Waste Paper Utilisation Prospects & Problems

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The paper industry in India has met the various challanges by adopting itself to the changed conditions. The country has an installed capacity of about 22 2 lakh tonnes producing a large variety of papers from a variety of raw materials. The target set for a paper capacity by the year 2000 AD are 42.5 lakh tonnes for paper and 12 9 lakh tonnes of newsprint.

It is a well known fact that present forest sources cannot meet the demand of raw material even for the existing units leaving aside the additional requirement for the future growth of this industry.

The wood requirement as per National Commission on agriculture[1] are as in table–1.

TABLE – 1
WOOD REQUIREMENT

Type	M³	Year 1980 %	Year 2000 M³	%
Fuel Wood	1886	87.5	2250	78
Timber	227 2	10.5	467.5	16
Pulp Wood	41.7	2.0	176.9	6
Total :	2154.9	100	2894.5	100

The forest based raw materials are in tremendous short supply and cannot meet the projected paper capacities. The depleting forest cover and the thrust to conserve ecological balance will force the industry to look to alternative fibrous raw materials other than wood and bamboo. The alternatives available include use of primary fibrous material sources, like agricultural residues or the secondary fiber sources like waste paper. The present policy of the government is clearly aimed at increasing use of these materials to reduce the pressure on forests.

Although about 50 million tonnes of bagasse and 100 million tonnes of rice and wheat straw are available as agricultural waste. Their availability to paper production is only a small fraction of the total. The availability of bagasse for paper production is restricted till the sugar mills are provided with assured alternate energy supply. Utilization of rice and wheat straw has its own problem like collection and high cost of production etc.

Even with fuller utilization of bagasse wheat and rice straw, the supply position will be far from satisfactory for meeting the set target. It is estimated that wheat and rice straw can perhaps produce about 1 5 million tonnes of paper and about 0·75 million tonnes of paper can come from bagasse (2). These are based on the assumptions that only 25% of the total straw is available for industrial use and is collected from 100 K n radius. Similarly the availability of bagasse will be limited to 10%, the rest remaining with sugar industry. The major limitations will be due to short fiber length of these fibers. (1.0 to 1·25 mm) resulting in poor strength properties. Better utilization of these fibers will result, if they can be blended with some long fibered material. This is an area which requires technalogical inputs as well as policy directives to make available the long fibered material.

WASTE PAPER USE :

The waste paper utilization as a source of fiber supply offers tremendous potential, as a matter of fact many countries like Japan and Western Europe use large quantities of waste paper to supplement their production. The figures range from 30-50% of the total fiber demand, There are mills which work on even 100% waste paper.

In India waste paper has been used by a few mills, mostly in the small sector till recently, however, growing shortages of primary fibrous raw material and attractive fiscal incentives of the government have led to large usage of imported waste paper, The use of waste paper can be gazed from the fact that almost 50,000 tonnes were imported last year and one particular large mill used almost 15,000 tonnes of this material.

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The waste paper source, could be indigenous or imported, from both sources, the quality and quantity will remain uncertain. The collection of indigenous waste papers will pose enormous difficulties, as at present there is no organised method of collection, except perhaps getting newsprint variety papers by door to door collection. The so called road sweeping represent a very poor secondary fiber source with lot of extraneous material, similarly the imported waste paper, unless properly sorted and packed, can cause a lot of difficulty in processing. All these resultant heterogenity in the quality of waste paper available for processing. These could be listed as under :

- Variation in moisture content
- Variation in size
- Contaminants
- Inclusion of undesirable nature
- Hetrogenity in grade
- Deteriorated waste.

For effective utilization of waste paper as source of secondary fiber, it is necessary to sort and classify the material into suitable category. The best grades of clean secondary fiber are utilized in place of virgin market pulp. The lower grade materials have to be cleaned up in seeondary fiber pulping system to remove contaminants such as ltsted in table below :

TABLE 2

CONTAMINANT SOURCES, TYPES AND PROBLEMS

Type of contaminant	Source	Type of in-Mill processing difficulties
Hot melts	Adhesive and coatings	Cleaning system can not handle adequately, fouls equipment causes defect in product.
Polystyrene foam	Blocks, beads etc. used in packing.	Difficult to remove sticks to rolls indents sheet, causes pickouts.
Dense plastie chips (Polystyrene etc.)	Foam blister packs and see through material,	Slows down pulper process causes product defect.
Wet strength resins	Papers treated with resins	Do not disperse in pulper, can cause spots in products.
Latex	Rubber latex as adhesive lining or coating, including flying posters and rubber bands,	Degrades product difficult to remove.
Pressure sensitives	Miscellanous uses splicing rolls, case sealings etc.	Sticks to wires and felts and deposit on wires can cause web breaks.
Waxes	Paper or paper board laminates and coatings.	Fails to disperse in pulper, fauls equipment, degrades products.
Asphalt.	Paper or board laminated or coated with asphalt.	Coagulates in pulping process sticks to Wires, causes black spots in product.
Fibres	Vegetable and synthetic fibers used for rope.	Causes product defect and web breaks,

EFFECT OF RECYCLING ON PAPER PROPERTIES :

At the 50% recycle level, which is generally considered to be practical maximum recycle rate, it is apparent that half of the material being recycled has already been througn at least one previous recycle process. The effect of multiple recycling operations on sheet properties and fiber characteristics are shown in Fig. 1 (3).

