

Printing Quality of Some Indigenous Newsprints

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Printability and runnability characteristics of indigenous newsprints were evaluated and compared with those of the newsprints of foreign origin. Printing tests conducted using IGT printability tester indicated a wide variation in the printing characteristics of indigenous newsprints. Some papers had higher ink requirement, surface roughness and second impression set off tendency than foreign newsprint samples whereas others had comparable characteristics. The common defect with all indigenous newsprints is high print strike through tendency possibly due to excessive pin holes present in these papers. Runnability behaviour assessed from the elastic limit of stress strain curves and cross direction in-plane tearing strength revealed that indigenous newsprints will not pose any problem in printing press operations, however, the tensile strength of some papers needs improvement to get elastic limit comparable to those of foreign grades.

Introduction :

Printing behaviour of a newsprint is one of the important properties as it has direct impact on the economics and legibility of the finished sheet. The problems encountered in newsprint printing are peculiar due to tight limits of cost and time which are especially important for this industry. Increasing printing speeds and number of pages, still higher demands for a faithful reproduction of illustrations and text matter necessitates parallel improvement in the quality of newsprint. Apart from strength and optical properties the printing behaviour of newsprint particularly in the Indian context requires special attention in view of the different nature of raw materials being employed for newsprint manufacture.

In the present investigations printability and runnability characteristics of few indigenous newsprint samples were evaluated and compared with similar properties of imported samples. Printing tests i. e. ink requirement, strike through, second impression set off and speckle tendency were carried out using IGT printability tester and the runnability was assessed from the elastic limit of stress strain curves and cross direction in-plane tearing strength.

Results and Discussion:

INK DEMAND :

Print density curves (Fig. 1) plotted between optical density of solid print and thickness of ink layer on the printing forms for different samples,

indicate that the ink requirement for the same value of optical density is quite high for two indigenous papers as compared to those for foreign papers. The remaining two indigenous newsprints have ink demand in the range of foreign papers (Table 2.)

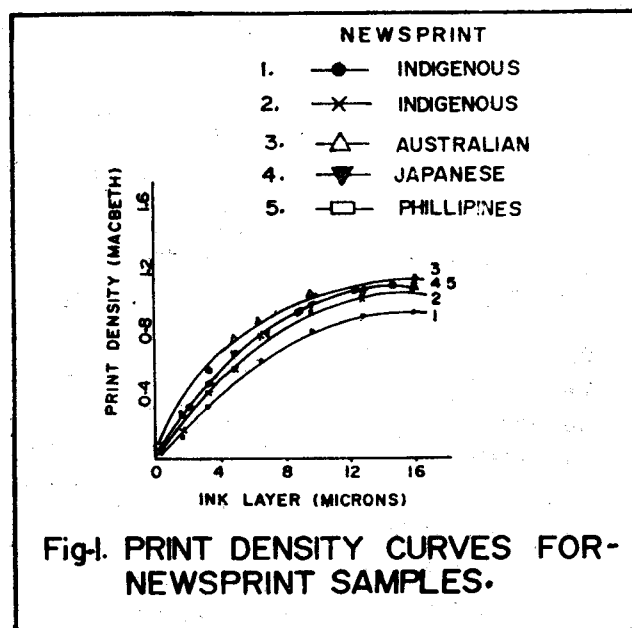


Fig.1. PRINT DENSITY CURVES FOR- NEWSPRINT SAMPLES.

The density curve smoothness parameter (m) calculated using the Tollennar relationship defined for the print density curve (1) is low for indigenous samples with high ink demand, implying that transfer of ink at low ink layer thickness is poor for these papers (Table 2). The possible causes of high ink demand for

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TABLE-1
STRENGTH CHARACTERISTICS OF INDIGENOUS AND FOREIGN NEWSPRINT SAMPLES

Characteristics	Units	Indigenous			Foreign			
		1	2	3	4 Australian	Japanese	Phillipines	
Grammage	(g/m ²)	55.2	56.1	54.1	53.7	51.7	53.8	52.7
Thickness	(μm)	112	108	75	74	96	102	106
Apparent density	(g/cm ³)	0.49	0.52	0.73	0.73	0.54	0.53	0.50
Tensile index MD/CD	(N.m/g)	18.0/10.5	19.0/11.5	40.5/17.5	38.5/16.0	32.0/13.5	39.0/14.0	29.0/16.5
Stretch MD/CD	(%)	0.6/1.7	0.7/1.3	1.1/2.2	1.1/1.8	1.1/1.3	1.1/1.6	1.1/1.5
Tear index MD/CD	$\frac{\text{mN.m}^2}{\text{g}}$	4.35/4.60	3.20/3.85	3.70/5.05	4.20/5.10	3.50/5.80	3.70/5.05	3.80/4.20
In plane tear MD/CD	(N)	2.0/2.2	1.7/2.0	0.9/1.7	1.4/1.8	1.1/2.0	1.3/2.1	1.4/1.8
Elastic limit MD	(kg/cm)	0.6	0.5	1.1	0.9	0.8	1.2	—

