Studies on Use of Cannabis Sativa And Ipomea Carnea For Development of Razor Blade Wrapper

Dharm Dutt*, Rao G.N.*, Tiwary K.N. and Upadhyaya J.S.**

ABSTRACT

*Razor blade wrapper is M.F. unglazed imitation parchment paper, commonly known as **Anti Rust Paper.** Cannabis sativa and Ipomea carnea sulphate pulps were taken to develop Razor blade wrapper paper. Cannabis sativa and Ipomea carnea pulps were blended in the ratio of 40:60 and 40 gsm handsheets were made in Laboratory which posseses 3.67 kPam²/g burst index, 51.60 Nm/g tensile index, 4.98mNm²/g tear index, 160 ml/min porosity, 550/650 ml/min smoothness, 85% opacity, 0.08% Cl (as NaCl) and 0.16 % SO_4 (as Na_2SO_4). These properties are suitable for making Razor blade wrapper.*

INTRODUCTION

Razor blade manufacturing Companies use MF unglazed imitation parchment paper of substance ranging from 35-40 gsm. The paper is impregnated with about 5% Sodium Benzoate, an antioxidant to prevent oxidation of Fe^{++} (ous ion) into Fe^{+++} (ic ion). The sulphate pulp is given certain chemical treatments to make it suitable for protecting the surface of ferrous metals against rust. That is why it is commonly known as Anti Rust Paper. Following are the properties required in Anti Rust paper.

i. It should be almost nonporous and free from pinholes. Extensive beating of the pulp and addition of high molecular weight glue at size press is recommended.

ii. The paper should contain Cl^- and SO_4 ions specified as per Razor blade manufacturers. Absorption of moisture from surroundings forms HCl or H_2SO_4 which acts as oxidants. The Fe^{++} (ous ion) is converted into Fe^{+++} (ic ion) resulting in rusting of metal surface. To over come this problem antioxidants such as Sodium Benzoate are added in the stock.

iii. The paper should be resistant to water, Sodium aluminate is also used to provide water and ink resistance in paper alongwith normal sizing chemicals such as size and alum. Waxing of paper also improves moisture resistence.

iv. pH is another important parameter for antirust paper and it should be as high as possible.

The properties which required for Razor blade wrapper, as specified by a typical Razor blade manufacturer, are as follows:-

pH	= 5.5	(minimum)
Chlorides, as NaCl	= 0.1 %	(maximum)
Sulphates, as Na_2SO_4	= 0.25%	(maximum)
Sodium Benzoate	= 1.0%	(minimum)
Paraffin wax of melting point 57 °C	= 16-26% of total weight	
Thickness	= 0.365 ± 0.041 mm	
Substance	= 35-40 g/m²	

THE RAW MATERIALS

Ipomea carnea

Ipomea carnea is a common weed and locally known as BESHARAM. Because of its high adaptability and resistance towards adverse climatic

* **Star Paper Mills Ltd. Saharanpur-247 001**

** **Institute of Paper Technology Saharanpur-247 001**

Table-I

Morphological characteristics of Ipomea carnea and Cannabis sativa hemp ribbons.

Sl. No.	Particulars	Ipomea carnea	Cannabis sativa hemp ribbon	Bamboo	Pinus kesiya	Picca abies
1.	Density, g/cm³	0.29	0.33	0.52	-	-
2.	Fiber length (L), mm	0.62	21.0	1.70	2.25	2.32
3.	Fiber width (D), μ	33.18	22.00	23.60	41.70	40.70
4.	Lumen width (d), μ	30.34	8.50	9.50	35.70	34.75
5.	Cellwall thickness (w), μ	1.47	6.7	7.00	6.00	5.85
6.	Flexiblity coefficient d/D x 100	91.46	40.56	-	85.54	85.62
7.	Ratio of length to width, L/D	18.68	95.45	72.03	53.96	57.00
8.	Ratio of twice cell wall thickness to fiber width, 2w/D	0.089	-	0.59	0.29	0.29
9.	Wall fraction, 2w/D x 100	8.89	-	59.30	29	29
10.	Runkel ratio 2w/d	0.97	-	1.47	0.34	0.51
11.	Ratio of wall thickness to lumen width, w/d	0.05	-	0.74	0.17	0.25

conditions it may grow in all types of climate and soils, marshy as well as dry. A large diffused or straggling shurbs with milky juice, native to South America, the plant was originally used for making fence for the road side fields, but due to its massive growth and rapid propagation it has grown rapidly in barren waste lands. Plantation of Ipomea carnea may be undertaken in the month of June-July with the on-set of Monsoon. Shoots are fast growing and attaining optimum size in about a year's time. The yield of Ipomea carnea is about 15-20 BDMT/Hectare/ Year (1).

