Tropical Products Institute

L51

Pulping characteristics of *Dicymbe altsoni* from Guyana

Tropical Products Institute

L51

Pulping characteristics of *Dicymbe altsoni* from Guyana

E. R. Palmer and J. A. Gibbs

December 1978

Tropical Products Institute 56/62 Gray's Inn Road London WC1X 8LU
Ministry of Overseas Development

This report was produced by the Tropical Products Institute, a British Government organisation that co-operates with developing countries in helping them to derive greater benefit from their plant and animal resources. It specialises in post-harvest problems and will be pleased to answer requests for information and advice addressed to the Director.

Palmer, E. R. and Gibbs, J. A. (1978) Pulping characteristics of *Dicymbe altsoni* from Guyana. *Rep. Trop. Prod. Inst.*, L51, iii + 8 pp.

Price £1.00, including packing and postage.
Single copies of this report are available free of charge to public bodies in countries eligible for British aid.

Tropical Products Institute
ISBN: 0 85954 0898

Contents

Summaries

SUMMARY

Pulping characteristics of *Dicymbe altsoni* from Guyana

A sample consisting of one tree of *Dicymbe altsoni* from Guyana was examined to determine its pulping characteristics. This sample was not large enough to produce definitive results, but it was considered that an indication could be obtained.

Bark content, wood density, chemical analyses and fibre dimensions are reported.

Sulphate cooks yielded 48.1% of screened pulp with a kappa number of 33.1 to 44.3% of pulp with a kappa number of 22.9.

Bleaching trials by a four-stage sequence, using successive applications of chlorine, sodium hydroxide, sodium hypochlorite and chlorine dioxide, produced pulp with a brightness of 83% (absolute scale).

It is believed that if *D. altsoni* was mixed with the six Guyanan species examined earlier, it would not make any major difference to the quantity or quality of the pulp.

RÉSUMÉ

Caractéristiques papetières du *Dicymbe altsoni* de Guyane

On a etudié un échantillon composé d'un arbre de *Dicymbe altsoni* de Guyane afin de déterminer ses caractéristiques papetières. Cet échantillon etait insuffisant pour donner des résultats definitifs, mais on a consideré qu'il etait possible d'en tirer une indication.

On a determiné la teneur en écorce, la densité du bois, la composition chimique et les dimensions des fibres.

Par cuisson au sulfate, on a obtenu une pâte classée d'indice Kappa de 33,1 avec un rendement de 48,1 % et une pâte d'indice Kappa de 22,9 avec un rendement de 44,3%.

Des essais de blanchiment en quatre phases comprenant successivement une chloration, une sodation, un traitement à l'hypochlorite de sodium et un traitement au bioxyde de chlore ont permis d'obtenir une pâte possédant un degré de blancheur de 83% (échelle absolue).

On pense que le mélange du *D. altsoni* avec les six essences de Guyane etudiées précédemment ne produirait pas de modification notable du rendement en pâte, ni de la qualité de la pâte.

RESUMEN

Características de la cocción de la *Dicymbe altsoni* procedente de la Guayana

Para determinar sus características en relación con la obtención de pasta, se examino una muestra, consistente en un árbol, de *Dicymbe altsoni,* procedente de Guayana. Si bien dicha muestra no es lo suficientemente grande para permitir obtener unos resultados definitivos, puede ser considerada como indicativa de lo que puede obtenerse.

Se dan unos datos relativos a contenido de corteza, densidad de la madera, análisis quimico y dimensiones de la fibra.

Las pastas al sulfato obtenidas tenían un rendimiento del 48,1% (pasta depurada) con un índice Kappa de 33,1 y un 44,3% con un indice Kappa de 22,9.

Los ensayos de blanqueo con una secuencia en cuatro etapas (cloro, hidróxido sódico, hipoclorito sódico y dióxido de cloro) condujeron a pastas con una blancura del 83% (escala absoluta).

Es presumible que si mezcla el *D. altsoni* con las especies de maderas de Guayana estudiadas anteriormente, no apatezcan diferencias importantes en cuanto a cantidad o calidad de la pasta.

Pulping characteristics of *Dicymbe altsoni* from Guyana

INTRODUCTION

In an earlier trial, six hardwoods from the Kereti Creek — Tiger Creek area of Guyana were evaluated. (Palmer and Gibbs, 1978). These six species came from the main concession area but in a second area *Dicymbe altsoni* (Fine leaf clump wallaba) is a major species. The purpose of the present trial was to obtain an indication of the effect of including a large proportion of *Dicymbe altsoni* in the mixture.