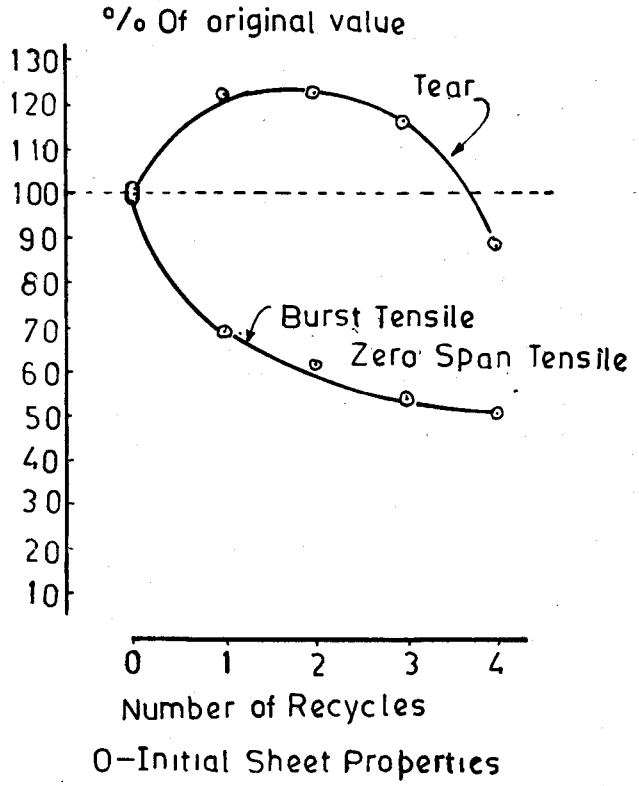

FIG. 1—EFFECT OF REPEATED RECYCLING ON STRENGTH PROPERTIES OF UN-BLEACHED KRAFT PULP

Repulped fibers, refined to same freeness level, show progressively lower strength and bonding potential. Tear gives an initial increase on recycling which may be due to the effect of drying on fiber stiffness.

Fig. 2 shows relative effects of repeated recycling of newsprint on individual fiber strength and on the bonding strength between fibers. Both streagth indices decrease, but the bonding between fibers show a more drastic loss. Reason may be enumerated as

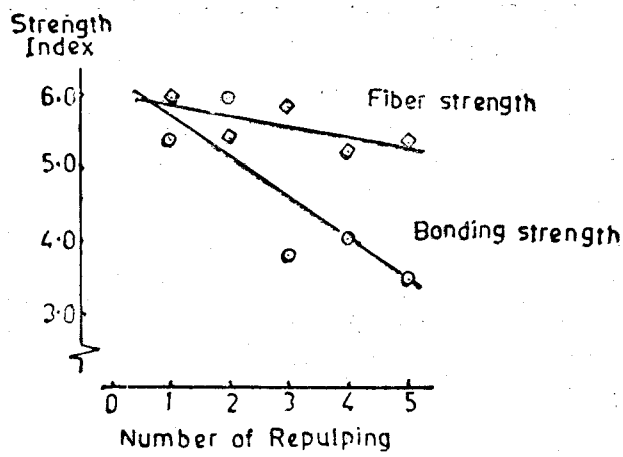

FIG. 2—EFFECT OF THE NUMBER OF REPULPINGS ON FIBER AND BONDING STRENTHS OF NEWSPRINT

1. With each drying and slushing cycle, the fibers become less flexible and less permeable to water and thus do not conform as well, as virgin fibers.
2. Cumulative loss of hemicelluloses from fiber surface also contributes toward reduced bonding.

Experiments have shown following relationship of the weight average fiber length and specific volume of sheet with that of final strength properties like breaking length, tear, burst, and regidity (4)

$$\text{Burst} = K_B \frac{L}{V}$$

$$\text{Breaking length} = K_P \frac{\sqrt{L}}{V}$$

$$\text{Rigidity} = K_R \frac{\sqrt{L}}{V^2}$$

$$\text{Tear} = K_T \, L^{15 \cdot V}$$

From these it is evident that if the value of these properties are known for every pulp, the strength properties of the resulting sheet can be predicted. Considering the variation in weight average fiber length with every treatment of recycling, it is evident that the value will decrease due to the reasons referred earlier i. e. loss of hemicellulose. Reviewing this for the three qualities namely corrugating board, Newsprint and cultural grade papers discussed later, the hemicellulose content will be highest in newsprint, generally made of mostly mechanical pulp component and cultural grades will have minimum due to chemical pulping process where as corrugating media will have medium value due to chemi-mechanical pulp. Consequently for every cycle

of these fibers the maximum loss of strength will be in newsprint, while corrugating and fine pulp will have comparatively lesser loss.

Looking into the relationship, reduction in tear will be most drastic with little change in value of weight average fiber length. The burst reduction will be comparatively less and breaking length and rigidity reduces to a lesser extent.

