

# Effect of Quality of Kraft Paper on the Physical Properties of Corrugated Fibreboard

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Kraft paper that is used in the manufacture of corrugated fibreboard for fishery products collected from different fabricators in and around Kochi were evaluated for grammage, caliper, bursting strength, ring stiffness, tearing strength, tensile strength and elongation at break in machine and cross direction. It is observed that the bursting strength, tensile strength and ring stiffness are dependant and the tearing strength is independant of the virginity of the kraft paper.

Corrugated fibreboard boxes are generally used as shipping container for the export of frozen shrimp. It has been reported that the inner cartons and master cartons used in India for export of frozen shrimp were not strong enough to withstand the stress and strains of goods transit. In a survey of the master cartons (corrugated fibreboard) used in frozen shrimp industry (Gopal & Govindan, 1980) it was observed that only 9.4% of samples studied confirmed to IS-6715 (1972) specification in respect of bursting strength. This may be attributed to the poor quality of kraft paper used for liners and corrugating media. It is observed that the kraft paper used in the fabrication of CFB boxes are of different grades namely virgin, semi virgin and non-virgin (recycled). The grammage of the kraft paper used generally in the industry for the liner varies from 90 to 120 GSM and it is made up of virgin or non virgin (recycled) or semi virgin. For the corrugating medium 140 to 150 GSM virgin or semi virgin paper should be used.

Two of the common defects reported in the master cartons exported from India are low mechanical strength and tendency to set wet (Gopal & Govindan, 1980). They are weakened easily by deposit of moisture caused by temperature fluctuations during loading, unloading and other handling stages. As a result the master cartons appear soggy and

often give way during handling. In view of these defects it is felt necessary to determine the physical properties of kraft paper that is used in the fabrication of CFB boxes collected from different manufacturers.

## Materials and Methods

Kraft paper samples were collected from the corrugated fibreboard (CFB) box fabricators from 4 different factories who are supplying them to fish processing industries for export of frozen shrimp in and around Kochi and subjected to the conditioning as per IS:1060, Part I (1966) at 27°C and 65% RH. The following tests were conducted as per the Indian Standards Institution methods indicated against each. Thickness, grammage, tearing strength, bursting strength and burst factor were determined as per IS:1060-Part I (1966) and tensile strength in machine and cross directions as per IS:1060 - Part I (1966) by taking 18 cm length of the specimen. The tensile properties of virgin, non-virgin and semi virgin kraft paper were tested in the universal testing machine Zwick 1484. Ring stiffness value was determined as per ASTM (1968).

## Results and Discussion

Table 1 shows the physical properties of virgin, non-virgin and semi virgin kraft

Table 1. Physical properties of virgin, semi virgin and non virgin (recycled) kraft paper

Details	Non virgin	Non virgin	Semi virgin	Semi virgin	Virgin	Virgin	Virgin	Non virgin	Non virgin	Virgin	Virgin	Semi virgin	Virgin	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
gramage														
$g/m^2$ Rated	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	100.0	90.0	100.00	150.00	150.00	140.00
Actual	133.5	126.03	121.73	126.4	125.60	126.40	125.83	129.4	103.16	92.33	106.70	155.93	152.23	140.06
Caliper,mm	0.165	0.156	0.162	0.153	0.167	0.153	0.157	0.148	0.138	0.131	0.136	0.205	0.212	0.186
Bursing strength, $kg/cm^2$	1.4	1.3	2.1	2.1	3.0	2.6	3.1	2.5	1.5	1.7	2.8	3.8	2.6	2.9
Burst factor	10.5	10.3	17.25	19.09	23.8	20.6	24.6	20.34	14.5	18.4	26.2	24.2	17.33	20.4
Ring Stiffness, N														
MD	77.0	83.5	86.0	93.8	137.8	137.8	142.2	136.0	65.7	56.2	85.0	192.2	149.3	139.3
CD	71.3	61.8	76.3	72.3	106.2	106.2	114.3	107.3	58.4	54.0	82.3	167.8	87.0	124.0
Tearing strength, gms														
MD	107.0	86.4	80.0	112.0	144.0	144.0	100.0	96.0	56.0	56.0	100.0	232.0	135.0	128.0
CD	123.0	96.0	104.0	115.2	152.0	176.0	116.0	116.0	100.0	68.0	164.0	288.0	138.0	132.0
Tensile strength* N														
MD	55.38	51.57	72.9	73.5	70.0	108.05	84.11	91.30	30.53	32.20	90.12	128.6	99.0	104.5
CD	30.95	27.94	31.2	37.5	35.0	46.03	55.90	60.65	20.60	21.48	32.50	53.4	56.23	60.7
Elongation%														
MD	1.30	1.56	1.30	2.06	1.6	1.83	1.77	1.88	0.98	1.10	1.46	1.57	2.24	2.80
CD	1.30	1.84	3.57	2.49	3.8	6.53	3.18	2.89	1.31	1.56	4.68	4.50	4.37	5.70