EXPERIMENTAL RESULTS AND DISCUSSION

The methods used in this trial were the same as those used in the earlier trial and this report should be read in association with Report L 50.

Samples

The sample consisted of four logs taken at 10%, 30%, 50% and 90% of the height of one tree. A log taken at 70% of the height of the tree was not received but since all the results were subject to the reservations due to sampling only one tree, it was considered that the required indication could be obtained from the available four logs.

Bark content

The amount of bark on each log was determined as a proportion of the whole log (wood plus bark) both by volume and by weight. The results were:

By weight 3.7% (range within tree 3.1 to 4.3)
By volume 4.9% (range within tree 4.6 to 5.4).

These values were below the average for the six species examined earlier.

Density

The density of the wood was determined as $\frac{\text{oven dry weight}}{\text{green (soaked) volume}}$. The value for the tree was 710 Kg/m^3 with a range for individual logs of 689 to 732 Kg/m^3. This value was very close to the average density of the six species examined earlier (735 Kg/m^3).

Chemical analysis

The results of proximate chemical analysis are given in Table 1.

Table 1

Chemical composition of *Dicymbe altsoni*

Alcohol-benzene extractives (%)	1.6
Alcohol-benzene/alcohol/hot water extractives (%)	6.5
Holocellulose (%)	67.1
Alpha cellulose (%)	47.9
Lignin (%)	29.6
1% NaOH solubility (%)	18.6
Hot water solubility (%)	3.5
Cold water solubility (%)	2.9
Ash %	0.6
Acid insoluble ash (%)	0.02

All values are expressed as oven dry extractives or component on oven dry unextracted wood and were within the range found for the six species examined earlier.

It was not expected that this species would be more difficult than the other six species to digest by the sulphate process.

Fibre dimensions

Fibre dimensions were determined by direct measurement of the magnified image of a dispersion of fibres from a well-cooked sulphate pulp, and the lengths were determined additionally by classification using a Bauer-McNett classifier. The results are given in Table 2.

Table 2

Fibre dimensions of *Dicymbe altsoni*

By measurement		
Length, all fibres (mm)	1.21	(0.03)
Length, whole fibres (mm)	1.37	(0.02)
Width (μm)	14.6	(0.35)
Wall thickness (μm)	4.5	(0.10)
Co-efficient of suppleness (%)	38.5	

(Figures in brackets are the standard error of the mean for each determination)

By classification:	**Weight of each fraction (%)**
Retained on screen 28	49.6
Passed 28 retained 35	17.8
Passed 35 retained 65	18.4
Passed 65 retained 200	4.6
Passed 200 (by difference)	9.6
Calculated length (mm)	
Without fines	1.05
With fines	0.98

These results were within the range found in the other six species.

Pulping and pulp evaluation

Three sulphate cooks with different degrees of severity made on this sample yielded from 48.1% of screened pulp with a kappa number of 33.1 for the least severe conditions to 44.3% of screened pulp with a kappa number of 22.9. These yields and kappa numbers were a little higher than those obtained when pulping the mixture of species (see Table 9 in report L50). The full details of the digestion conditions and the yield of pulp are given in Table 3.

The pulps were evaluated by standard methods. The strength of the pulp interpolated at 500 and 300 Canadian Standard freeness (CSf) are given in Table 3 and full pulp evaluation results in Table 4. The bulk of the pulp from *D. altsoni* was lower,

