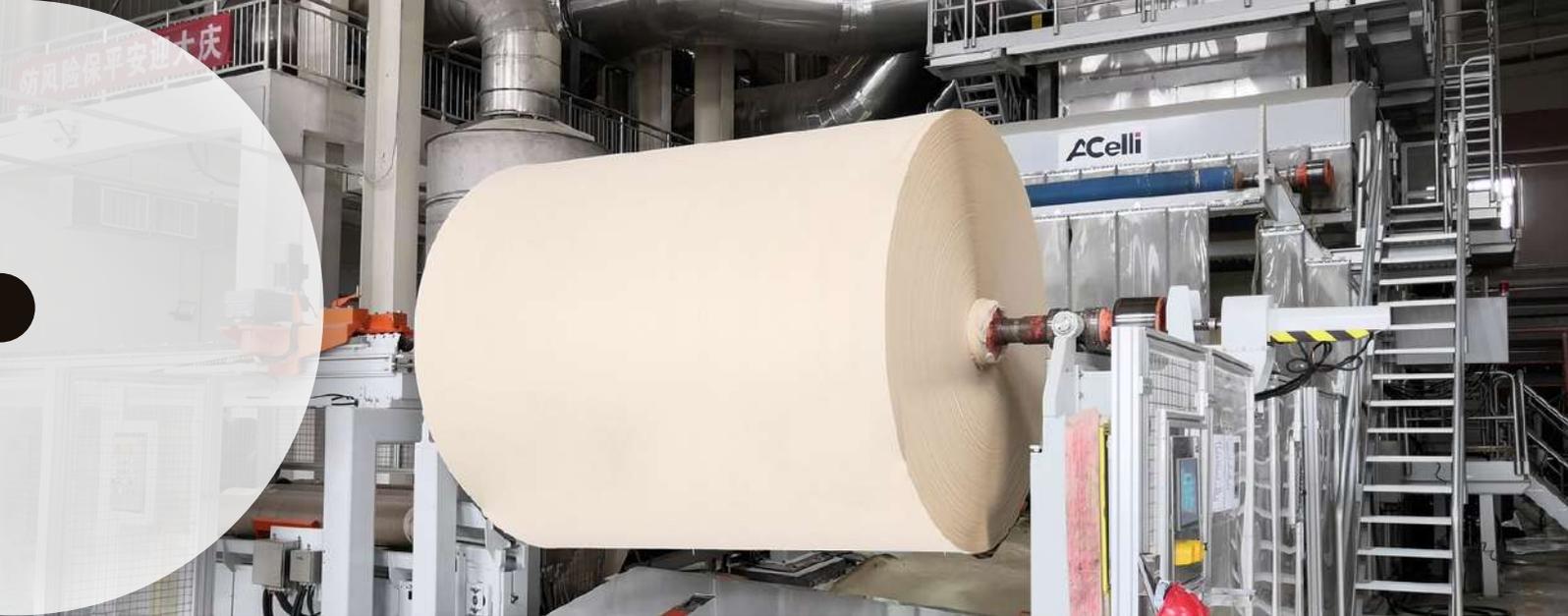


A close-up photograph of several green bamboo stalks with visible nodes and some young leaves. The background is a soft, light green gradient. A large, semi-transparent white circle is overlaid on the right side of the image, containing a faint, light green bamboo branch. A solid dark grey circle is positioned to the right of the white circle. A solid red square is located in the bottom left corner of the image.

case study

ACelli

**Paper production: the use
of bamboo to reduce the
cost of raw materials**



At the dawn of paper production and before the invention of the mechanical and chemical pulping processes in the 19th century, paper was produced using fibers from numerous materials, such as mulberry tree bark, rags, cotton, hemp and linen. Nowadays, with the exclusion of secondary fibers, the paper production process involves the use of a mix of two main types of fibers:

- **Softwood**, or long fiber
- **Hardwood**, or short fiber

Long fibers obtained from slow-growing conifers such as pine, are used to impart strength to paper, while the short fibers obtained from broad-leaved trees such as birches, acacias or eucalyptus are responsible for the bulk and softness.

As regards the current **pulp market**, it is dominated by few producers and the **price of raw materials is very unstable**. This is a significant risk factor for the profitability of paper mills which, combined with the growing attention towards the **sustainability** of production processes and resources used, leads producers to consider alternative raw materials.

WHY BAMBOO?

