

# Eucalyptus: Today's Preferred Short-fiber Pulp

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**E**ucalyptus is presently the most widely used short-fiber papermaking raw material in the world, and its importance is growing. For a long time, however, the story was completely different. In the beginning of its penetration into the printing and writing segment of the market, eucalyptus pulp was used only to a very limited extent as a “filler” pulp. This situation has changed radically over the last two decades. Eucalyptus pulp has dramatically gained acceptance by papermakers all over the world.

## EUCALYPT PULP'S MARKET DEVELOPMENT

Until fairly recently, papermaking was considered an art which could be learned only through a long apprenticeship. Few alternatives to the traditional pulp grades were available, with softwood pulps extensively used as the common denominator in all paper grades. Scandinavian birch, southern mixed hardwoods and northern hardwoods (all of them from native forests) were used in varying percentages in the furnishes of a variety of paper grades — from commodity CPO and converting grades to premium printing papers.

The rapidly-growing demand for better quality and the increasing need for specialty paper grades, have pushed producers to implement fundamental and applied research with the objective of being able to offer new pulp and papermaking alternatives.<sup>2-8</sup> Many technical marketing presentations were conducted in order to show how distinctive eucalyptus pulps were and how suitable they were for uncoated free sheets and fine papers.<sup>9-18</sup> Many discussions focused on describing the distinctive differences between all the various hardwood fibers. Each species of tree offers a different fiber morphology and chemical composition, which in turn has a great impact on the final product, making each one more or less attractive — depending upon the grade of paper being produced.<sup>19</sup>

In this context, eucalyptus pulp was first introduced as a market pulp in the early 1960s and even in the late 1970s it was considered a “new pulp”,<sup>20</sup> since many of its properties were not well understood and very little had been written about it or discussed at conferences. Since then, and through extensive experimentation, aided by some

fundamental work, mostly on pulp refining, papermakers have recognized that eucalyptus is indeed a very special fiber. Currently, bleached eucalyptus pulps are recognized for their ability to produce good formation, softness, surface smoothness, high opacity and especially good bulk (**Figure 1**). Of course, eucalyptus pulps had to be used in high enough percentages in the furnish to be able to make a significant impact. These fiber attributes translate into a number of desired paper properties in combination, which more recently have also led to the successful development of thinner lightweight opaque grades as well as stiffer printing paper grades.

Eucalyptus now continues its steady growth for several reasons. A major one is the low wood cost: The plantation growing of eucalyptus trees in Brazil can be carried out all year round. Superior seedlings and cloned trees produce harvestable trees in 5-7 years, which is about ten times as fast as the growing rates in Scandinavia and Canada. In addition, the development of cloning techniques means that the best trees can be selected and propagated with greater efficiency, which translates into very uniform fiber quality. But another even more important factor is the combination of distinctive **fiber properties**.<sup>9-19</sup> Brazilian eucalyptus fiber has much greater uniformity, fewer undersized fibers and fewer overly long fibers than other hardwood and softwood market pulps (**Figure 2**). This helps to explain the extremely good formation papermakers can get from the paper sheet made from eucalyptus fiber. Eucalyptus exhibits a population of 20 million-plus fibers per gram of pulp, whereas Scandinavian birch and northern hardwoods have 8-9 million and southern US hardwoods (which are coarser) about 5 million (**Figure 3**). Moreover, eucalyptus has a lower fines content, which gives it this interesting combination of properties, influencing the performance of paper machines.