Cannabis sativa

It is commonly known as 'Soft hemp' or True hemp' and locally known as BHANG. The plant is an annual herb with 1-5 meter high slender angular stem. The plant is abundantly available in submountain tracts of Punjab. U.P. and Bihar. The cultivation of the hemp plant is permitted in the districts of Almorha, Garhwal and Nainital excluding Tarai and Bhabhar area. It is grown on rich loamy soil in a mild humid climate with a temperature range of 15-27 °C. An average crop yields 2-3 tonnes dry stems per acre from which 0.5 to 0.25 tonnes of clean bast fibers are extracted (2).

EXPERIMENTAL METHODOLOGY

Morphological characteristics

A small portion of Cannabis sativa hemp ribbon and Ipomea carnea chips was heated seperately with aquous acitic acid and sodium chlorite solution for degrading lignin-the cementing materials. The microscopic slides of cellular elements were made as per IS: 5285-1994. Fiber length was determined at 40X magnification, while fiber width and cellwall thickness were determined at the magnification of 160 X. The results are reported in **Table-1.**

Proximate chemical analysis

Air dried material was disintegrated in the laboratory WEVERK disintegrator. The portion of wood meal passing through 40 mesh sieve but retained on 80 mesh sieve was utilised for proximate chemical analysis. The proximate chemical analysis was done as per Tappi standard methods. The results are reported in **Table-II.**

Pulping studies

The chips of Ipomea carnea and hemp ribbon of Cannabis sativa were digested separately in WEVERK electrically heated rotary digester by sulphate process. The optimum cooking conditions for Ipomea carnea and Cannabis sativa hemp ribbon are given in Table-III. The cooked material was properly washed, crumbled and screened. Kappa number, pulp yield and rejects were determined in each case. The results are reported in **Table-III.**

Bleaching studies

The unbleached pulp of Ipomea carnea and Cannabis sativa hemp ribbon were bleached by using

Table-II			
Proximate chemical analysis of Ipomea carnea and Cannabis sativa hemp ribbons			
Sl. No.	**Particulars**	**Ipomea Carnea**	**Cannabis sativa hemp ribbon**
1.	Cold watersolubles, %	3.90	3.90
2.	Hot water solubles, %	9.30	8.06
3.	Alcohol-Benzene solubles (1:2 V/V), %	4.65	12.00
4.	1% NaOH solubles, %	24.44	29.00
5.	Lignin, %	16.59	7.30
6.	Pentosan, %	17.30	6.30
7.	Holocellulose, %	72.00	-
8.	Hemicellulose, %	21.00	-
9.	Alpha cellulose, %	43.21	58.80
10.	Beta cellulose, %	10.00	-
11.	Gamma cellulose, %	18.00	-
12.	Ash, %	6.45	-
13.	Acetyl content, %	2.05	-
14.	methoxyl content, %	3.06	
15.	Cross & Bevan cellulose	-	61.20
16.	Pentosan in C&B cellulose, %	-	2.40

CEHH and CEH bleaching sequence respectively. The results are given in Table-IV.

Beating and blending

The Ipomea carnea bleached pulp was blended with Cannabis sativa hemp ribbon pulp in different proportions viz. 100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 0:100. In first set the pulps were blended in unbeaten form and beaten to a freeness level of 40±1 °Sr. In second case, both the pulps were beaten separately to a freeness level of 40±1 °SR and then bleanded in different proportions as described above. The results are reported in Table-V.

