

# Influence of Recovered Paper Furnish in Deinking and Newsprint Properties

Reddy P.N., Sridhar P., Reddy J.V.R., Sundaram T.S., Bhargava S.C.

## ABSTRACT

*Furnish plays a vital role in deciding the final product of the paper. Option to choose the secondary fibre for end product, depends upon cost, availability, deinking plant equipment, bleachability, runnability on the machine and printability etc. Evaluations were carried out in laboratory on various types of furnishes for reuse, by different furnish combinations in the washing deinking system. This has given guidelines, for paper maker to choose the furnish to meet the specifications of newsprint required by the customer. Various recovered paper furnishes were evaluated for bleaching, pulp evaluations, final product quality etc were discussed in the paper.*

## INTRODUCTION

All over the world, deinking process and bleaching by various chemical systems are developed mainly on three factors.

1. Raw material quality
2. Stock preparation technology
3. Product quality

Recycled waste paper quality is determined on one hand by the types of fibres used and on other hand the percentage of non fibrous components. As furnish quality depends upon fibre composition, i.e. amount of wood free and wood-containing fibres and also fully bleached, semi bleached or unbleached fibres. Bleachability is determined by the percentage of mechanical pulp and unbleached kraft pulp fibres. The non fibrous components disturbing the deinking and bleaching process are printing inks, dyes, adhesives, waxes, fillers and coating components etc. They diminish or prevent any significant development in deinking process. The negative

influence of non fibre components has to be removed as before any bleaching process since non fibre components completely destroy the bleaching effect of peroxide rationally used in bleaching of secondary fiber. These components are to be found particularly in the shot fiber fraction (1). The deinking system consists of pulping, screening, cleaning, washing or flotation depending upon the process stages. These process system efficiencies are influenced by water circuits and water cleaning (2). These process stages also represent a good preparation for bleaching. The bleaching itself is characterized by increase in brightness and colour stripping as well as reduction in mottling effect.

Raw Material furnish and system design ultimately will determine the finished stock quality, in terms of pulp freeness, dewatering behaviour, cleanliness, yield, physical, strength and optical

**Rama Newsprint and Papers Ltd.,  
Village : Barbodhan, Taluka Olpad  
Dist. Surat -395 005 (Gujarat)**

properties. Yield is primarily a function of recovered paper which is very important factor. The cheapest grade of recovered paper which still produces the required quality as well as acceptable yield is to be the goal of recycled fibre mill. Due to furnish cost, availability etc. a lab scale experiments were carried out to study the suitability of various furnishes by simulating our existing washing deinking system, for production of newsprint. The system consists of low consistency pulper, screening, cleaning, washing, oxidative bleaching followed by paper machine, without modifying and make use of existing power, steam and waste disposal services.

Laboratory experiments were carried out, with the following furnishes.

1. Indian English news papers : Times group of newspapers, Hindustan Times, Hindu, Indian Express, Mid-day, Mumbai Age, Afternoon, Investors guide.
2. Indian vernacular news papers : Gujarat samachar, Sandesh, Sakal, Lokmat, Navkal, Lok satha, Rajasthan patrika.
3. Imported News papers : The Sun, Newyork Times, Maryland, The Boston Globe, Sunday Star

4. Indian magazines : Readers Digest, Business Today, India Today, Savvy, Out Look, Auto, Data quest
5. Text books : collected in and around Maharashtra and Gujarat states

The pulping, bleaching with hydrogen peroxide, pulp evaluation and hand sheets testing were carried out for the composite samples. Age, types of printing inks, fibre classification, filtrate water clarification yield were not studied. The composite sample ash content, Freeness, furnish composition and initial brightness were measured. Pulp pads were prepared after disintegrating the sample in lab disintegrator. The pulping and bleaching parameters and chemical dosages were kept same for all the experiments. The fatty acid ethoxylates used as surfactant in pulper and residual surfactant, was measured using (cobaltous nitrate + ammonium thiocyanate) blue cobalt dye in presence of dichloromethane. The colour extracted is proportional to the concentration of residual surfactant. The colour absorbance was measured at 620 nm in HACH DR 4000U spectrophotometer

The pulp from lab pulper passed through 60 BSS mesh and thickened upto 10% consistency and bleaching was carried out with hydrogen peroxide in