MD - Machine direction; CD - Cross direction \* samples size, 18cm length and 1.5 cm width

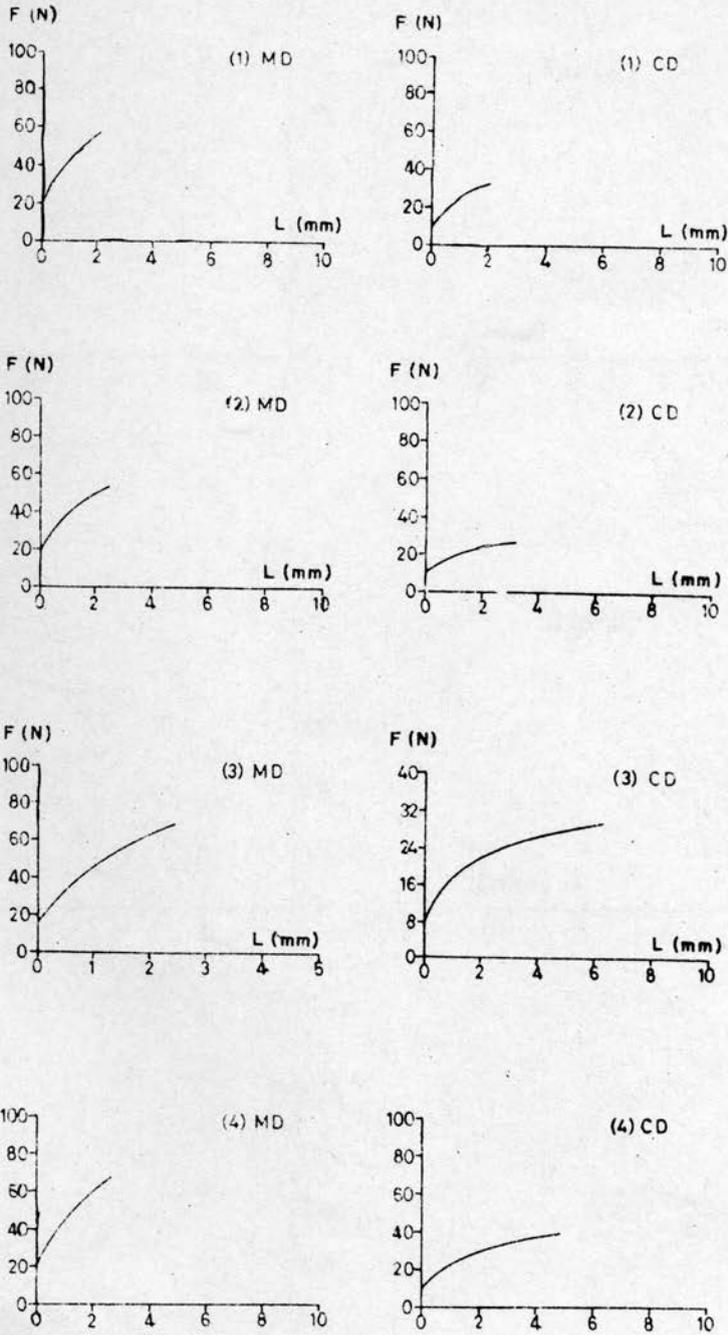


Fig1 Load elongation curve of virgin (5, 6, 7, 8,11, 12,& 14) semi virgin (3, 4 & 13) and non-virgin (1, 2, 9 & 10) kraft papers used in the manufacture of corrugated fibreboard