Consequently, producers have become used to increasingly greater proportions of eucalyptus in their furnishes. Today it is well-established fact that the use of eucalyptus offers several advantages in the production of fine papers. Therefore, printing and low-grade wrapping papers are today commercially manufactured from up to 100% eucalyptus.<sup>2,9,10</sup> Tissue producers have also stepped up



their demand for eucalyptus, as quality demands increase — and if any grade has growth potential, it's tissue.<sup>21</sup> Tissue producers have learned that Brazilian eucalyptus has the unusual ability to produce tactile softness when layered on the surface, which quickly became its outstanding attribute.<sup>1</sup> Therefore, eucalyptus has established itself as a leading market pulp grade, commanding an established premium over mixed hardwood pulps.<sup>21</sup>

## THE EUCALYPTUS: A RENEWABLE RESOURCE

There are over 700 varieties of eucalypt species but only about 20 have been exploited commercially and fewer than a dozen are presently of economic importance. It is widely promoted for the following reasons:<sup>22-23</sup>

- It is a fast-growing tree, which enables it to be used for short-term purposes.
- It is tolerant of climate, arable land and infertile soil even when there is a 2-3 month or longer rainy season.
- It is highly resistant to disease, and easy to grow. In addition, animals do not eat its leaves, so it is easy to care for when young.
- Its wood is useful in many ways. It is suitable for dimension lumber, for processing as plywood, for papermaking pulp, for firewood, construction and charcoal.
- It can also be used as a wind-break, for perfume-making, bee raising, etc.

## EUCALYPTUS: A VERY SPECIAL TREE<sup>24-25</sup>

- Reduces the need to cut tropical forests and protects their fauna
- Restores soil that has been exhausted by crop overplanting and fires
- Controls soil erosion
- Regenerates degraded regions
- Contributes to regulating the flow and quality of water resources
- Stabilizes the soil, promoting water retention
- Absorbs large quantities of CO<sub>2</sub> from the atmosphere, decreasing pollution, global warming and assists in combating the greenhouse effect
- Is productive without being harmful to nature
- Maintains soil coverage through the deposit of forest residues
- Supplies raw materials for products that are indispensable to maintaining lifestyles
- Is a major source of economic and social wealth

Why Eucalyptus appears ideal for fine and tissue papers: The properties of the eucalyptus species are acknowledged worldwide for the benefits they provide to papermaking. The fiber morphology of eucalyptus is quite distinctive.

## EUCALYPTUS: A SPECIAL FIBER<sup>16, 19, 26</sup>

- Fiber length is relatively short. Depending on the way it is measured (light microscope or optical electronic devices) typical fiber length can be as low as 0.65 mm. European species such as birch, aspen, beech and oak are 15 – 40 per cent longer.
- Fiber coarseness is the lowest of the traditional market pulp fibers.
- Number of fibers per gram is high, as a consequence of short fiber length and low coarseness (in the range of 20 million plus).
- Eucalypt fibers resist collapse: not only are they slender but their wall thickness is also relatively high.
- The internal architecture of eucalypt fibers is also different: basic fiber wall components (called microfibrils) show a low winding angle with fiber axis when compared with other hardwoods.

As a result of these distinguishing characteristics, eucalyptus pulp has the following advantages in terms of most paper properties:

- Uniform paper formation and high opacity are important for all grades of fine papers. The inherent high number of fibers per gram and short fiber length are critical characteristics in this respect. Using eucalyptus has allowed papermakers to consistently produce premium quality grades of paper.
- Bulk and stiffness are critical for board or non-impact printing papers. Eucalypt has been found to be very suitable for such uses.
- Smoothness is one of the most sought after properties in coated papers, especially art papers having a matt finish, for which surface defects diminish print quality. Low coarseness requires the use of eucalyptus when high quality is desired.

Softness is unquestionably the most desirable characteristic in facial tissue papers. In this respect, none of the other commonly used market pulps can compare to eucalyptus for its high number of fibers and low coarseness.

## WHAT DOES THE FUTURE LOOK LIKE?

Prospects for the eucalyptus fiber are good. Europe's printing and writing paper producers, in particular, have been increasing their consumption of eucalyptus. This can be explained by the following aspects: there is little new northern bleached softwood kraft (NBSK) capacity on the horizon while, on the other hand, new eucalyptus production capacity has been increasing continuously,<sup>18,27</sup> thanks to the very low wood cost of eucalyptus and its unique fiber properties.