Table 3

Dicymbe altsoni — **Sulphate digestion conditions**

Pulp yields and pulp evaluations

Cook Number		MK358	MK347	MK357
Digestion conditions				
Active alkali as Na_2O% oven dry wood		17.5	30	20
Sulphidity, %,		25	25	25
Liquor to oven dry wood ratio		5:1	5:1	5:1
Maximum temperature, °C		170	170	170
Time to reach maximum temperature, hours		2	2	2
Time at maximum temperature, hours		2	2	3
Chemical consumption				
Active alkali consumed as Na_2O% oven dry wood		13.4	14.8	15.2
Yield of pulp				
Yield of oven dry digested pulp % oven dry wood		48.8	46.1	44.3
Yield of oven dry screened pulp % oven dry wood		48.1	45.9	44.3
Yield of screenings (on 0.15mm slits) % oven dry digested pulp		1.4	0.4	0.1
Pulp evaluation				
Kappa number of screened pulp		33.1	28.0	22.9
Beating time in PFI mill, minutes	500 CSf	3.4	4.0	3.4
	300 CSf	8.1	7.5	7.5
Bulk, cm^3/g.	500 CSf	1.88	1.84	1.81
	300 CSf	1.74	1.74	1.68
Density, g/cm^3	500 CSf	0.53	0.54	0.55
	300 CSf	0.57	0.57	0.60
Air resistance, Gurley, $100cm^3/6.45cm^2$, seconds	500 CSf	0.8	1.2	1.0
	300 CSf	11	9	9
Tensile index, Nm/g	500 CSf	74	75	72
	300 CSf	88	85	85
Burst index, $kPam^2/g$	500 CSf	3.6	3.6	3.4
	300 CSf	5.1	4.7	4.5
Tear index, $mN.m^2/g$	500 CSf	8.7	8.6	8.6
	300 CSf	10.0	10.5	9.5
Double folds, Kohler-Molin, 7.85N load	500 CSf	33	35	30
	300 CSf	240	115	66

the bonding strengths slightly lower and the tearing strength slightly higher than pulps made from the mixed hardwoods.

The precise effect of including *D. altsoni* in a mixture of pulpwoods would depend on the proportion of *D. altsoni* and which species of the mixture would be replaced, but the results obtained indicate that its inclusion would not make a major difference.

Bleaching and bleached pulp evaluation

The pulp with the lowest kappa number was bleached in four stages using successive applications of chlorine, sodium hydroxide, sodium hypochlorite and chlorine dioxide. The yield of bleached pulp was 42.3%, which represents a loss in yield of about 4.5% of unbleached pulp, and the brightness of the pulp was 83% (absolute scale). Details of the bleaching conditions are given in Table 5.

Compared with the bleaching trials on the mixture, the chlorine consumption was higher, as was expected because of the higher kappa number, and the brightness was a little higher.

The strength of pulp was determined and the strength values interpolated at 500 and 300 C.S.f are given in Table 5 and in full in Table 4. The bleached pulp from *D. altsoni* was less bulky, had about the same bonding properties and slightly higher tearing strength than bleached pulp from the mixture of six species.

Table 4

Dicymbe altsoni

Unbleached sulphate pulp evaluation
Beaten in P.F.I. mill

	Beating time min	Canadian Standard freeness	Drainage time sec	Air resistance, Gurley $100cm^3/6.45cm^2$ sec	Bulk cm^3/g	Density g/cm^3	Burst index $kPam^2/g$	Tensile index Nm/g	Stretch per cent	Tear index $mN.m^2/g$	Double folds Kohler-Molin 7.85N load	Brightness Elrepho 457nm filter Absolute scale	Printing capacity per cent	Specific scattering co-efficient
Unbleached														
MK 358	0	660	4.5	0.2	2.72	0.37	0.9	27	2.5	3.4	1	16		
Yield of screened pulp 48.1%	1	620	4.8	0.3	2.19	0.46	2.2	55	2.9	6.1	6	14		
Kappa Number 33.1	3	520	5.0	0.7	1.90	0.52	3.4	72	3.2	8.5	28	13		
	5	430	5.6	1.5	1.81	0.55	4.1	80	4.4	9.4	65	12		
	7	340	6.2	5.0	1.76	0.57	4.8	86	4.2	9.8	151	12		
MK 347	0	660	4.5	0.2	2.82	0.35	0.9	25	1.0	3.4	1	17		
Yield of screened pulp 45.9%	1	625	4.8	0.4	2.22	0.45	2.2	54	2.2	6.2	6	15		
Kappa Number 28.0	3	550	5.0	0.8	1.91	0.52	3.2	70	3.3	8.1	22	14		
	5	445	5.4	1.8	1.79	0.56	4.1	78	3.6	8.9	52	13		
	7	330	6.4	6.2	1.75	0.57	4.6	84	4.2	10.4	100	13		
MK 357	0	665	4.6	0.2	2.66	0.38	0.9	30	4.0	3.4	1	16		
Yield of screened pulp 44.3%	1	635	4.7	0.4	2.09	0.48	2.2	54	3.1	5.8	7	14		
Kappa Number 22.9	3	525	5.0	0.8	1.84	0.54	3.2	70	5.2	8.4	24	13		
	5	410	5.8	2.6	1.72	0.58	4.2	79	4.6	9.0	58	13		
	7	320	6.6	6.8	1.69	0.59	4.4	84	4.6	9.4	78	13		
Bleached														
MK 357	0	605	4.7	0.2	2.67	0.38	1.0	34	1.6	3.7	1	76	83	479
	1	590	4.6	0.4	2.15	0.46	2.1	50	2.7	6.8	6	74	81	403
	3	510	5.0	1.0	1.87	0.54	3.1	65	3.6	8.4	22	74	79	369
	5	415	5.5	1.6	1.78	0.56	3.4	70	4.2	9.7	42	73	78	360
	7	315	6.6	7.6	1.65	0.61	4.3	77	4.5	10.1	85	73	79	360