In this respect the most interesting non-wooden fiber is **bamboo**, a tropical herb known since ancient times for a wide range of uses, from cooking to building. In paper production, the price of bamboo pulp is in fact lower than that of traditional fibers thanks to its peculiar characteristics:

- Higher cellulose content (up to 50%)
- Faster growth rate than wood, which leads to a higher productivity of arable land
- Chemical composition that facilitate Kraft cooking process
- Possibility of being used without bleaching, thanks to its natural color

In terms of morphology, the characteristics of bamboo fibers can vary greatly depending on the species, showing properties similar to those from hardwood, softwood or even intermediate between the two. The length of the fiber varies from 1.5 to 4 mm, with a high length-to-diameter ratio, while the cell wall and the lumen are respectively thicker and smaller than the wood fibers.

THE USE OF BAMBOO TO REDUCE THE COST OF RAW MATERIALS

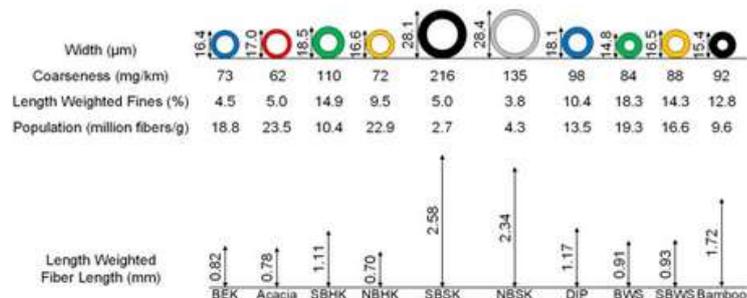


Fig.1 - Sections of various fibers*

Due to its ability to impart strength and bulk to paper, **bamboo pulp is an ideal candidate to replace hard and soft wood pulp.**

In an unrefined state bamboo can provide greater water absorbency and can be used to replace SBHK pulp, achieving similar softness. At higher refining levels, on the other hand, bamboo pulps can both impart softness and strength similar to those obtained from NBSK pulps, and replace softwood pulp to provide similar water absorption capacity at a given strength.

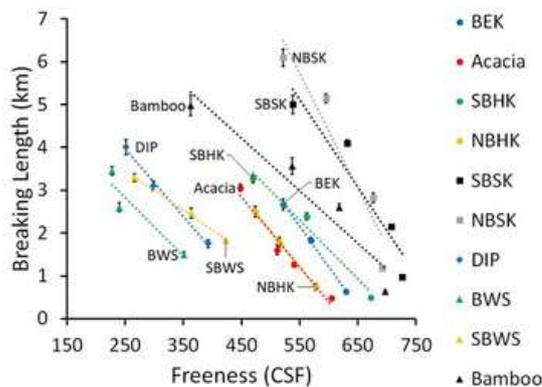


Fig.2 - Breaking length vs freeness*

The majority of the paper mills that use bamboo produce the pulp and directly feeds the machines with slush pulp: a very effective way to reduce energy costs related to drying while preserving the strength of the fibers. However, this is not the only option, as for those who cannot produce pulp it is possible to buy pre-dried pulp on the market.

*de Assis, T., Pawlak, J., Pal, L., Jameel, H., Venditti, R., Reisinger, L. W., Kavalew, D., and Gonzalez, R. W. (2019). "Comparison of wood and non-wood market pulps for tissue paper application," BioRes. 14(3), 6781-6810

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A.CELLI PAPER & YIBIN PAPER INDUSTRY: CASE STUDY



Yibin Paper Industry Co. Ltd., founded in 1944 and based in Yibin, Sichuan, is the largest newsprint paper manufacturer in western China, also active in the production of packaging paper, paper bowls and cups destined to the food market.

In recent years, Yibin Paper has fully relied on the region's abundant bamboo resources by building an integrated bamboo pulp and paper mill to turn this raw material into a competitive advantage, obtaining a win-win situation between enterprise efficiency, farmers' income, economic development and respect of the environment.

In 2017 Yibin Paper chose A.Celli for the supply of **five IDEAL® crescent former tissue machines** designed to achieve a total capacity of **130.000 tons per year of 100% bamboo paper**. As regards the technical details, two tissue machines were equipped with a 18' Steel Yankee Dryer and three with the 16' inches version, all with a web width at the pope reel of 2.800 mm and a design speed of 1800m/min. Both configurations were equipped with 1220 mm suction press rolls and steam heated hoods, plus various ancillary systems.

The **A.Celli IDEAL® solutions** have since been used with great satisfaction by Yibin Paper to produce facial and toilet bamboo paper, both with tensile strength and softness comparable to the premium tissue market standards.



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