

Utilisation of waste paper for paper & board manufacture-A.P. paper mills experiences

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ABSTRACT

Paper Mills in India are facing acute shortage of conventional forest based fibrous raw materials and the situation is likely to worsen in future with increase demand and utmost emphasis to conserve forests for ecological reasons. As such, Indian Mills are forced to go in for usage of more and more recycled fibers to supplement its fibrous raw materials requirement by way of imported waste papers. Some of the imported waste papers are observed to be even better than domestic pu'ps with respect to strength properties.

The present paper discuss the experience at Andhra Pradesh Paper Mills Limited in utilizing these waste papers and various measures undertaken to overcome some of the problems arising out of their usage.

Paper Mills in India are currently facing acute shortage of conventional forest based fibrous raw materials. The situation is likely to worsen in future with increased paper demand and utmost emphasis to conserve forests for ecological reasons. In order to meet the situation, efforts are on for creation of sustained supply of wood through man made forests, afforestation and social forestry : but these are long term projects and have a considerate gestation period. Hence, Indian Mills are forced to go in for the usage of recycled fibers which have been established as a potential source of furnish for Paper Industry. Further, Government concessions by way of allowing waste paper imports and offering liberal excise concessions for usage of waste paper have also provided attractive incentives to the Industry towards usage of more and more waste paper.

AP Paper Mills in order to supplement its requirement of fibrous raw materials, has also gone in for waste paper usage since past few years. Initially, we had only a 40 TPD waste paper plant comprising of continuous slusher, Turbo Separator, High density Cleaner and Deflaker. Later in 1989 one more unit

of 60 TPD was installed to meet the increased requirement.

Paper Qualities

Out of about 50—60 varieties of waste papers, (as per Scrap specifications Circular issued from time to time as guidelines for paper stock ; PS-89, by Institute of Scrap Recycling Industries, Washington), we at APPM have used quite a few varieties as given below :

- i) Computer print out (CPO) with and without ground wood pulp.
- ii) Hard White Shavings (HWS)
- iii) Hard White Envelop Cuttings (HWEC)
- iv) Sorted White Ledger (SWL)
- v) New Double Lined Kraft Corrugated Cuttings (NDLKC)
- vi) Old & New Corrugated Containers (OCC/NCC)

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Usage of CPO, HWS, HWEC, SWL was confined to writing grade papers such as white printing, cream wove, posters and pulp board while NDLKC and OCC/NCC were utilised for making plain kraft and ribbed kraft.

The Laboratory Evaluation results of some of the varieties of imported waste papers are given in Table-1.

From the results vide Table-1 it is evident that some of these qualities of waste paper are comparable and at times found to be even better than our virgin pulps. However, waste papers invariably contain contaminants like grifts, strings, printing ink, wax, synthetic resins, gummy materials, loose plastic and light weights like self adhesive tapes etc. The presence of contaminants effect the end product quality besides creating various problem in processing. Many troublesome contaminants can not be eliminated by hand sorting as was formerly practiced, and even segregation at the source of these contaminants is not necessarily infallible. As such, waste paper processing systems today must be suitably designed to handle all types of trash, plastic coatings, adhesive etc. and to eliminate them as completely as possible with lowest energy input and capital investments.

One of the most difficult contaminants to process is "stickies". These sticky contaminants in waste paper originate from the synthetic resins, adhesive backing for labels and tapes, coated products and plastics. Stickies may agglomerate in the stock and affect final product appearance such as transparent spots, oily spots, loss of glaze etc. These also impair machine runnability and efficiency of process machinery and clothings.

Quality Of Imported Waste Paper Supplies :

To restrict the contaminants entering along with the waste paper in to the waste paper plant, care is to be taken to place the stringent specifications in addition to the stipulations mentioned in PS-Circular of guidelines for paper stock, on suppliers, while issuing the purchase order.

