

Nonwood Fiber Content Papers - Part 2: Unbleached Papers Physical Properties

[Robert W. Hurter](#), P.Eng., MBA, President, [HurterConsult Incorporated](#)
April 2002

The data contained in the following table is from an excellent paper entitled "Industrial Experiences & Problems Involved In Stock Preparation & Papermaking Utilizing Non-Wood Fibrous Materials", written by D.K. Misra, Thessalian Pulp & Paper Industries Ltd., Larisa, Greece, and published in 1975 in the TAPPI Non-Wood Plant Fiber Pulping Progress Report No. 6.

This data was developed from tests on commercially produced paper and paperboards which were available at the time. Some of this data likely is a little outdated due to advancements in paper machine design such as improvements in Fourdrinier drainage and the development of twin wire paper machines and no-draw press sections, all of which allow for a high nonwood fiber fraction in the furnish. Nevertheless, this actual mill data still offers a valuable insight into the potential use of nonwood fibers in papermaking.

Unfortunately, since this paper was presented, no one has undertaken a similar ambitious project to determine the characteristics of currently available nonwood fiber content papers. With the renewed interest in nonwood fibers for papermaking in North America and Europe, perhaps the time has come for a research organization to undertake such a project.

The following table provides physical properties of **unbleached papers** produced from nonwood pulps. Even using pre-1975 technology, a few points to consider include:

- breaking length and tear factor of papers produced using the selected nonwood fiber pulps are low compared to paper produced with 100% woodpulp, which is expected based on the properties of the nonwood pulps used
- sack papers produced with 34-35% **bagasse** pulp in the furnish register a lower breaking length compared to sack paper produced with 100% woodpulp. However, by increasing the basis weight of this paper by 10-15%, comparable values can be obtained. And, using a "Clupak" extensible unit significantly improves the overall strength properties of sack paper.
- Kraft paper produced from **bamboo** pulp has lower strength values compared to kraft paper produced with 100% conventional long fiber, unbleached kraft woodpulp. Various **bamboo** MF and MG kraft papers are produced in India and China mostly for wrapping and grocery bag purposes, and, for this requirement, the strength properties are reasonably acceptable. However, it should be noted that Misra's paper did not indicate the species of **bamboo** which were used in the papers tested. Given the wide range of bamboo species which could be used (see [Bamboo - A Fiber Resource with Great Potential](#)), it is conceivable that properly selected species of **bamboo** would provide different, higher strength results for **bamboo** papers. It is worthwhile to note that three U.S.-based paper companies introduced lines of uncoated freesheet printing and writing papers during the 1990's using **bamboo** market pulps purchased from Asian locations, that some of the **bamboo** papers were produced using a 100% **bamboo** pulp furnish, and that these papers had strength properties similar to woodpulp papers.
- strength properties of MG kraft paper produced with 50% **wheat straw** pulp and with 70% **bagasse** pulp are favourably comparable to those produced with 100% kraft woodpulp
- strength properties of 100% **rice straw** kraft paper are low and this paper may have been acceptable for

local markets only. It is unlikely that a 100% **rice straw** furnish would be used and more likely that some softwood kraft would be added to improve strength properties.

Physical properties of unbleached papers produced with nonwood pulps										
Paper Grade	Furnish	Basis Weight (g/m²)	Ash (%)	Thickness (microns)	Breaking Length (m)	Burst Factor	Tear Factor	No. of Folds	Porosity (sec/100cc)	Cobb (g/m²)
Bagasse Content Papers										
Sack paper	34% bagasse	74.0	0.9	145	4880	36.9	113.0		18	31
Sack paper	35% bagasse	78.7	1.0	160	4590	25.4	112.0		22	40
Sack paper	40% bagasse	90.6		135	4300	23.3	112.5			
Linerboard	36% bagasse	130.6	1.0	225	5080	33.8	110.0			34
Linerboard	36% bagasse	240.1	0.9	380	5460	39.4	165.0			47
MG Wrapping	70% bagasse	79.5		101	5980	27.4	80.6			
Bamboo Content Papers										
MG Kraft	50/70% bamboo	63.5	3.8	105	3540	17.4	76.2	23	12	25
MG Kraft	50/70% bamboo	78.3	2.3	140	3780	20.1	80.6	28	7	27
MG Kraft	50/70% bamboo	99.0	3.1	155	3520	18.0	97.8	32	10	47
MG Kraft	50/70% bamboo	107.1	2.9	190	3600	18.1	84.5	34	8	59
MG Kraft	50/70% bamboo	115.1	3.0	195	3080	14.6	76.8	66	11	68
MG Kraft	50/70% bamboo	152.3	3.2	230	3250	17.2	76.0	76	12	31
MG Kraft	50/70% bamboo	168.7	3.7	265	3170	16.8	68.8	58	22	32
MG Kraft	50/70% bamboo	96.4	2.6	160	4095	24.5	74.2	13	9	52
Straw Content Papers										
Kraft paper	100% rice straw	40	5.6	80	3080	12.5	40.0	3	46	17
Kraft paper	100% rice straw	48	5.6	80	2850	12.5	35.4	4	70	21
Kraft paper	100% rice straw	54	5.6	95	2960	12.0	38.9	4	86	25
Kraft bag	50% wheat straw	60	5.0	95	5610	29.8	60.7	103	56	25
Woodpulp Papers for Comparison										
Linerboard	100% woodpulp	127	0.6	215	5890	32.2	179.0			54
Linerboard	100% woodpulp	338	0.6	600	4940	68.5	169.0			39
Sack paper	100% woodpulp	70	0.7	130	6150	47.1	158.6		20	25