***Book review***

PULP PRODUCTION AND PROCESSING: HIGH-TECH APPLICATIONS, edited by Valentin I. Popa, Walter de Gruyter GmbH, Berlin/Boston, 2nd edition, 2020, 404 p.

The first edition of this book, published in 2013 by Smithers Rapra Technology Ltd., was received by readers with special interest, which encouraged the editor to publish a new one. The structure of the two editions is similar, but several chapters in the first edition have been replaced with new ones to reflect the progress in the field of biomass-derived feedstock valorization.

The first chapter aims to prepare the reader with regard to the content of the book by discussing the ways of implementing biorefining into the pulp industry. The concept of integral processing of phytomass (wood and agricultural) is explained and the possibilities of capitalization of this valuable resource are emphasized. The author advocates for whole fractionation and refining of phytomass and for the utilization of its components in production of high-tech biorefining products.

The second chapter deals with pulping fundamentals and processing. The basics of mechanical, semichemical, chemical, and organosolv pulping methods are briefly presented. Special attention is paid to kraft pulping, because it is the most commonly used pulping process on a global scale. It emphasizes the idea that pulp mills must be converted into integrated forest biorefineries to produce, besides pulp, higher value-added products, such as ethanol, polymers, carbon fibers, biodiesel, and so on.

Fibrous raw materials from agricultural residues are discussed in the third chapter. The importance of nonwoods as raw materials for pulp production is underlined. The methods used for obtaining fibrous materials from agricultural residues, as well as the morphological and papermaking properties of nonwood plant fibers, are presented. It is stated that biorefining of nonwoods is of high interest due to their abundance and low cost.

The latest developments in pulp bleaching are discussed in chapter four. The fundamentals of optical properties of pulp are reviewed and a discussion on unbleached pulp chromophores (residual lignin and other oxidizable structures) is included. Special attention is given to environmentally-friendly bleaching reagents, which are discussed in accordance with their importance in a multistage bleaching sequence: oxygen, peroxide and ozone. Enzyme bleaching is also described and it is considered a way of saving bleaching chemicals.

Chapter five entitled “Recent advances in processing of biomass feedstocks for high added value outlets through bio-greening pathways” includes the main results obtained by the Bioresource Technology Unit, a research and innovation group operating within the National Technical University of Athens. The biomass is processed through several pathways classified in seven technological areas: biofeedstocks, biorefineries, plant fibers, bioethanol, biohydrogen, thermo-refining and integrated biosystems. In addition, new innovative methods, products and applications are presented: hydrothermal fractionation of some lignocellulosic wastes, leafy biomass refining, a strategy of hydrogen production from lignocellulosics, plant-derived dyes and their applications, and obtaining of innovative pine oleoresin products. The chapter ends with a discussion regarding the education of researchers for greening projects skills.

Valuable biobased products obtained through hydrothermal decomposition of lignocellulosic biomass is the subject of the sixth chapter. The feedstock for hydrothermal conversion is presented and the mechanism and parameters of the hydrothermal carbonization process of biomass are briefly discussed. The main industrial and environmental applications of hydrochars (adsorbents and carbon-rich activated materials) are also presented.

The seventh chapter is entitled “Catalytic conversion of hydroxymethylfurfural and levulinic acid to biomass-based chemicals”. The chapter provides an overview on the production of hydroxymethylfurfural and levulinic acid from carbohydrates and lignocellulosics using various solvents and catalyst systems, then surveys their main derivatives and finally discusses the applications of the obtained products.

A comprehensive review of the chemistry and physics of cellulose and cellulose substance is made in the eighth chapter. The presence of such a chapter in the book is welcome due to the economic importance of cellulose as a source of high-tech products. The chapter is logically structured and begins with a convincing

presentation of the basic chemistry of cellulose. This section insists on the supramolecular structure of cellulose as the most studied area of investigation in polymer science. The epimolecular characteristics of cellulose and lignocellulose materials are discussed in a particular approach. As water is the key component in controlling the formation and behavior of cellulose and cellulosic materials, a large section of the chapter is dedicated to interactions between cellulose and water. Finally, the H-bond formation ability of cellulose and hydration bonding/antibonding processes are discussed.

Chapter nine deals with the wood and nonwood fibers used in fibrous structures in common and high-tech applications. The structure of the chapter and its content express the point of view of a senior researcher in science and engineering of papermaking. Valuable information on pulp fiber properties and on their behavior during the main processes involved in papermaking is included. Special attention is given to refining of cellulosic fibers, being known that refining induces major changes in individual fibers and in the fibrous structure as well. New high-tech applications found in paper-based microfluidics and paper-based electronics are also presented.

A broad overview of the state-of-the-art in the field of cellulose-based hydrogels for medical usage is the objective of chapter ten entitled "Cellulose-based hydrogels: design, structure-related properties, and medical applications". It incorporates most recent and solid research regarding the fundamental aspects, design, manufacturing approaches, and main characteristics of cellulose-based hydrogels, with application in the biomedical area.

Chapter eleven deals with a challenging field of research and application – nanocelluloses. The diversity of their properties, together with the variety of cellulose sources, leads to a vast array of industrial applications of nanocelluloses. The chapter begins with a description of structural characteristics of cellulose, followed by some considerations regarding the preparation and characterization of nanocelluloses. A useful discussion on the nomenclature used to designate cellulose nanomaterials is included in order to specify the meaning of the terms and avoid confusion. Considerations are made regarding cellulose nanocrystals (cellulose whiskers) in terms of isolation processes and their properties. Similarly, the processes involved in obtaining cellulose nanofibrils are described. The wide range of utilization of nanocelluloses is discussed, with a focus on biomedical applications.

New information on ionic derivatives of cellulose, with emphasis on advances in synthesis, characterization and applications, is provided in chapter twelve. The classes of cellulose ionic derivatives (anionic, cationic and nonionic) are reviewed. The most important categories of anionic derivatives (sulfate derivatives, phosphate derivatives and carboxylic derivatives) are largely presented. Recent applications of ionic derivatives of cellulose, such as cell encapsulation, drug delivery systems and anticoagulant products, are discussed. New products developed from cellulose derivatives (nanofibers, 3D bioprinting materials, orthopedic biomaterials and membranes and films for high-tech applications) are also presented.

One of the most important applications of cellulose esters refers to optical films used for liquid crystal displays. Chapter thirteen deals with state-of-the-art methods used to control the optical anisotropy of cellulose esters. Important characteristics of cellulose esters for optical films are introduced, such as material design by chemical modification, utilization of crystalline parts for good processing capacity and capability to accept various organic compounds with low molecular weight. Prior to their explanation, the basics of optical properties, especially orientation birefringence and its wavelength dispersion, are presented.

The book *Pulp Production and Processing – High-Tech Applications* edited by professor Valentin I. Popa contains the work of 26 prominent specialists in pulp, paper and cellulose derivatives from 7 countries. It is a useful tool for scientists, postgraduates and students working in the field of renewable resources processing. The volume may not only help in research and development, but also may be suitable in teaching. We invite you to read this book and contact the editor for any new idea or any cooperation you might consider, as this represents the viable path towards extended implementation of biomass-derived feedstock processing for high-tech applications.

Dan Gavrilescu and Adrian Cătălin Puiţel