TABLE-2
OPTICAL AND PRINTING CHARACTERISTICS OF INDIGENOUS & FOREIGN NEWSPRINT SAMPLES

Characteristics	Units	Indigenous				Foreign		
		1	2	3	4	Australian	Japanese	Phillipines
Optical properties								
Brightness ISO	%	31.6	42.7	51.7	52.9	57.5	45.6	51.0
Luminance	%	36.5	56.5	60.2	62.2	63.4	54.7	53.8
Printing opacity	%	99.2	96.1	95.0	93.7	95.7	96.7	97.9
Sp. Scatt, co-eff.	m ² /kg	—	45.1	45.0	43.8	55.1	45.7	51.8
Printing properties								
Print surf roughness	(μm)	5.35/5.90	5.00/5.40	3.90/4.20	3.60/3.70	3.70/3.95	3.85/4.30	3.80/4.10
H-20 Top/wire								
Print through	(Macbeth density)	0.24	0.33	0.37	0.56	0.20	0.20	0.17
Pin holes		Present	Present	Excessive	Excessive	Nil	Nil	Nil
Print Set Off after (s)	(Macbeth density)							
0.1		0.38	0.36	0.30	0.30	0.27	0.30	0.31
1.0		0.36	0.29	0.26	0.23	0.24	0.25	0.26
5.0		0.28	0.25	0.17	0.20	0.17	0.22	0.23
Speckle at print density 0.90	IGT std. scale	3-4	5-6	4-5	3-4	4-5	3-4	3-4
Density curve contact factor (m)		0.08	0.06	0.27	0.29	0.30	0.30	0.22
IGT ink layer to get 0.90 print density	(μm)	14.0	10.0	7.8	7.8	7.6	8.6	8.6

these newsprints appear to be due to higher surface roughness and lower brightness as compared to foreign samples (Tables 1 & 2). Slight improvement in this parameter may be possible by carrying the calendering to smoother surface. The brightness improvement will lower the ink requirement remarkably as visual blackness is affected mainly by contrast between printed area and the paper surface. The other two indigenous newsprints have comparable smoothness parameter to foreign papers tested.

STRIKE THROUGH :

Strike through which is the visibility of print on the reverse side of printed area is quite high for all the indigenous newsprint samples (Table 2.) These papers have pin holes which could be the possible cause of excessive passage of ink vehicle alone or alongwith ink pigment to the other side of sheet thus causing high print through defect. Improvement in the efficiency of pulp cleaning system and removal of air bubbles absorbed in the pulp by installing deculator before the head-box may reduce the number of pin holes in the paper sheet.

SPECKLE (SNOW) TENDENCY :

Speckle which represents the extent of unprinted spots (white area) in solid print (Fig. 2) is quite high

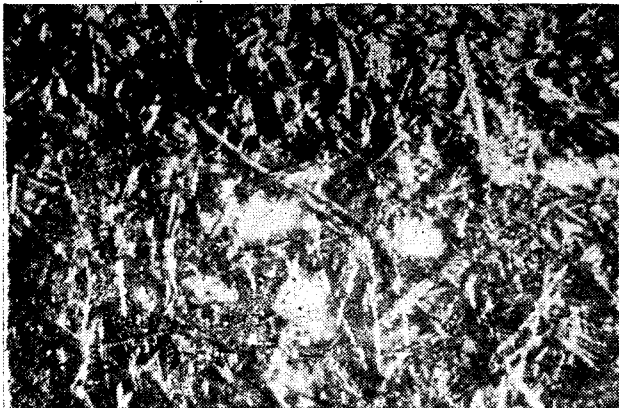


FIG. 2

(Range 5-6) for one indigenous paper indicating its poor print quality. This mottling of print for this paper is due to uneven formation. Other samples have values comparable to those for foreign samples.

SET OFF :

Extent of ink set off to blank sheet after different time gaps is higher for two indigenous papers as compared to foreign newsprints. The other two samples have values comparable to those obtained for the foreign papers. It will cause trouble during printing

due to high ink transfer from printed area on to the different points of the printing press viz. impression cylinder, turner bars, folder or back on to the copy when the printing will be controlled to get print density comparable to foreign newsprint. This high tendency for these papers is due to high ink requirement for attaining 0.90 solid print density at which this property has been examined. The other two samples have comparable values to the foreign papers.

