

Contents

1	Preparation and Characterization of Lignin-Carbohydrate Complexes	1
1.1	Extraction with Hot-Water or a Dilute Alkaline Solution	1
1.1.1	Early Research into Water-Soluble Lignin-Carbohydrate Complexes	1
1.1.2	Extraction with Hot Water of Finely Divided Wood	4
1.1.3	Extraction by the Steam Explosion Technique	8
1.2	Extraction with Organic Solvents	10
1.2.1	Extraction with Dimethylformamide or Dimethylsulfoxide of Finely Divided Wood	10
1.2.2	Extraction of Alkylated Wood	13
1.2.3	Extraction with Aqueous Dioxane of Finely Divided Wood	17
1.3	Fractionation and Characterization of Lignin-Carbohydrate Complexes	21
1.3.1	Fractionation by Ion-Exchange Chromatography	21
1.3.2	Fractionation by Hydrophobic Interaction Chromatography	26
1.3.3	Characterization of Hardwood LCCs	29
1.3.4	LCCs from Other Lignified Plants	37
2	Location of Lignin Moieties Along Polysaccharide Chains in Lignin-Carbohydrate Complexes	61
2.1	Early Investigations	61
2.2	Isolation of Acidic Lignin-Carbohydrate-Complex Oligomers	62
2.3	Location of Lignins Along Carbohydrate Chains in Softwood Lignin-Carbohydrate Complexes	71
3	Formation of Lignin-Carbohydrate-Complex Micelles and Pectin/Lignin/Hemicelluloses	77
3.1	Tail Analysis of Acidic Lignin-Carbohydrate Complexes by Gel Filtration	77
3.2	Determination of the Critical Micelle Concentration of LCCs Based on Electrical Conductivity	78
3.3	Determination of the Critical Micelle Concentration of Lignin-Carbohydrate Complexes by the Colorimetric Method	79

3.4	Solubilization of Sudan III in Lignin-Carbohydrate-Complex Solution	80
3.5	Dissociation of the Lignin-Carbohydrate-Complex Micelle by Detergents	81
3.6	Pectin/Lignin/Hemicelluloses Association	82
4	Analysis of Native Bonds Between Lignin and Carbohydrate by Specific Chemical Reactions	91
4.1	Introduction	91
4.2	DDQ-Oxidation Method	99
4.2.1	Analysis of Benzyl Ether Bonds Between Lignin and Carbohydrates by DDQ Oxidation	99
4.2.2	DDQ Oxidation	99
4.2.3	Oxidative Cleavage of Benzyl Ethers with DDQ	102
4.2.4	Isolation of LCC Fragments	105
4.2.5	Binding Site Analysis of Benzyl Ethers with DDQ	105
4.2.6	Binding-Site Analysis of Benzyl Esters with DDQ	120
4.3	New Approaches to Structural Characterization of Lignin-Carbohydrate Complexes	126
5	Residual Lignin in Alkaline Pulps	131
5.1	Characterization of Residual Lignin	132
5.2	Reaction of Residual Lignins in Conventional Chemical Bleaching	161
5.3	Enzyme-Aided Bleaching of Kraft Pulps	167
5.3.1	Behavior of Xylan and Lignins in Xylanase-Aided Bleaching ..	167
5.3.2	Effect on Delignification of Other Enzymes Applied with or without Xylanases	197
5.3.3	Residual LCCs as a Target Substrate for Enzyme-Aided Bleaching	205
5.4	Effects of Lignin-Carbohydrate Bonds on Kraft Pulping	212
6	Functions of Lignin-Carbohydrate Complexes	217
6.1	Role of Lignin-Carbohydrate Complexes as a Compatibilizer of Lignin and Polysaccharides	217
6.2	Lignin-Carbohydrate Complexes as Active Components in the Intestinal Immune System: The Modulating Activity of Kampo	232
7	Microbial Degradation of Lignin-Carbohydrate Complexes ...	237
7.1	Microbial Degradation of Lignin-Carbohydrate Bonds Under Aerobic Conditions	237
7.1.1	Extracellular Free-Radical Reactions of White-Rot Fungi	237

7.1.2 Solubilization of LCCs by White-Rot Fungi and Actinomycetes	242
7.1.3 Binding-Site Analysis of Glycosidic Lignin-Carbohydrate Bonds and the Role of Glycosylation in Lignin Degradation by Wood-Rot Fungi	245
7.1.4 Degradation of Nonphenolic β -O-4 Type LCC Model Compounds with Oxalic Acid	252
7.1.5 Effect of Oxalic Acid on Lignin-Peroxidase-Catalyzed Degradation of Nonphenolic β -O-4 Type LCC Model Compounds	255
7.1.6 Structures and Enzymatic Degradation of Pectic Substances Associated with Ferulic Acid and Lignin	257
7.1.7 Reaction of Manganese Peroxidase with Residual Kraft Lignin	259
7.2 Microbial Degradation of Lignin and Cinnamic Acid Bridges in LCCs by Anaerobes	260
7.2.1 Cinnamic Acid Bridges in LCCs of Plant Cell Walls	260
7.2.2 Coupling of Cinnamic Acids with Lignin During Cell Wall Formation	265
7.2.3 Degradation of LCCs in Ruminant Digestion	273
7.2.4 Degradation of Feruloylated LCCs by Hydrolases from Aerobic and Anaerobic Microorganisms	283
8 Condensation of Lignins with Carbohydrates in Concentrated Sulfuric Acid	289
References	297
Subject Index	325

Association Between Lignin and Carbohydrates in Wood
and Other Plant Tissues

Koshijima, T.; Watanabe, T.

2003, IX, 329 p., Hardcover

ISBN: 978-3-540-43805-2