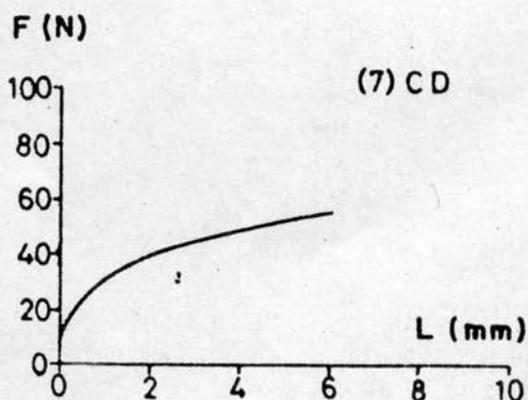
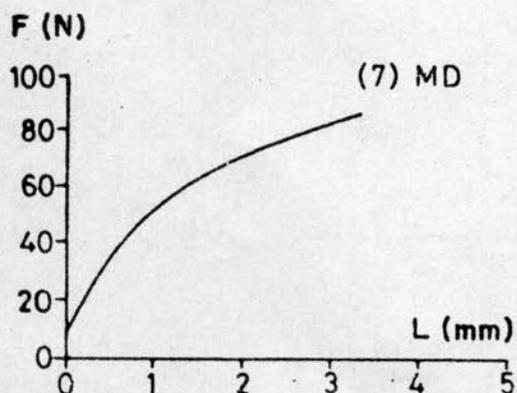
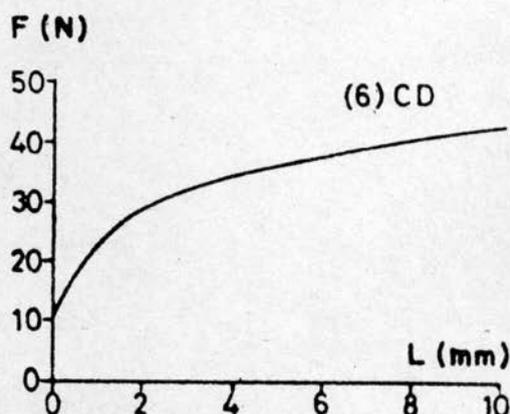
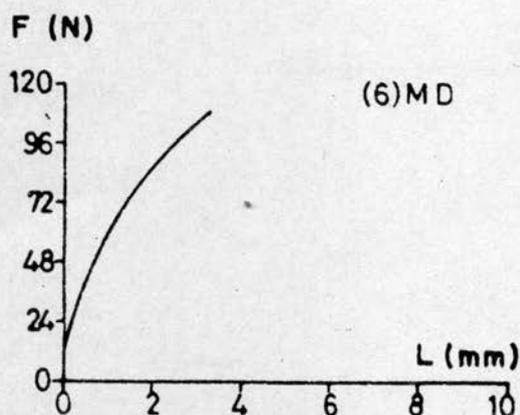
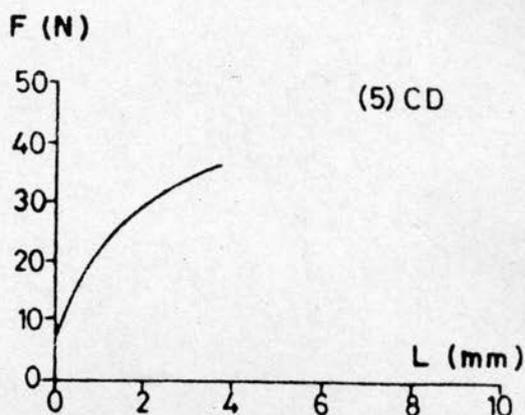
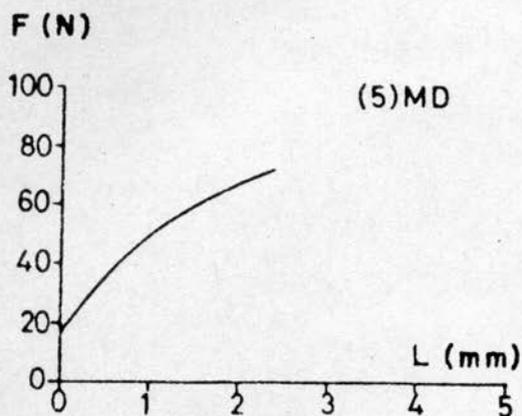


