ALTERNATIVE RAW MATERIALS OF CELULLOSE PULP FROM AGROFORESTRY RESIDUES

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ABSTRACT

Vegetables of alternative cultures to the agro-alimentary ones are used, for the paste manufacture for paper, with the purpose of diminishing the wood consumption and the imports of paste and paper, as well as diminishing the excesses of nourishing products that are obtained in the European Economic Community. For it species of inoculated leguminosas or with rhizobium have seted out, in order to help degraded land recovery.

After a first winter lignification, the characteristies of the raw materials (*Leucaenas*, *Chamaecytisus proliferus, Prosopis, Retama monosperma, Arundo donax and Phragmites*) has been studied.
Keywords: *Paper, Non-woody, Leucaena, Chamaecitysus proliferus, Retama, Prosopis, Arundo donax, Phagmites.*

INTRODUCTION

Soil degradation has been described as an important problem in Europe: 12% of total European land area has been affected by water erosion and a 4% by wind erosion (Van den Born et al., 2000). Among the main effects of degradation soils leads to reduce vegetative cover, decrease water quality, lower efficiency of use of water and management and increase risk from pests and diseases because lowered biological control (ICRAF, 2002). Despite proposals for a diversity of solutions and the investment of time and resources it continues to prove a substantially problem (Zalidis et al., 2002). The possible solutions involve an agricultural sustainability that using natural resources to enhance progressively the productive capacity without jeopardizing future potential. There are many studies concerning bioremediation for highly contaminated areas (Leung et al., 2000; Lombardi and Ramalho, 2003; Naidja et al., 2000; Pascucci and Kowalak, 1999). With this perspective, the use of *Leucaena* (5 varieties: *L. diversifolia, L.. collinsii, L.. leucocephala* Honduras, L. leucocephala India and L.. leucocçcephala K360), *Chamaecitysus proliferus (4 varieties:*. La Palma, Huelva, Nueva Zelanda and Australia), Prosopis (2 varieties: *P. alba, P. julyflora), Retama momosperma, Arundo donax* and *Phragmites.* in soil restoration has been studied in several countries (Sharma et al. 1998; Vanlauwe et al., 1998).

On the other hand, the use of non-woody faster-growing species for papermaking could have a great advantage that they provide remediation for the environmental problems associated with the industrial use of that vegetable species. The necessary harvesting for the suitable regrowth of plants, provides trimming residues. These wastes could be used as papermaking raw material. Trimming residues wood were formed by branches of 0.5-5 cm thickness.

MATERIALS AND METHODS

Composition of fourteen raw material from several species of agroforestry have been studied, Leucaenas: (L.diversifolia, L.colinsi, L. leucocephala India, L. leucocephala Honduras and L. leucocepha K360), Chamaecitysus proliferus: (Huelva, Nueva Zelanda,. La Palma and

Australia), Retama monosperma, Phragmites, Arundo donax and Prosopis(P. Alba and P. julyflora). samples of raw material were milled to pass a 4 mm screen, since no diffusional limitation were observed for this particle size in preliminary studies. Samples were air-dried, homogenized in a single lot to avoid differences in composition among aliquots, and stored.

Aliquots from the homogenized wood lot were subjected to moisture determination (drying at 105 ºC to constant weight) and to quantitative acid hydrolysis with 72% sulphuric acid following standard methods. The solid residue after hydrolysis was recovered by filtration and considered as Klason lignin. The moisture of wood was considered as water in the material balances.

Characterization experiments involved the following parameters:

- Physical characterization: length fiber and diameter ofm fiber.
- Chemical characterization: 1% NaOH solubles (Tappi 212) , ethanol-benzene extractives (Tappi 204), hot water solubles (Tappi 257), Klason lignin (Tappi 212), holocellulose by the Wise et al., method and α-cellulose (Tappi 203-OS-61).

We used non- wood trimmings but only wood was considered as it contained the bark, which was very thin and difficult to strip off allso, it accounted for only 1-2% of the overall mass.

RESULT AND DISCUSSION

With regard to the characterization of the raw material, a first study has been made from the effect of the plot of land , it was not significant over any parameter of biomass production so it was eliminated from the statistical analysis.