Eucalyptus has become the benchmark hardwood grade and, as the largest producer of eucalyptus pulp worldwide. Latin American producers are in the enviable position of being able to offer competitive high-quality fiber. They



have adopted the use of the best available forest management practices. These practices are in accordance with sustainable forest principles, have developed exceptionally fast plantation growth rates, and enjoy continuously improving cost structures.

Currently, several genetic improvement methods are being employed to produce advanced generations of eucalyptus and hybrids. These newly developed techniques, building upon the fact that eucalyptus is a particularly responsive species, associated with the fact that it has been very little improved to date in comparison with other cultivated plants, assure customers that new improvements will be soon forthcoming, which will continue to contribute to competitiveness.<sup>29</sup> Moreover, the benefits of biotechnology in forestry (e.g., eucalyptus' shorter rotation), both economic and ecological, are potentially very promising.<sup>30</sup>

Acacia papermaking pulps, which have now made their way onto the world scene, are a potential competitor of eucalyptus, especially in Southeast Asia. For the foreseeable future, however, the acacia supply as a single species pulp appears to be available only in limited quantities. The use of acacia as a crop for woodpulp may take a somewhat longer time than eucalyptus to become well-established in all parts of the global marketplace.

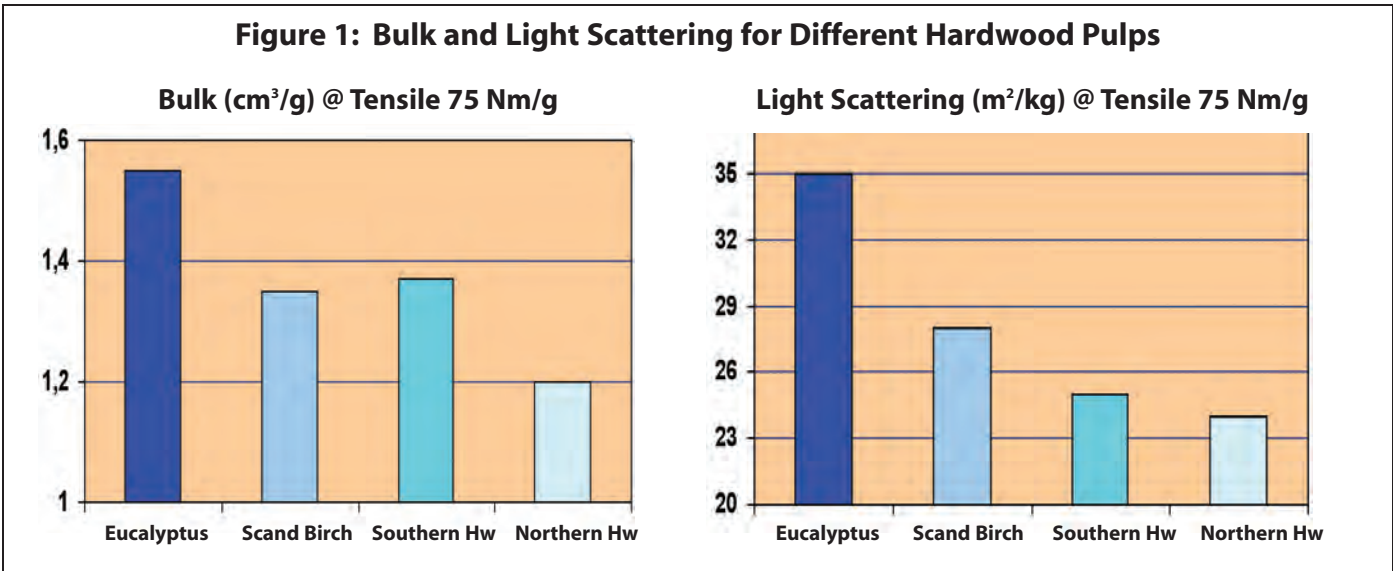
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**Figure 1: Bulk and Light Scattering for Different Hardwood Pulps**



**Figure 2: Uniformity of Fiber Length: Eucalyptus vs. Scandinavian Birch and Pine**