**The furnish characteristics**

Sr. No.	Furnish	Brightness % ISO	Ash %	Freeness ml csf	Approx. Fibre furnish M : C*	Visual print density	Visual specks & Dirt
1	Indian ONP (English)	43	4.2	230	75:25	Medium	Low
2	Indian ONP (vernacular)	40	6.2	250	80:20	Heavy	High
3	Imported ONP	45	3.6	290	70:30	Medium	Low
4	Indian Magazines	47	21.0	240	45:55	Heavy	High
5	Indian text books	54	15.2	420	25:75	Medium	Low

\*M : MECHANICAL, C CHEMICAL

### Annexure I parameter of pulping stage

1. Consistency %	-	5
2. Temperature (deg.c)	-	50
3. Slushing time (min)		20
4. Na <sub>2</sub> CO <sub>3</sub> addition %	-	0.3 on OD paper
5. Surfactant %	-	1.0 "

	Brightness % ISO After pulping	Residual surfac- tant ppm
1. Vernacular ONP (Indian)	48.2	10
2. Indian English ONP	48.8	35
3. Imported ONP	50.6	42
4. Indian magazine	51.5	54
5. Text books	58.5	68

polythene bags in constant temperature bath. Final pulp was beaten in valley beater upto 180 ml csf and hand sheets were prepared and tested as per Tappi T-200 & T-220. The bleaching conditions, results were given in annexure - II. The pulp evaluation and hand sheet testing results were given in annexure-III. Based on the lab scale results plant scale trials were carried out and the newsprint strength and optical

properties were given in annexure - IV (except Indian magazines and text books). Brightness values in pulping & bleaching and Breaking length, Tear factor at 180 ml csf were shown in figures. During plant trials the furnish was processed in washing deinking system consists of screening, frovipulper, cleaning system, washing, dewatering and H<sub>2</sub>O<sub>2</sub> bleaching and sent to paper machine running at 500 m/min speed.

### RESULTS AND DISCUSSION

1. Indian Vernacular ONP : Consists mainly short mechanical fibre having high print density. The base brightness was 40% ISO and having heavy visual dirt specks. The loading material was also high, when compared with other furnishes. The brightness after pulping was 48.2% and the residual surfactant was 10 ppm only. The bleached pulp brightness was 54% ISO and the residual H<sub>2</sub>O<sub>2</sub> was also low. Breaking length, tear factor, burst factor were also low at 180 ml csf in lab studies. The same trend was seen in newsprint manufactured in the plant. Indian vernacular ONP alone, can not be used in high speed machine because of low strength which may create the web breaks leading to production loss. The freeness and beating time are lower indicating less long fibre fraction

2. Indian English ONP : The fibre composition was 75:25 ratio of mechanical and chemical pulp. The base brightness was 43% ISO and is better than Indian vernacular news papers. Ash content also was low. The visual print density was medium so the ink

### Annexure - II H<sub>2</sub>O<sub>2</sub> bleaching stage

1. Consistency %	-	10
2. Temperature (deg.c)	-	75
3. Na <sub>2</sub> SiO <sub>3</sub> % on OD pulp	-	1.5
4. NaOH%	-	0.8
5. Mg SO <sub>4</sub> %	-	0.05
6. H <sub>2</sub> O <sub>2</sub> %	-	1.5
7. Retention time (min)	-	90

	Residual H <sub>2</sub> O <sub>2</sub> , ppm	Brightness % as such	Brightness % After washing
1. Vernacular ONP (Indian)	traces	52.0	54.0
2. Indian English ONP	18.0	52.3	54.6
3. Imported ONP	30.0	53.7	55.2
4. Indian magazine	40.0	54.3	56.8
5. Text books	21.0	63.2	68.1