Every species and origin show a good adaptation of the earth and climate to the area of study. The growing of every species was wide coming to a stop only in winter. In table 1 we can see how the less productive species were *Retama monosperma* y *Prosopis julyflora*, following by *Leucaena colinsi.*

Table 1

Species	ligneous dry weight (t/ha)	total dry weight (to/ha)
L. diversifolia	4.83± 0.94	7.45± 1.46
L. collinsii	3.02± 0.70	3.09± 1.43
L. leucocephala	8.73± 1.04	12.87± 1.50
Ch. proliferus	1.38±0.36	2.20±0.60
P. alba	1.53±0.29	1.55±0.30
P. juliflora	0.35±0.09	0.35±0.09
R. monosperma	0 31±0.08	0 32±0.08

Length fiber of the most of the raw materials was determined as it is shown in table 2 . Length fiber between in 0.67 mm (*Retama monosperma*) and 1.16 mm (*Arundo donax*) are observed. Different types of *Leucaenas* and *Chamaecytisus proliferus* have a similar length fiber, 0.8 mm.

In order to make a chemical characterization of the raw materials, many proceeding were leaded to prepare a sample, such as stripping the bark, splintering and mashing that away, samples show homogeneous size and humidity conditions (from 0.2 mm to 0.4 mm). In the table 3, the result obtained in the chemical characterization of the raw materials used are shown. We can observe how the forteen species can be divided into four groups, *Leucaenas* (*diversifolia, colinsii, leucocephala Homduras, leucocephala India* and *leucocephala k360*), *Chamaecytisus proliferus* (*Huelva, La Palma, Australia* and *Nueva Zelanda*), *Prosopis* (*alba* and *julyflora*) and a

heteroneneous group (*Retama monosperma, Arundo donax* and *Phragmites*. Result into the group for every analysis are similar for each specie. Derivation level of the chemical parameter oscillated between the following values: 1% NaOH solubles from 16.2% (*Chamaecytisus proliferus*) to 26.1% (*Retama Monosperma, Arundo Donax* and *Phragmites*), ethanol-benzene extractives de 2.9% de (*Chamaecytisus proliferus*) a 6.2% de (*Retama Monosperma, Arundo Donax* y *Phragmites)*, hot water solubles from 2.8% (*Chamaecytisus proliferus*) to 5.6% (*Prosopis),* content of lignin from 15.3% (*Chamaecytisus proliferus*) to 22.5% (*Retama Monosperma, Arundo Donax* and *Phragmites)*, holocellulosa from 63.2% (*Prosopis*) to 78.5% (*Tagasaste*) and α-cellulosa from 39.5% (*Prosopis*) to 45.4% (*Chamaecytisus proliferus*).

Table 2

Species	Length (mm)	Diameter (micras)
Leucaena diversifolia	0.734	19.825
Leucaena colinsi	0.612	15.600
L.leucocephala Honduras	0.829	17.850
L.leucocephala India	0.875	21.538
L.leucocephala K360	0.766	20.625
Tagasaste Australia	0.742	15.975
Tagasaste Nueva Zelanda	0.790	19.988
Tagasaste la Palma	0.749	13.475
Retama Monosperma	0.630	11.463
Arundo donax	1.161	15.950
Prosopis Alba	0.561	11.500
Phragmites	0.815	11.775

Table 3

Species	1% NaOH solubles (%)	Ethanol-benzene extractives (%)	Hot water solubles (%)	Holocellulosa (%)	Lignin (%)	α-cellulosa (%)
Leucaena diversifolia	17.38	4.44	3.24	77.88	19.088	40.10
Leucaena colinsi	20.02	4.64	4.30	80.79	17.041	43.77
L.leucocephala Honduras	20.26	6.05	5.01	74.11	19.391	41.21
L.leucocephala India	18.44	4.64	3.98	75.92	21.430	44.43
L.leucocephala K360	23.41	8.19	6.81	68.34	18.396	39.41
Tagasate Huelva	16.67	2.64	2.79	79.73	16.796	45.37
Tagasaste Australia	15.55	2.17	2.96	82.16	15.706	47.65
Tagasaste Nueva Zelanda	16.15	3.43	2.99	75.36	14.838	43.59
Tagasaste la Palma	16.62	3.30	2.41	76.47	14.104	44.99
Retama Monosperma	16.93	5.03	3.84	71.76	21.498	42.75
Phragmites	34.77	6.36	5.38	64.16	23.660	35.76
Arundo donax	26.80	7.30	4.73	70.20	22.338	40.46
Prosopis Julyflora	22.56	5.30	6.49	62.77	20.601	36.55
Prosopis Alba	20.86	4.65	4.67	63.56	19.270	41.55

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