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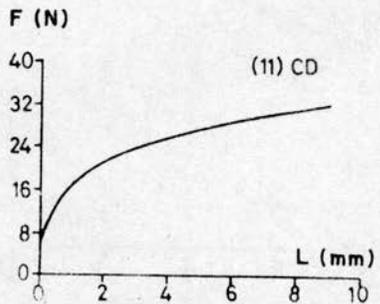
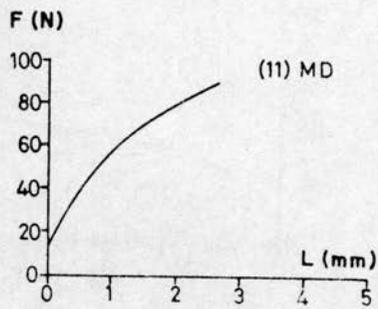
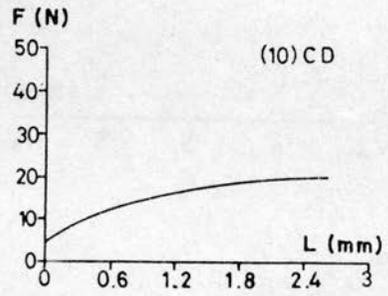
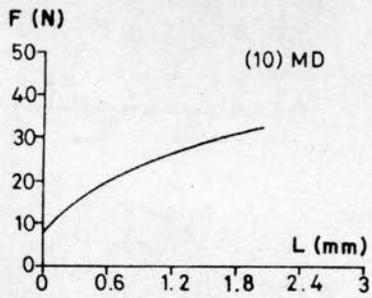
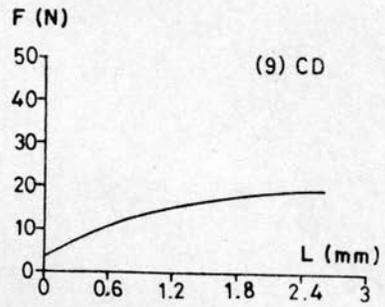
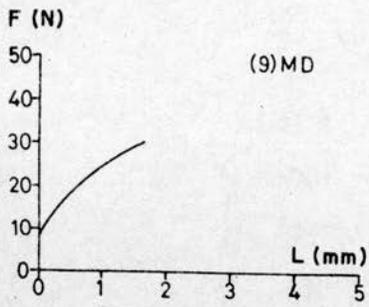
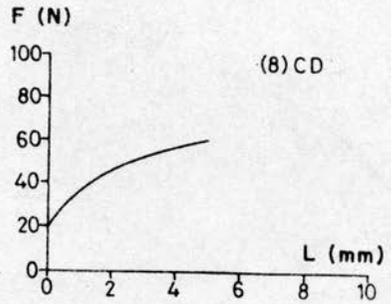
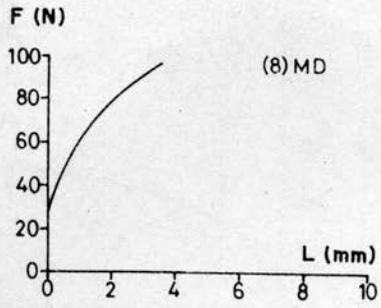


