	133
8.2	Biopolyols and Bio-based Polyurethane	134
8.3	Lignin-Based Polyurethane.	136
	8.3.1 Lignin-Based Polyurethane Elastomers	136
	8.3.2 Lignin-Based Polyurethane Coatings/Adhesives/Sealants . . .	138
	8.3.3 Lignin-Based Flexible Polyurethane Foams.	139
	8.3.4 Lignin-Based Rigid Polyurethane (RPU) Foams	142
8.4	Summary	151
	References.	152

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