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3.5.1 Chemical Methods 3.5.2 Spectrophotometric Methods; 3.5.3 Methods Based on Oxidant Consumption; 3.6 Comparison of the Different Determination Methods; References; Chapter 4 Biosynthesis of Lignin; 4.1 Introduction; 4.2 The Biological Function of Lignins; 4.3 The Shikimic Acid Pathway; 4.4 The Common Phenylpropanoid Pathway; 4.5 The Biosynthesis of Lignin Precursors (the Monolignol-Specific Pathway); 4.5.1 The Biosynthesis of Other Monolignols; 4.5.2 The Transport of Monolignols; 4.6 The Dehydrogenation of the Precursors; 4.7 Peroxidases and Laccases; 4.8 The Radical Polymerization 4.8.1 Dimerization 4.8.2 Quinone Methides; 4.8.3 Lignification; 4.8.4 Interunit Linkage Types; 4.8.5 Dehydrogenation Polymer (DHP); 4.9 The Lignin-Carbohydrate Connectivity; 4.10 Location of Lignins (Cell Wall Lignification); 4.11 Differences Between Angiosperm and Gymnosperm Lignins; References; Part III Sources and Characterization of Lignin; Chapter 5 Isolation of Lignins; 5.1 Introduction; 5.2 Methods for Lignin Isolation from Wood and Grass for Laboratory Purposes; 5.2.1 Lignin as Residue; 5.2.2 Lignin by Dissolution; 5.3 Commercial Lignins; 5.3.1 Kraft Lignin 5.3.2 Sulfite Lignin (Lignosulfonate Process) 5.3.3 Soda Lignin (Alkali Lignin); 5.3.4 Organosolv Pulping; 5.3.5 Other Methods of Separation of Lignin from Biomass; References; Chapter 6 Functional and Spectroscopic Characterization of Lignins; 6.1 Introduction; 6.2 Elemental Analysis and Empirical Formula; 6.3 Determination of Molecular Weight; 6.3.1 Gel-Permeation Chromatography (GPC); 6.3.2 Light Scattering; 6.3.3 Vapor-Pressure Osmometry (VPO); 6.3.4 Ultrafiltration (UF); 6.4 Functional Group Analyses; 6.4.1 Methoxyl Group (MeO); 6.4.2 Phenolic Hydroxyl Group (OH ph) 6.4.3 Total and Aliphatic Hydroxyl Groups (R-OH)

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### Sommario/riassunto

As naturally occurring and abundant sources of non-fossil carbon, lignin and lignans offer exciting possibilities as a source of commercially valuable products, moving away from petrochemical-based feedstocks in favour of renewable raw materials. Lignin can be used directly in fields such as agriculture, livestock, soil rehabilitation, bioremediation and the polymer industry, or it can be chemically modified for the fabrication of specialty and high-value chemicals such as resins, adhesives, fuels and greases. Lignin and Lignans as Renewable Raw Materials presents a multidisciplinary overview

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