PRESENT STATUS IN THE UTILIZATION OF EUCALYPT WOOD FOR PULPING IN BRAZIL.

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1 - INTRODUCTION

There is no doubt that eucalypts, among the hardwoods, have recently acquired considerable importance as fibrous raw materials. However, in view of the fact that there are about 600 species of the genus *Eucalyptus*, it is difficult to generalize in discussing eucalypt as a source of fibers.

DADSWELL & STEWART, 1962, reported that all eucalypts can be pulped satisfactorily by the standard pulping processes, but yields and chemical consumption are influenced by the amounts of extraneous materials present. The best results are obtained with those samples where the alkali soluble content is low. Young plantation-grown material is often more suitable than over-mature wood. For assessment of pulping quality of the wood, it is suggested that specific gravity be low or medium (between 0,35 and 0,60 g/ cm^3).

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The genus *Eucalyptus* is indigenous to Australia and neighbourhoods. Although there are several hundred species, only a small number has economic importance.

Eucalyptus was first described by L'Heritier in 1789. The spreading of eucalypts through the world started by 1850, when seeds were sent to Europe . The species developed very well in many of the new"habitats", particularly those with warm and relatively dry climate. Extensive plantations of suitable species were made in countries bordering the Mediterranean sea, South America and South Africa.

The first planted eucalypt homogeneous stands showed good rate of growth, ease propagation,resistance to insects and diseases, no special problems with forest management, and the wood had good quality for sleepers,poles, firewood and charcoal. The utilization of eucalypts as pulpwood developed somewhat later and now-a-days it has acquired its maximum importance.

In Brazil, eucalypts were first planted about 70 years ago, with amazing results. In 1904, Navarro de Andrade introduced seeds of *Eucalyptus* in our country and stablished experimental plots in parks which belonged to a railroad company. The purpose was to use the wood as fuel , railway sleepers and poles. However, the development of other energy sources, such as fuel oil and electric power , replaced the first purposed eucalypt wood utilization. The availability of these forests attracted the attention of the pulp and paper industry.

The first pulping investigation with Brazilian eucalypt was made in 1925 - 1927 at the Forest Products Laboratory, in Madison, Wisconsin, USA. Wood obtained from trees of *Eucalyptus saligna* (15 year - old) and *E. tereticornis* (13 year - old), grown in the state

of São Paulo, were pulped at the F.P.L. by the sulphate, soda, sulphite and mechanical processes. The results were encorageous, specially those obtained with alkaline and sulphite processes.

The first eucalypt pulp mill in Brazil was put in operation in 1927 - 1928 by Gordinho Braune S.A . It was a 10 ton/day sulphite mill.

However, during the period 1930 - 1955 ' very little material on the pulping of eucalypt was published in the world literature. At the end of the fifty's, eucalypt wood was relatively unknown as pulping raw material. Now, after 20 years, this wood is highly pulped in many countries and this utilization grows day-a-day.

The knowledge developed over the past two decades in the growing and pulping of suitable eucalypt species has supported the confidence of the pioneers and eucalypts are now looked as one of the important pulpwoods of the future (WATSON & COHEN, 1969).

Brazil was one of the first countries to utilize eucalypts for the production of paper pulp.

Recently, a large number of pulp and paper mills have entered in commercial operation and today, many more are in instalation or in project.

The dominant pulping process for eucalypt wood is the sulphate or kraft. Bleached kraft pulp with 90-92 % brightness and good strength can be made from eucalypt wood.

The participation of eucalypt pulp on the total country pulp production is increasing sharply, as it is shown in table I.

TABLE: I: Brazilian pulp production (1000 metric tons.), (2)

Year	1950	1955	1960	1965	1970	1971	1972	1973	1974	1975
Total pulp production	40	73	200	370	664	721	898	971	999	1047
Eucalypt pulp	1,3	4,7	89	203	385	429	589	641	682	747
% of eucalypt pulp over total	3	6	45	55	60	60	65	66	68	71

The most important species are *Eucalyptus saligna*, *E. grandis* and *E. alba* (*E. urophylla*), but *E. robusta*, *E. tereticornis*, *E. globulus* and *E. camaldulensis* are also pulped. Potential high wood specific gravity species are *E. citriodora*, *E. paniculata* and *E. maculata*.

Brazil now ranks as one of the larger producers of eucalypt pulp, both in the unbleached or bleached grade. Mechano-chemical pulp or chemigroundwood pulp are also developing industries.

Many grades of writing and printing paper are made from 100 % eucalypt pulp and they show good strength and high opacity. Eucalypt paper has also proved its suitability for coated paper manufacture.

2 - PROPERTIES OF EUCALYPT WOOD

2.1 - Fiber morphology

Average values for fiber dimensions occur in the following ranges:

length = 0,75 - 1,3 mm; width = 15 - 20 µ, and wall thickness = 3 - 6 µ.

The ratio of fiber length to fiber width, called felting index, is variable between 40 and 80. Runkel's index of the fibers (ratio between twice the fiber wall thickness and lumen diameter) varies from less than 0,5 to 1. Such fibers give good grade pulps.

High specific gravity eucalypt wood is generally associated to thick-walled fibers, with Runkel's

index greater than 1. These fibers are usually stiff and their flexibility is low. In these cases, pulps have higher tear strength but poorer burst and tensile strengths, and other properties which depend on fiber bonding.

Coarseness of eucalypt fibers is lower than those for other hardwood pulps found in the international market. This means a comparatible higher number of fibers per gram of eucalypt pulp, almost double that of birch pulp and three times the number found in beech pulp. HASVOLD & LUND (1974) reported that in a furnish consisting of equal parts by weight of spruce and eucalypt pulps, about 85 % of the fibers are eucalypts. In a furnish containing the same number of eucalypt and spruce fibers, the weight percentage of eucalypt pulp is as low as about 10 %.