Stock preparation

The blend containing Ipomea carnea and Cannabis sativa in the ratio of 40:60 were mixed with 10% Soapstone powder, 1% Pepsol, 1% Sodium aluminate, 1% M.F. resin, 5% sodium benzoate and

Table-III				
Optimum cooking conditions for Ipomea carnea and Cannabis sativa hemp ribbon				
Sl. No.	**Particulars**	**Unit**	**Ipomea carnea**	**Cannabis sativa**
1.	Active alkali, as Na_2O	%	16	18
2.	Sulphidity	%	20	20
3.	Time for maximum temp	minutes	90	90
4.	Time at maximum temp	minutes	120	120
5.	Maximum temperature,	^0C	165±2	165±2
6.	Liquor to wood ratio		4.0:1	5.0:1
7.	Unbleached pulp yield,	%	46.40	68.45
8.	Rejects	%	3.50	2.20
9.	Kappa no.		29	11

Table-IV

Bleaching conditions and results of kraft pulps of Ipomea carnea and Cannabis sativa hemp ribbon

Sl. No.	Particulars	Ipomea Carnea	Cannabis sativa hemp ribbon
1.	Unbleached pulp kappa number	29	11
2.	**Chlorination stage (C)**		
	Amount of Cl_2 added on O.D. pulp, %	5.50	1.73
	Amount of Cl_2 consumed on O.D. pulp basis, %	5.48	1.72
	Cl_2 consumtion, %	99.6	99.4
	Final pH	2.05	2.50
3.	**Extraction stage (E)**		
	NaOH added on O.D. pulp, %	2.78	0.74
	Initial pH	11.5	10.98
	Final pH	10.20	9.72
4.	**Hypochlorite stage (H_1)**		
	Hypo added as av Cl_2 on O.D. pulp, %	1.09	1.10
	Hypo consumed as av Cl_2 on O.D. pulp, %	1.05	1.08
	Hypo consumption, %	96.3	98.10
	Final pH	8.23	8.50
5.	**Hypochlorite stage (H_1)**		
	Hypo added as av Cl_2 on O.D. pulp, %	0.73	-
	Hypo consumed as av Cl_2 on O.D. pulp, %	0.70	-
	Hypo consumption, %	95.89	-
	Final pH	8.17	-
6.	Total av Cl_2 added on O.D. pulp, %	7.25	2.83
7.	Total av Cl_2 consumed on O.D. pulp, %	7.23	2.80
8.	Bleaching losses, %	10.01	9.50
9.	Bleached pulp yield, %	44.18	60.68
10.	Pulp brightness, ^{0}PV, %	81.50	80.00

Bleaching conditios:

	C	E	H_1	H_2
Consistency, %	4	9	10	10
Temperature, ^{0}C	25±2	55±2	45±2	45±2
Time, minutes	40	60	60	120

nonferric alum to maintain pH around 7.0 with continuous stirring. Laboratory handsheets of 40 gsm were prepared on British sheet forming machine and evaluated for different properties at 27±2 °C temperature and 65±2% relative humidity. The results are reported in **Table-VI.**

Table-V

Strength properties of Ipomea carnea and Cannabis sativa hemp ribbon kraft pulps

Furnish, ratio I. carnea C. Sativa	Blending after beating			Blending before beating		
	Burst index $kPam^2/g$	Tear index mNm^2/g	Tensile index Nm/g	Burst index $kPam^2/g$	Tear index mNm^2/g	Tensile index Nm/g
100:00	3.81	4.65	61.20	3.72	4.12	66.11
90:10	3.87	4.82	62.41	3.70	4.33	60.54
80:20	4.10	5.21	63.09	3.98	4.98	62.03
70:30	4.48	5.69	64.41	4.13	6.02	64.40
60:40	4.50	6.59	66.23	4.22	6.23	66.21
50:50	4.91	7.43	67.73	4.56	6.98	67.21
40:60	5.12	8.23	66.02	4.88	7.85	68.89
30:70	5.62	8.92	69.22	5.22	8.73	69.03
20:80	5.72	9.52	70.81	5.49	9.17	69.12
10:90	6.14	10.19	71.31	5.94	9.92	70.30
00:100	6.34	11.10	71.50	6.11	10.07	71.22

RESULTS AND DISCUSSION

Microscopic examination of Ipomea carnea fibers shows that the fibers are shorter in length but fiber width and lumen width are much higher and resembles with softwood like Pinus kesiya and Picca abies (3&4). Flexibility coefficient of Ipomea carnea fibers are comparable with those of tropical pine and