In spite of these efforts, it is observed that the incoming waste paper contains higher percentage of contaminants which are non-permissible as per the purchase specifications. For instance, the paper stock specifications for NDLKC (item No. 13) clearly specify "non soluble adhesives, slabbed or hogged medium and treated medium or liners are not acceptable in this grade." Unfortunately, it is very difficult to assess the material from external inspection of a large bale at the time of unloading at the site. Of course, some contaminants can be traced

TABLE-1
LABORATORY EVALUATION RESULTS OF IMPORTED WASTE PAPERS

(Valley beater evaluation at 40°SR)

SI. No.	Material	Yield %	Ash %	B. F.	T. F.	B L (Km)
1.	NDLKC (Normal)	92-98	1.2-2.0	32-44	85-117	4.9-6.9
2.	NDLKC (with dark medium)	—	—	20	78	3.66
3.	NDLKC (Outer Layers)	—	—	39-48	114-117	6.8-8.0
4.	NDLKC (Middle Layers)	—	—	28	81-95	3.5-4.4
5.	CPO	90-94	6.0-9.0	30-33	76-79	5.4-5.7
6.	WS	—	15-25	36	72	5.2
7.	CPO (G.W)	—	—	20	67	3.4
8.	HWEC	—	9-10	43-35	80-107	5.2-7.4

and isolated during usage, but, prohibitive materials like synthetic adhesive, resins; wax and poly coated materials tend to escape the watchful eye of the supervisor and appear in the finished product causing considerable damage in the form of machine downtime and sub-standard product.

Manual sorting is a labour intensive process and requires large sorting sheds, double transportation etc. but, it is not foolproof method to isolate stickies such as insoluble gums, waxes, polycoat etc.

STORAGE PROBLEMS :

Besides quality aspects, the storage of waste paper is a big problem normally encountered by the mills with limited storage facilities. As it is not possible to store all the material in closed storage sheds, the waste paper is to be stored outside. This results in material loss as well as quality deterioration.

A typical study results of effect of outside storage of CPO is given in Table—2.

APP MILLS EXPERIENCE :

A. Usage of Waste Paper Pulp in Bleached Varieties of Paper :

Imported waste paper like hard white envelope cuttings (HWEC), hard white shavings (HWS), and computer print outs (CPO), was used in the manufacture of various bleached varieties without resorting to deinking process. By and large no serious problems were observed regarding the runnability of the paper machines. However, despite strength characteristics being satisfactory with usage of more than 50% HWEC and HWS, overall glaze was observed to be less on

MG Machines. Fines picking on the MG Cylinders resulting in MG Cylinders getting coated was also observed. More foam formed in the system resulting in occasional foam spots/holes in the paper. Moreover, the overall consumption of rosin was considerably higher for achieving required degree of sizing.

In the usage of CPO, depending on the type the quality, especially brightness and cleanliness of the final paper was severally affected. The worst quality observed was laser printed CPO since it was very difficult to remove the charred black particles even by conventional deinking process. Similarly, while using SWL, the cleanliness of the paper was badly affected due to the presence of heavily printed material with deep colours. It has been experienced that it is no longer possible to use either CPO or SWL without deinking for any quality of the papers being manufactured.

B. NDLC and other waste papers in unbleached grades:

APPM is using about 7,500 MT of NDLC per annum in the manufacture of MG Plain Kraft. Some of the problems encountered during the usage of NDLC waste papers are due to the presences of—

- i) Very darker medium with lot of shives etc.
- ii) Contaminants like self adhesive tapes, synthetic reinforced fibers, plastics etc.
- iii) Natural and synthetic resin coated materials.
- iv) Coloured material
- v) Problems faced in slushing due to presence of poly-coated material and wet strength additives.

TABLE—2
EFFECT OF OUTSIDE STORAGE OF CPO AND GROUND WOOD CPO
FOR PROLONGED PERIOD ON STRENGTH PROPERTIES

SI.	Particulars	CPO		GW CPO	
		Before	After	Before	After
1.	Burst Factor	30	13	20	4
2.	Tear Factor	76	46	67	8
3.	Breaking Length. km	5.42	3.39	3.36	0.85
4.	Double Folds, No.	50	3	6	NIL

Note : Evaluated at 40°SR

In order to find out the adverse effects due to the presence of some of these contaminants which are not possible to remove either in high density cleaning, screening and deflaking, laboratory studies were conducted at our Mills and these findings are given below :

Nature of Contaminants	Observations
1. Heavily gum coated	i. Yield loss was observed (80% compared to 95% for normal NDLKC) ii. Transparent spots were observed iii. Sheet stuck to sheet former.
2. Difficult to slush papers	i. The slushing time was very high (45 minutes) compared to normal time of 6-8 min. Even then 20% material remained undefibred.
3. Wax coated	i. Longer time for slushing ii. Hot water treatment helped in solving slushing problem, however, oil and transparent spots were observed in oven dried hand sheets.
4. Darker medium	Darker shade with more surface blemishes like shives, specks and transparent spots.