Table 5

Dicymbe altsoni

Bleaching conditions and bleached pulp evaluation

Cook Number		MK357
Yield, unbleached screened pulp % oven dry wood		44.3
Kappa number of unbleached screened pulp		22.9
Bleaching		
1. Chlorination for 1 hour at 20°C, pulp consistency 3%		
Chlorine applied as Cl_2% oven dry unbleached pulp		6.1
Chlorine consumed as Cl_2% oven dry unbleached pulp		5.63
2. Alkali extraction for 1 hour at 60°C, pulp consistency 6%, NaOH% oven dry unbleached pulp		3
3. Hypochlorite for 2 hours at 35°C, pulp consistency 6%, sodium hypochlorite		
as available chlorine % oven dry unbleached pulp		1.0
Available chlorine consumed % oven dry pulp		0.95
4. Chlorine dioxide for 3 hours at 70°C, pulp consistency 6%		
ClO_2 applied as Cl_2 equivalent % oven dry unbleached pulp		2.63
ClO_2 consumed as Cl_2 equivalent % oven dry unbleached pulp		2.38
Total chlorine applied as Cl_2% oven dry unbleached pulp		9.73
Total chlorine consumed as Cl_2% oven dry unbleached pulp		8.96
Yield		
Oven dry bleached pulp % oven dry unbleached pulp		95.5
Oven dry bleached pulp % oven dry wood		42.3
Pulp evaluation		
Brightness, Elrepho 457 nm filter, absolute scale		83
Specific scattering co-efficient, unbeaten pulp		479
Beating time, mins	500 CSf	3.3
	300 CSf	7.2
Bulk, cm^3/g	500 CSf	1.86
	300 CSf	1.65
Density, g/cm^3	500 CSf	0.54
	300 CSf	0.61
Air resistance, Gurley, 100 cm^3/6.45 cm^2, secs	500 CSf	1.1
	300 CSf	10
Tensile index, Nm/g	500 CSf	66
	300 CSf	78
Burst index, $kPam^2/g$	500 CSf	3.2
	300 CSf	4.3
Tear index, $mN.m^2/g$	500 CSf	9.7
	300 CSf	10.1
Double folds, Kohler-Molin, 7.85 N load	500 CSf	24
	300 CSf	89
Printing opacity, %	500 CSf	79
	300 CSf	79
Specific scattering co-efficient	500 CSf	369
	300 CSf	360

CONCLUSIONS

(1) The results of this examination could be only a broad indication of the pulping properties of *Dicymbe altsoni* because the sample comprised logs from only one tree.

(2) The proportion of bark was below the average for six species of hardwoods from Guyana previously examined.

(3) The density, 710 Kg/m^3, was very close to the average for the six species.

(4) Chemical analysis showed 67.1% holocellulose, 47.9% alpha-cellulose, 29.6% lignin. These and all other values determined were within the range found for the six species.

(5) The fibre dimensions were within the range found for the six species.

(6) The sample was pulped by the sulphate process and the quantity and quality of the pulp was close to the quantity and quality of pulp obtained from a mixture of the six hardwoods.

(7) The most severely cooked pulp was bleached in four stages using chlorine, sodium hydroxide, sodium hypochlorite and chlorine dioxide. The quality of the pulp was close to the quality of the bleached pulp from the six species.

(8) It is not possible to predict what would happen if *D. altsoni* was added to the mixture or replaced some part of it, without information about the proportions of each species in the mixture, but there was nothing in these results to indicate that the inclusion of *D. altsoni* would cause a major change in either the pulping conditions or the quality of pulp obtained.

Reference

PALMER, E. R. and GIBBS, J. A. (1978) Pulping characteristics of six hardwoods from Guyana. *Rep. Trop. Prod. Inst., L 50* (in press).

Printed in England for Her Majesty's Stationery Office by Hobbs the Printers of Southampton
(1694) Dd0543646 1M 10/78 G3313