Table-VI

Proximate chemical analysis of Ipomea carnea and Cannabis sativa hemp ribbons

Sl. No.	Particulars	Laboratory handsheets	Specification of typical blade manufactures
1.	Substance, $g/^2$	40	40
2.	Thickness, mm	0.365	0.365
3.	Tensile index, Nm^2/g	51.60	56.90/55.50
4.	Burst index, $kPam^2/g$	3.62	3.23
5.	/tear index, mNm^2/g	4.98	6.66/7.05
6.	Brightness, ^0PV	78.00	78.00
7.	Opacity, %	85.00	85.00
8.	Smoothness, ml/min	550/625	600/650
9.	Porosity, ml/min	165	180
10.	Cobb-60, gsm	35	40
11.	Wet strength, g/cm	105	90
12.	pH	6.5	7.0 or above
13.	Cl^-, as NaCl %	0.08	>0.1, max
14.	SO_4^{--}, as Na_2SO_4 %	0.16	>0.25, max
15.	Water klemn, sec	15	10

spruce. However, runkel ratio is comparatively low. The wall thickness is very low thus giving a low wall fractions. The fibers having low wall fraction and runkel ratio give stronger paper. The thin walled wide lumen fibers of Ipomea carnea collapse easily to double walled ribbon like structure on delignification and exhibit plastic deformation, thus offering more surface contact and fiber bonding (4&5). This gives good physical strength properties and less porosity which favours the preparation of Razor blade wrapper. This paper needs high breaking length and tear strength. Hence the Ipomea carnea pulp is blended with Cannabis sativa. The individual fibers of Cannabis sativa are very long measuring from 5 to 50 mm with an average of 20 mm and moderately wide raging from 7 to 50 microne with an average of 22 microne.

The result of proximate chemical analysis shows that Ipomea carnea and Cannabis sativa hemp ribbon have got higher extractives as compared to bamboo. The lignin content in Ipomea carnea is 16.59% and that in Cannabis sativa hemp ribbon is 7.50%. Ipomea carnea gives pulp yield of about 46.40% at kappa number 29. The optimum cooking condition for Ipomea carnea is active alkali 16%, sulphidity 20%, maximum temperature 165±2 °C, maximum pulping time 90 minutes and liquor to wood ratio of 4.0:1. Cannabis sativa hemp ribbons gives pulp yield 67.25% at kappa no. 11. The optimum cooking condition for Cannabis sativa is Active alkali 9%, sulphidity 20%, maximum temperature 165±2 °C, maximum pulping time 90 minutes and liquor to wood ratio of 5:1.

The unbleached pulp of Ipomea carnea bleached in CEHH sequence gives 44.18% bleached pulp yield at 81.5 °PV brightness. Cannabis sativa hemp ribbon bleached in CEH bleaching sequence gives 60.68% bleached pulp yield at 80.0 °PV brightness.

It can be seen from **Table-V** that pulp blend after beating separately to 40 °SR has got slightly higher strength properties than that of blends before beating. The blend of 60% Ipomea carnea and 40% Cannabis sativa pulp beaten to 40 °SR having burst index 4.50 kPam^2/g, tear index 6.59 mNm^2/g, and tensile index 66.23 Nm/g was choosen for making Razor blade wrapper.

Table-VI shows that the properties of laboratory handsheets of 40 g/m^2 are tensil index 51.60 Nm/g, burst index 3.67 kPam^2/g, tear index 4.98 mNm^2/g, porosity 165 ml/minute, smoothness 550/625 ml/min, brightness 78 °PV, opacity 85%, and Cobb-60-40 gsm. Also it contians 0.08% chlorides (as NaCl) and 0.16% sulphates (as Na_2SO_4). The above properties are found suitable for making Razor blade wrapper.

CONCLUSION

1. The pulp blend containing 60% Ipomea carnea and 40% Cannabis sativa hemp ribbon after beating separately to 40 °SR is found suitable for manufacturing Razor blade wrapper.

2. The optimum dose of nonfibrous additives in above blend are, 10% Soapstone powder, 1% sizing chemicals, 1% Sodium aluminate, 1% M.F. resin, 5% sodium benzoate and nonferric alum to maintain pH around 7.0.

3. The Laboratory handsheets which posseses 3.67 kPam^2/g burst index, 51.60 Nm/g tensile index, 4.98 mNm^2/g tear index, 160 ml/min porosity, 550/650 ml/min smoothness, 78 °PV brightness, 85% opacity, 40 gsm Cobb-60, 0.08% clorides (as NaCl) and 0.16% sulphates (as Na_2SO_4) are found suitable for making Razor blade wrapper.

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