Annexure - III Pulp evaluation results after bleaching

Sr.	Particulars	Vernacular ONP		English ONP		Imp ONP		Ind. Mag		Text books	
01	Beating time (min)	-	09	-	10	-	21	-	7	-	18
02	Drainage time (secs)	07	10	08	11	07	09	7	12	7	15
03	Freeness : ml csf	23	180	250	180	280	180	240	180	410	180
04	Substance. g/m <sup>2</sup>	50	50.9	51.0	51.2	52.9	53.0	50.5	51.5	51.8	53.2
05	Moisture %	6.	6.9	6.6	6.9	6.8	7.0	7.2	7.4	5.2	5.8
06	Bulk cc/gm	2.	2.15	2.26	2.10	1.98	1.77	2.2	1.9	1.87	1.47
07	Breaking length. m	24	320	268	427	480	580	360	440	331	475
08	Tear factor	68	58	69	65	75	71	81	74	51	34
09	Burst factor	9	11.5	10.2	16.1	24.5	31.0	14.9	18.9	12.4	21.2
10	Brightness-% ISO	55	54.6	56.0	56.3	57.6	56.8	58.6	57.3	70.2	62.6
11	Opacity %	95	95.8	96.5	96.7	93.4	94.6	96.7	96.5	88.3	90.3

quality is better. The brightness after pulping was 48.8% and in bleaching with H<sub>2</sub>O<sub>2</sub> the brightness of bleached pulp 54.6% ISO and the breaking length 4300 meters and burst factor of 16 and tear factor of 65. The brightness requirement for newsprint is 56, which can be met by single stage bleaching.

3 Imported ONP : The fibre composition was 70:30 of mechanical and chemical pulps. Higher freeness of 280 indicates presence of more long fibre fraction. The initial brightness of 45% indicates less bleaching requirement, when compared with Indian newspapers. The brightness in pulping stages was more than 2.4 points and high residual surfactant and H<sub>2</sub>O<sub>2</sub> presence indicates less Deinking and bleaching requirement. Breaking length, tear factor, burst factor were more when compared with Indian ONP However opacity is slightly less compared to Indian ONP

4 Indian magazines : The Indian magazines consist of 55:45 ratio, chemical and mechanical fibres. The high ash content indicates the filler is more and the ink density was also heavy. It contains coated material and multi colour pages. The brightness after deinking was 51.5% and after bleaching it was 56.8%. However the tear factor was

more compared with other furnishes. The contaminants like staple pins, gum, coated matter are present.

5 Indian text books : It is mostly of chemical pulp. The higher freeness indicates mostly of long fibre fraction from chemical pulping. The brightness after pulping was 58.5% and after peroxide bleaching it was 68.1%. high residual surfactant of 68 ppm indicates less requirement of deinking chemical and inks may be bleachable. As the beating time is less, it indicates the papers were made with hard wood chemical pulp as there was no further improvement in strength properties.