RUNNABILITY :

Elastic limit estimated from the stress strain curves (Fig. 3) of different paper samples is low for two of the indigenous papers whereas the remaining two have this value better than foreign news-prints (Table 1)

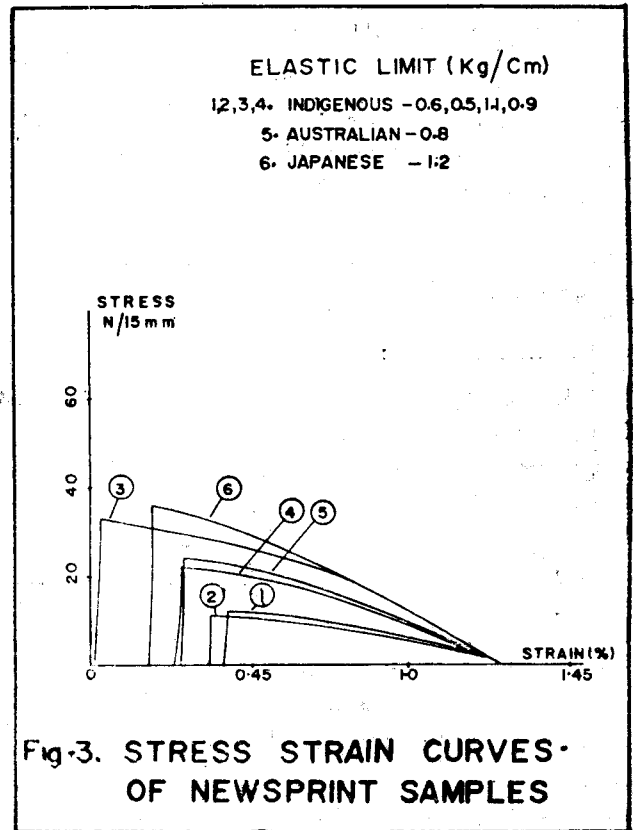


Fig-3. STRESS STRAIN CURVES OF NEWSPRINT SAMPLES

As the stress in newsprint printing press is in the vicinity of 0.5 kg/cm, therefore, all the paper samples are expected to have smooth runnability. However, the tensile strength of two indigenous papers needs to be improved to get improvement in the just marginal value of elastic limit. Fibre cuts placed at a tight edge or a thin part of paper web generally start web breaks and cross direction in-plane tearing strength is considered an important parameter to assess this property (2,3,4). Cross direction in-plane tearing strength is

comparable for all the paper samples thereby indicating that web rupture resistance on printing press will be comparable for all the papers (Table 1).

CONCLUSIONS :

1. There is wide variation in the quality of newsprint collected from different Indian newsprint manufacturing mills. Apart from the control of apparent density, brightness, scattering power, and smoothness, the printing tests described above should also be carried out by control laboratory for better check on paper quality.
2. The common printing defect with indigenous papers is high tendency of print strike through, which can possibly be improved by controlling the excessive pin holes present in these newsprints.
3. Elastic limit assessed from stress strain curves indicate that runnability on printing press will not pose any problem for indigenous newsprints. However the tensile strength needs to be improved for some papers to get values comparable to those of foreign papers.

EXPERIMENTAL :

The paper samples tested were received from two Indian newsprint mills, samples No. 1&2 belong to mills I and No. 3&4 belongs to mill II. Before testing, all the samples were conditioned at 27°C and 65% R H. All printing tests were carried out using an IGT printability tester according to the standard procedures (5,6,7).

PRINT DENSITY :

Strips of 35 mm width were taken in the machine direction. Prints were made on the wire side of paper using different ink layer thicknesses of IGT striking-in-ink on the printing forms. The printing conditions used were—

Speed	—	Constant, 350 cm/s
Printing pressure	—	196 N
Printing disc	—	2 cm wide (aluminium)
Blanket	—	IGT paper blanket

The prints were allowed to dry overnight and the optical density of printed area in reference to optical

density of the blank paper was measured using Macbeth densitometer (RD514).

STRIKE THROUGH :

The strips were printed using thick layer (16 micron) of IGT striking-in-ink. The density of the print penetrated to the other side of the paper was measured after allowing the printed sheets to dry overnight.

SPECKLE :

The prints were made on the wire side of the paper using the amount of ink sufficient to get print density equivalent to 0.90. The extent of unprinted area in solid print was compared with IGT speckle scale for newsprinting. This scale has been numbered from 1 to 7 and the higher value indicates more unprinted spots in solid print thus poor print quality.

SET OFF :

The prints were made on the top side of paper strip using the amount of ink required to get print density 0.90. The printed strip was run through the second nip after time interval of 0.15, 1.05, 5.05 so that part of the ink got transferred to a clean strip. The set off print density on the later strip was measured using Macbeth densitometer.

The printing conditions used for set off tests were :—

Speed	—70 cm/s, constant
Pressure	— 686 N
Disc	—2 cm aluminium
Blanket	—IGT paper blanket

OTHER TESTS :

Thickness	— ISO R 438
Tensile strength	— ISO 1924
Tearing strength	— ISO 1974
Brightness	— ISO 2470
Opacity	— ISO 2471
Sp. Scatt. co-eff.	— SCAN C 2769
Surface roughness	— Measured using Parker print surface roughness tester under letter press printing conditions.

Stress-strain property —Measured using Alwetron Universal strength tester with strip of 180 mm. length and 15 mm. width in machine direction.

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