

WOOD FIBERS FOR PAPERMAKING, Maria Cristina Area and Valentin I. Popa, Smithers Rapra Technology Ltd, Shawbury, Shropshire, SY4 4NR, UK, 2014, 106 pp., ISBN 978-1-90903-086-2

Paper is one of the oldest known and probably the most used bio-based material. Having multiple uses, from information support to high-tech material, it has become an important part of our everyday life. The book "Wood Fibers for Papermaking", authored by Maria Cristina Area and Valentin I. Popa, is dedicated to the most intensively used raw material source of the papermaking industry and it is aiming at reviewing the most important characteristics of this fiber source.

Chapter 1, *Natural Forests and Forest Plantations*, outlines the most important points in the timeline of wood use as fiber source for the papermaking industry. Natural coniferous forests have historically been an important log source and have been preferred due to the purity of the forests and also due to good characteristics of the fibers. The increase of raw material demand at the beginning of the 1950's has turned the interest of the paper industry towards usage of hardwoods. Overcoming some technological problems related to the diversity of species in natural forests and to the differences in fiber dimensions has led to an increase in hardwoods usage for pulp production to over two thirds of the total wood quantity used for pulping.

The concern for overexploitation of natural forests and the increase of wood consumption in the papermaking field has determined the implementation of forest plantations as a method of ensuring the raw material supply. The most important criteria in the selection of tree species are chemical composition, quality of fibers, the age of maturity and the adaptability to the environmental conditions. As an example, in the case of hardwoods, the Eucalyptus sp. are preferred in warm humid areas, while the Salicaceae hybrids are preferred in the temperate regions. Achievements in forestry practices, genetic engineering and the improvement of forest management systems have led to a share of about 38% of forest plantation wood in the total raw wood used by the pulping industry in 2004.

Nonwood fibers may complete the need of virgin fiber for the production of paper, especially in parts of the globe where wood is a scarce resource. Several alternative types of fiber sources are also discussed: natural growing plants, agricultural wastes (mainly straws and stalks) and industrial crops (bast fibers, cotton and sisal). Several potential problems in using nonwoods as fiber sources are also pointed out, together with the most used pulping processes.

The second book chapter, *Anatomy, Structure and Chemistry of Fibrous Materials*, provides the most important information on the role of tree stem as the most used part as pulping feedstock. The main anatomical features of the tree trunk and their role in the living tree are described in a comprehensive and handy manner. Chemical composition and cell structure are also outlined, together with the most important differences between softwood and hardwood species.

In chapter three, the most important categories of *Abnormal Wood* are depicted. Reaction wood is the result of a tree's reaction to the extreme or abnormal stress existing in the growth environment. While compression wood is mostly considered undesired due to lower quality fibers, tension wood fibers are generally considered acceptable. Reaction wood differs from normal wood in fiber distribution, mechanical properties and also in chemical composition. Compression wood has higher lignin content and compressive strength than normal wood. Tension wood is characterized by a higher alpha cellulose and extractives content, compared to normal wood.

Although the content of juvenile wood was not considered an important feature during the period when the pulping feedstock was ensured by naturally grown trees, its importance became obvious when the plantation forests started to become a source of raw material. The most important differences between the juvenile wood and the mature wood are cell dimensions, specific gravity and strength. These are usually lower in juvenile wood when compared to mature wood. Both juvenile and compression wood tend to generate higher consumption of pulping chemicals, lower yield and poorer quality fiber than normal or mature wood.

Paper mechanical properties may vary significantly as a result of the fibers used in the papermaking process. The fourth chapter focuses on the relationship between *Characteristics of Cells and Properties of Pulp*s. The dimensions of fibers vary significantly among tree species, as well as within the same tree.

Softwoods have been preferred in the first half of the 20th century due to the higher length of the fibers and narrower distribution in terms of fiber dimensions.

The correspondence between the fiber dimensions and some mechanical properties is briefly emphasized. It is also pointed out that the studies on the effect of fiber dimensions on paper properties have evidenced similar relationships for both wood and nonwood species. Among other factors that influence paper properties, the pulping process, yield and the intensity of refining are worth noting. Intrinsic fiber strength measured by the zero span tensile test and related to basis weight provides a measure of the fiber strength. The factors influencing paper strength are also mentioned.

At the end, the authors' final remarks reinstate the most important ideas discussed in the previous chapters. By providing key information on wood as raw material for papermaking, on the correlations between the characteristics of this renewable resource, the obtained paper properties and its behavior in different applications, the book constitutes a fundamental work of great use for all people working in the field of bio-resources.

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