Darker Medium of NDLKC :

Next to stickies, the dark medium of NDLKC causes more problems in the process and adversely affects the quality of the kraft paper made. Though, in some cases the purchase order stipulates the percentage of allowable darker medium as already pointed out in the earlier part of the paper, many a time disputes arise about the percentage content of dark medium as it is very difficult to assess the quantum. Further, even the allowable percentage itself causes serious quality problems. Accordingly, studies were conducted at our Mills to find out suitable ways and means to reduce the problem, if not totally eliminate the same.

Modified Method of Pulping NDLKC with darker and sticky materials :

The laboratory studies have indicated that if alkali is added during slushing/pulping operations in hydropulper and the temperature increased to about 90°C, with a retention time of about ½ hr., the cleanliness of the pulp improved considerably as also the shade (brightness values). Further, due to alkali addition at elevated temperature the stickies are loosened during pulping stage itself to a greater extent thereby reducing the presence of transparent spots in the final paper. The improvement in brightness values are given in Table—3.

TABLE—3
EFFECT OF ALKALI TREATMENT ON OBJECTIONABLE NDLKC

S I. No.	Name of the Material	With Process Water		Brightness of Hand Sheets. %	
		With Water	Without Washing	Hot Water With Washing	2% NaOH 95--100° C ½ Hr. with washing
1.	Oily marked NDLKC	18.0	20.0	20.5	—
2.	NDLKC darker medium	14.0	14.5	15.2	16.5
3.	Darker Kraft Cuttings	13.0	13.2	13.7	14.5

Note : Pulping was done at 4% consistency.

Plant Improvisation :

With the initial system of heating we are able to raise temperature to 45-50°C only. The working consistency of the pulp in the pulper is $4.5 \pm 0.2\%$ with the addition of Machine back water. At this temperature, the desired results are not observed to tally with laboratory findings. Hence, the hydropulper was fitted with steam coils in an effort to elevate the temperature to atleast about 80°C. Facilities were also provided to dose caustic continuously to hydropulper. To improve the cleanliness of the waste paper pulp further, the treated waste paper pulp was washed on vacuum filters with warm water sprays.

Plant Observations :

Machine glazed or machine finished kraft Papers are generally used as top liner in the corrugated box board manufacture. The surface must be very clean and free from blemishes for eye catching printing and appearance.

Introduction of steaming and alkali addition in the pulping of NDLKC has helped to certain extent in mitigating the problem of stickies and dark medium. Problems caused due to stickies at wire and press parts, dryers and MG Cylinder have also reduced considerably. However, less glaze, oily, transparent and dark spots still appear at times in paper manufactured rendering the paper unsuitable for the end use. Incidentally installation of water doctor at MG Cylinder helped in to improve the glaze to certain extent.

Conclusions :

- * CPO, laser printed CPO, SWL are not suitable for use in good quality grade of writing and printing papers without resorting to deinking. Hard white shavings and hard white envelope cuttings (If they are free from windows) are a good source of alternate raw material.

- * Old corrugated cuttings cause innumerable problem in processing, particularly when the waste paper plant is provided with rough cleaning loop only.
- * NDLKC is a good source to supplement the unbleached pulp requirement to manufacture MG/MF Kraft papers. However, it is associated with many problems due to the presence of stickies, waxes and other contraries. Unfortunately, the supplies are also not as per the guidelines for Paper stock specifications. Moreover, it is also observed that many suppliers are not willing to replace the defective material for obvious reasons, though they are under obligation to do so when the material is not conforming to P.S. specifications. The concessions rebate offered by the suppliers are not adequate enough because many a time considerable quantity of paper is to be converted into Mill Wrapper or marketed as substandard paper, besides losing valuable machine productive time for system cleaning etc. At times the paper manufactured so has to be outrightly rejected altogether creating severe broke handling problems.
- * Our studies have shown that chemical treatment (Caustic addition), steaming for elevating the slushing temperature and post slushing washing do reduce 'stickies' problem to considerable extent with improved machine runnability. However, even with above process modification, the paper made need not remain free from surface blemishes always.

Acknowledgements :

The authors convey their sincere thanks to the management of the Andhra Pradesh Paper Mills Ltd. for giving permission to present this paper in IPPTA 2nd Zonal Meeting, 1990.