The content of undesirable vessel elements in eucalypt pulp is acceptable to the manufacture of printing papers.

Based on fiber characteristics one can expect the following properties for eucalypt pulps: good formation, high opacity, high bulk, high tensile and burst strengths and fair tear strength.

This unusual combination of good qualities makes eucalypt pulp an ideal raw material for fine paper manufacture.

2.2 - Wood specific gravity

Specific gravity of eucalypt wood is often related to species and age.

The ideal age for pulping is from 5 to 8

year-old stands. Average rate of growth of eucalypt forest in Brazil is 20 stere cubic meter/hectare/year. However, in many well-managed forests, it can grows up to 35 stere cubic meter/ha/year.

Young *E. saligna* and *E. grandis* woods have specific gravity in the range 0,4 - 0,6 g/cm^3. They yield good quality pulps.

Eucalyptus citriodora and *E. paniculata* are very dense (0,6 - 0,8 g/cm^3) and hard wood species. They are generally avoid for pulpmaking due to their high alkali requirements and lower pulp quality. However they are attractive species in some parts of the country and research and efforts should be placed in their pulping characteristics.

2.3 - Wood composition

There is a general similarity of the chemical composition of eucalypt woods and the more common hardwoods of the temperate zones. The main difference lies in the nature and amount of extractives. In general, the light-weight pale-coloured woods contain less extractives than do the denser dark-coloured woods.

Chemical composition of *Eucalyptus saligna* and *E. grandis* is shown in table II.

TABLE II: Chemical composition of eucalypt wood, (%)

Species	*E. saligna*	*E. grandis*
Hot water solubility	3,0	2,4
NaOH 1 % solubility	13,1	13,7
Alcool-benzene solubility	2,4	1,8
Lignin content	24,3	26,2
Holocelulose content	77,4	76,9
Pentosan content	17,8	17,3
Ash content	0,3	0,4

3 - KRAFT PULPING

The kraft process is by far the most common and the most suitable for pulping eucalypts.

Because of their low lignin content and also, because of their particular cellular structure, eucalypts are easily delignified. Liquor penetration is fast in all wood directions. So, alkali requirements and cooking time are low.

Wood consumption per ton of air-dry pulp

is about 5 to 6,5 stere cubic meter. Kraft pulping of eucalypt gives yields of 50 % or more, based on o.d. wood.

Most common cooking conditions to yield pulps of permanganate number of 12 to 16 are: active alkali: 12 - 16 % (% Na_2O); sulfidity = 25 %; liquor - to- wood ratio = 4 : 1, 3:1; maximum temperature = 170 - 175° C ; time to maximum temperature = 50 - 90 minutes; time at maximum temperature = 0 - 30 minutes.

Bleaching of eucalypt kraft pulps is ease. Active chlorine of 7 - 9 % on o.d. pulp brings to brightness of about 85 %.

Table III shouws the quality of mill - made kraft pulps.

TABLE III: Quality of kraft eucalypt pulps

Pulp	Unbleached		Bleached	
Mill	"A"	"B"	"A"	"B"
Permanganate number	13,5	16	-	-
Viscosity (cps)				
- C E D	-	48	7	10
- C U A M	54	-	-	-
Brightness	-	-	86	83
Pulp properties at 30°SR				
- Breaking length (m)	7.200	7.900	7.000	7.600
- Burst factor	54,2	57,2	52,0	51,2
- Tear factor	160	129	120	110
Pulp properties at 45°SR				
- Breaking length (m)	7.800	8.900	7.850	8.500
- Burst factor	56,8	66,4	56,0	59,3
- Tear factor	115	140	111	100

4 - ACTUAL KRAFT PULPING TECHNOLOGY IN BRAZIL

The pulping technology is quite variable, going from old-fashioned equipments to very sophisticated ones.

4.1 - Barking

The wood from young plantations can be easily debarked in mechanical devices such as drum - barkers or cambium-rupture type barkers. However, most common process in Brazil is hand peeling.

Since young woods can be cooked satisfactorily with bark, some mills are cooking unbarked wood. The resulting pulps are only slightly weaker than pulps from debarked wood, and the bleached pulp requires better screening.

4.2 - Chipping

There is no special problem in chipping young, green eucalypt wood. However, with increasing age and wood specific gravity, some difficulties arise, and it becomes necessary to use chippers with more power and equipped with specially designed knives.

4.3. - Chip classification

Chip classification is usually performed in flat screens.

4.4 - Digestion

Digestion of wood is performed either in small stacionary units, with direct heating, until continuous digesters with internal washing.

4.5 - Washing and screening

Both operations are generally realized on classical equipments used for other wood pulps, such as rotary filters, knotters, centrifugal screens, centri-cleaners, etc. Diffusion washing is also adopted.

4.6 - Bleaching

The first-instaled mills had sequences as C E H and C E H H to obtain brightness of 78 - 82° GE. Recent sequences as CEHEH and CEHD lead to brightness near 86° GE. The sequence CEDED, adopted in some mills, leads to 88° GE. By using the sequence CEHDED some mills have as objective to get brightness so high as 92° GE.

The dominant technology of bleaching is of the classical type: up-flow and down-flow towers, with vacuum filters for washing.

4.7 - Recovery of black liquor

Today, there are no doubts that it is

possible to concentrate eucalypt black liquor up to 62 % of solids, with normal evaporators and to burn this strong liquor in furnaces. The problems found in the operations of the first recovery units were related to the high viscosity of the concentrated eucalypt black liquor.

4.8 - Drying

Either the conventional drying systems or flash and flakt drying are operated without problems for eucalypt pulp.

5 - LITERATURE

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