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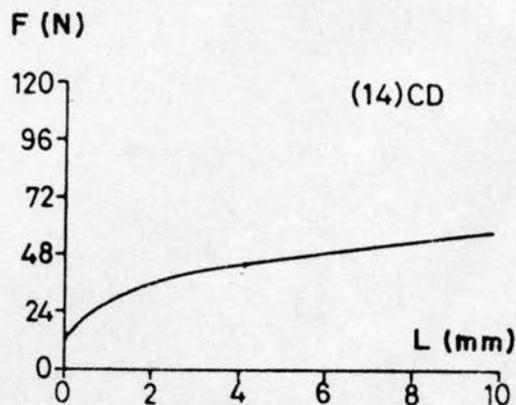
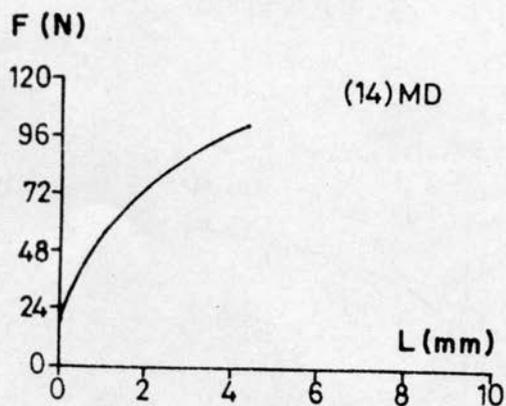
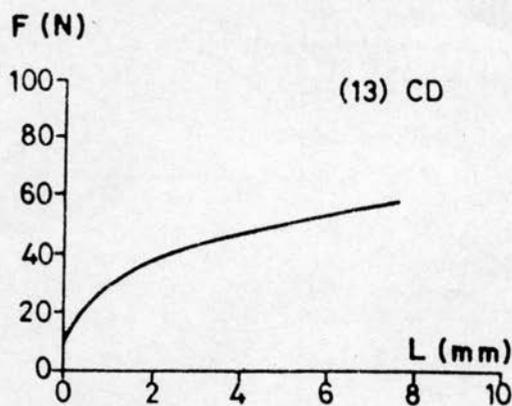
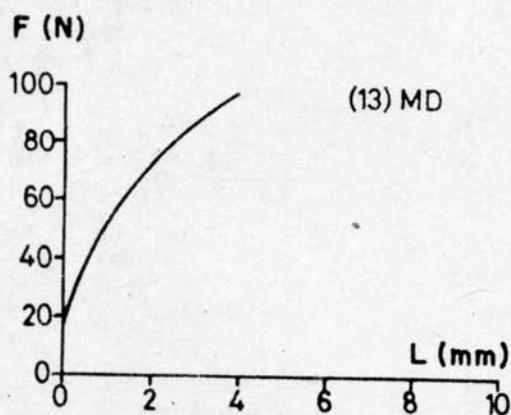
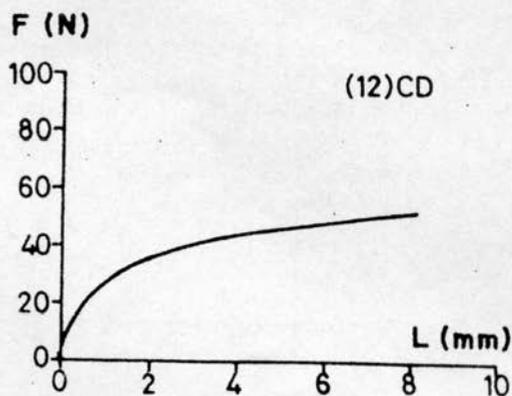
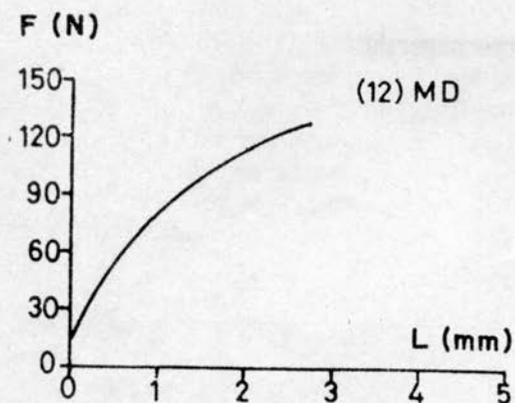


Fig1 Continued

paper that is generally used for the manufacture of corrugated fibreboard. The bursting strength, ring stiffness and tensile strengths are more in virgin kraft paper than recycled paper. In semi virgin paper the values lies in between virgin and non-virgin paper. Burst factor is an important physical parameter of paper which ultimately decides the load bearing capacity of the finished container. The values for the grade 1 paper as mentioned in IS:1397 (1967) are above 30. The values obtained in the present study for virgin kraft paper are between 20 and 30 which refer to grade II as per the above standard. Non virgin and semi virgin kraft papers used in the analysis have burst factor below 20 which are classified as others as per the above standard. Figure 1 indicates the tensile properties of different kraft paper in machine and cross direction. Virgin kraft paper possesses higher tensile strength ranging from 70 to 108N in machine direction and in case of non virgin paper it varies from 51 to 55N in machine direction for the same rated 120 grammage kraft paper. As bursting strength is a combination of tensile strength and stretch, the bursting strength increases as the tensile strength increases. It is noted that the tearing strength is more or less independent of the virginity of the paper. Even in case of non

virgin paper the tearing strength may be more than the virgin paper for the same grammage of kraft paper. The above results show that the use of non virgin paper yields poor quality corrugated fibreboard with lower strength. Hence for the fabrication of master cartons for frozen seafoods virgin grade kraft paper should be used.

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