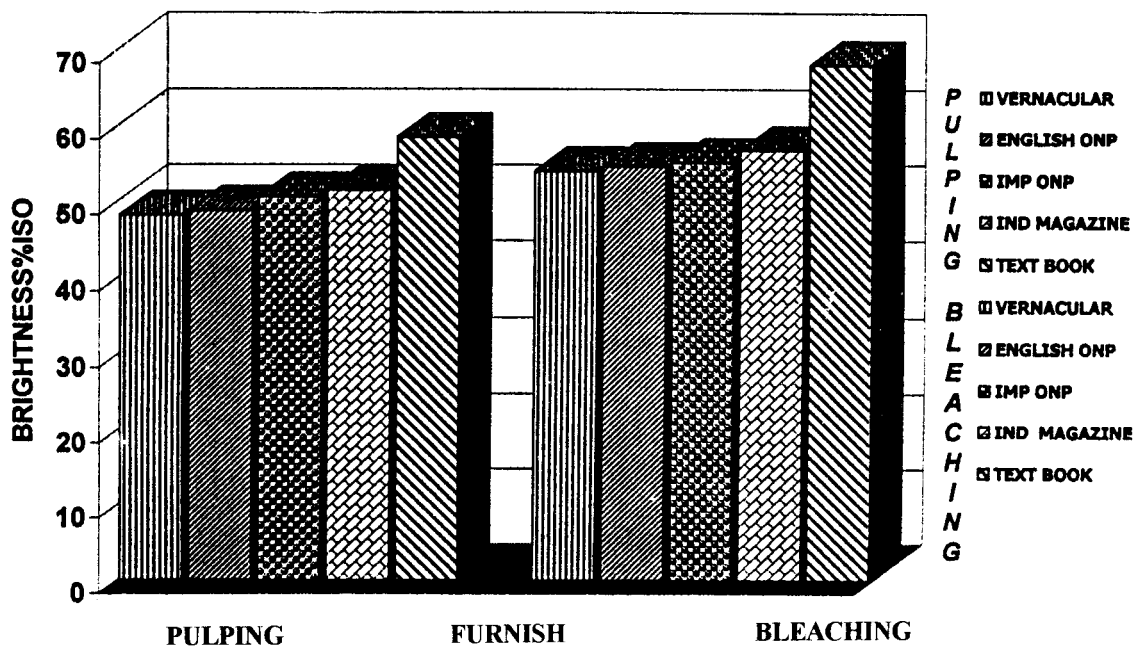
CONCLUSION

1. With 100% Indian vernacular news papers the deinking and bleaching, chemical requirement are more and strength properties are less. More fines create problem of linting, dusting etc apart from poor runnability in high speed paper machines and in printing press resulting more down time.
2. Indian English newspapers use mostly from

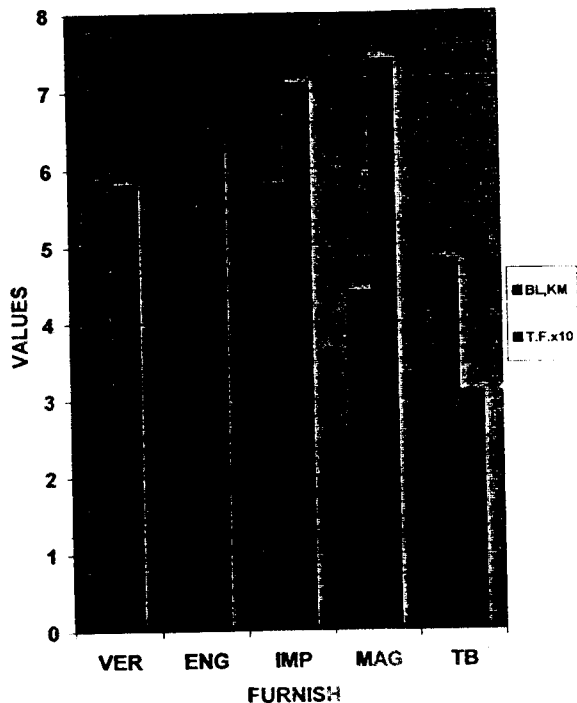
**Annexure - IV Newsprint Manufactured Using Various Furnishes**

Sr. No	Parameter	Vernacular ONP	Indian ONP	Imported ONP
01	Substance, g/m <sup>2</sup>	48.2	48.8	48.7
02	Moisture %	6.7	6.3	6.8
03	Ash, %	4.3	5.0	5.6
04	Bulk, cc/gm	1.71	1.65	1.7
05	Breaking length m MD	3920	4350	4650
06	CD	1620	2050	1800
07	Tear Factor MD	41	43	45
08	CD	56	60	62
09	Burst Factor	11	13.5	14.1
10	Smoothness, ml/min Side-I	150	146	140
	(Bendtsen) Side II	160	164	155
11	Porosity, ml/min	480	500	350
12	Brightness, % ISO	54	55	56
13	Opacity, %	95.9	95.9	95.5

**Fig1 : Brightness of Various Furnishes**



**Fig2 : Breaking Length & Tear Factor of Various Furnishes (AT 180 ml CSF)**



news print manufactures and ink quality is better as indicated by deinking and bleaching brightness apart from strength properties. High tear factor indicates less fines, and further improvement in breaking length and burst factor can be achieved if further refining is done. This furnish can be used for manufacturing of newsprint without much difficult.

3. It was evident from the brightness and the residual chemical that the Imported newspapers are using better quality ink and

better bleachability when compared with Indian Newspapers. The long fiber fraction, less ash content reflect in advantages in less linting, and more strength & yield etc to produce newsprint acceptable to the printers. It is advantageous over Indian ONP in terms of low deinking and bleaching costs.

4. Indian magazines : Higher ash gives low yield and the contaminants like adhesives, pins, coating material may aggravate the process problems in washing, drainage, stickies, dust and fluff in newsprint manufacturing.
5. Indian Text book : Due to high chemical fibre fraction and high brightness level with single stage peroxide it can be used for writing printing papers. Further brightness enhancement can be achieved by further bleaching. As such it can be used for high bright newsprint papers.
6. Depending upon the customer requirement the paper maker has to choose the furnish, for achieving required quality of newsprint. Choosing the right furnish ratio may help in production and quality.

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