The newsprint pulps, in general, will have lowest initial strength compared to corrugating media or fine grade pulp, all made from virgin pulp. The recycling of fiber will show itself loss in strength properties, most predominant in newsprint grade and comparatively lower in other grades. This will necessarily mean that the newsprint strategies must include a higher percentage of virgin pulp or of a good quality waste paper to ensure minimum strength properties. Thus percentage recycle of secondary fibers will have to be lower in newsprint compared to other grade of paper.

COMPARISION OF WASTE PAPER PROCESSING FOR DIFFERENT GRADES OF PAPER :

Slushing and deinking of pulp for manufacture of different grades of pulp remains almost the same, difference occur only in degree of cleaning. In case of corrugating paper very little or no deinking is required. The given table -3 describe briefly dfferent steps for processing waste paper.

TABLE—3

	Corrugating medium paper	Newsprint	Cultural or fine grade of paper.
Grade of Waste	Corrugating container, unbleached kraft, corrugated cuttings.	High class waste news, press room over issues paper (other than news) containing not more of rota-gravure printing.	Envelops trimmings business machine cards, computer waste, office ledgers.
Prohibited material	Sand, dirt, iron, particles, plastic films and latex.	Same as in corrugating medium	Ground wood, wet strength paper, hot melts, pressure sensitives, matallic and fluorescent inks, ultraviolet heat set inks and tacky adhesives.
Pulping	Either batch or continuous high consistency pulping in a pulper with ragger and junker. Do not require secondary pulping.	Batch or continuous pulping in a pulper with ragger and junker. Deflaking is required.	Primary pulping is same but secondary repulping is very necessary in a fiberizer.
Chemicals	2–5% of caustic soda. If required 1–3% of soda ash.	1–2% sodium peroxide upto 3% sodium silicate and caustic soda. Because of presence of high ground wood content temperature should be low. Zinc hydrosulfite is sometimes used.	2–3% caustic, soda ash, sodium peroxide, sodium meta silicate. in varying proportion depending upon the end. grade to be produeed
	Deinking chemical not required.	Soap, other detergent like sodium stearates are added.	Deinking chemicals required. Kerosene also help clearing small quantities of asphalt and waxy particles.

	Corrugating medium paper	Newsprint	Cultural or fine grade of paper.
Cleaning	Simple high density cleaners.	Centrifugal cleaners working at low pressure high consistency are beneficial.	Two stage centrifugal cleaners or reverse cleaning system is used.
Screening	Single stage pressure screening.	Two stage screening system gives desirable product.	Multistage screening necessary.
Washing	Single stage washing either by side hill washer, or inclined screw or vacuum washer.	Same as for corrugating.	Same as for corrugating.
Bleaching	Does not require bleaching.	If required, either by hydrogen peroxide or sod. or zinc hydro sulphite.	Sodium hypo chloride bleaching can also be used.
Deashing	Not required.	Not required.	For high grades of paper e.g. tissue deashing by modified floatation deinking process where filtrate of thickners is treated in clarifier,

All different grades of recycled pulp give common problem, when processed further for paper making. In the final sheet recycled pulp causes certain defects. Few of them are listed here.

1. Drainage becomes poor because of increased formation of fines.
2. Low wet web strength causes problem in sheet transfer.
3. With high load at presses, crushing may occur.
4. Rigid recycle fiber will increase fluff on machine.
5. Uneven moisture content due to varying quality across machine will result in cockling and curling of paper.
6. Requirement of total heat energy on dryer will increase due to longer falling rate period.
7. With increasing recycled fiber, structural, optical and surface two sided-ness occur in paper.
8. Low wet web strength causes more loss of elongation and higher permanent set in paper.

SUGGESTED WASTE PAPER PROCESSING FOR SMALL MILLS PRODUCING NEWSPRINT

With the present situation of shortage of newsprint due to lack of suitable raw material, high cost of energy to produce mechanical pulp, case therefore exists to recycle waste news as part of the fiber furnish to produce newsprint.

The factors, to be considered, for small mills in selecting a suitable deinking process system are as under.

- Economy in capital costs for equipment.
- Simple processing system for operation.
- High degree of labour intensity.
- Simplicity in maintenance with most replacement parts to be turned out locally.

Based on above factors the deinking system that could be recommended for small mills would comprise of simple process equipment in order to achieve the following :

— Pulping i. e. mechanical defibering by pulper alongwith deinking chemicals.
— Cleaning and screening.
— Washing.

Batch pulping method has the advantage of better control of deinking chemicals, water and quality of waste paper added to the pulper. Defibering is completed in pulper if sufficient time is allowed for mechanical action. Periodic samples can be taken before dumping a batch, to determine the pulping completed to the degree required.

Waste paper stock could be cleaned with centrifugal cleaners either by high pressure drop and low consistency or law pressure and high consistency. Single stage arrangement is preferred to avoid high capital cost of elaborate equipment.

Open vibratory screen could be conveniently arranged to perform both primary and secondary functions.

For washing choice of equipment could be inclined screw, side hill or decker washer.

Based on above recommendations a typical flow arrangement, for small mill, could be suggested, is as per Fig. 3.

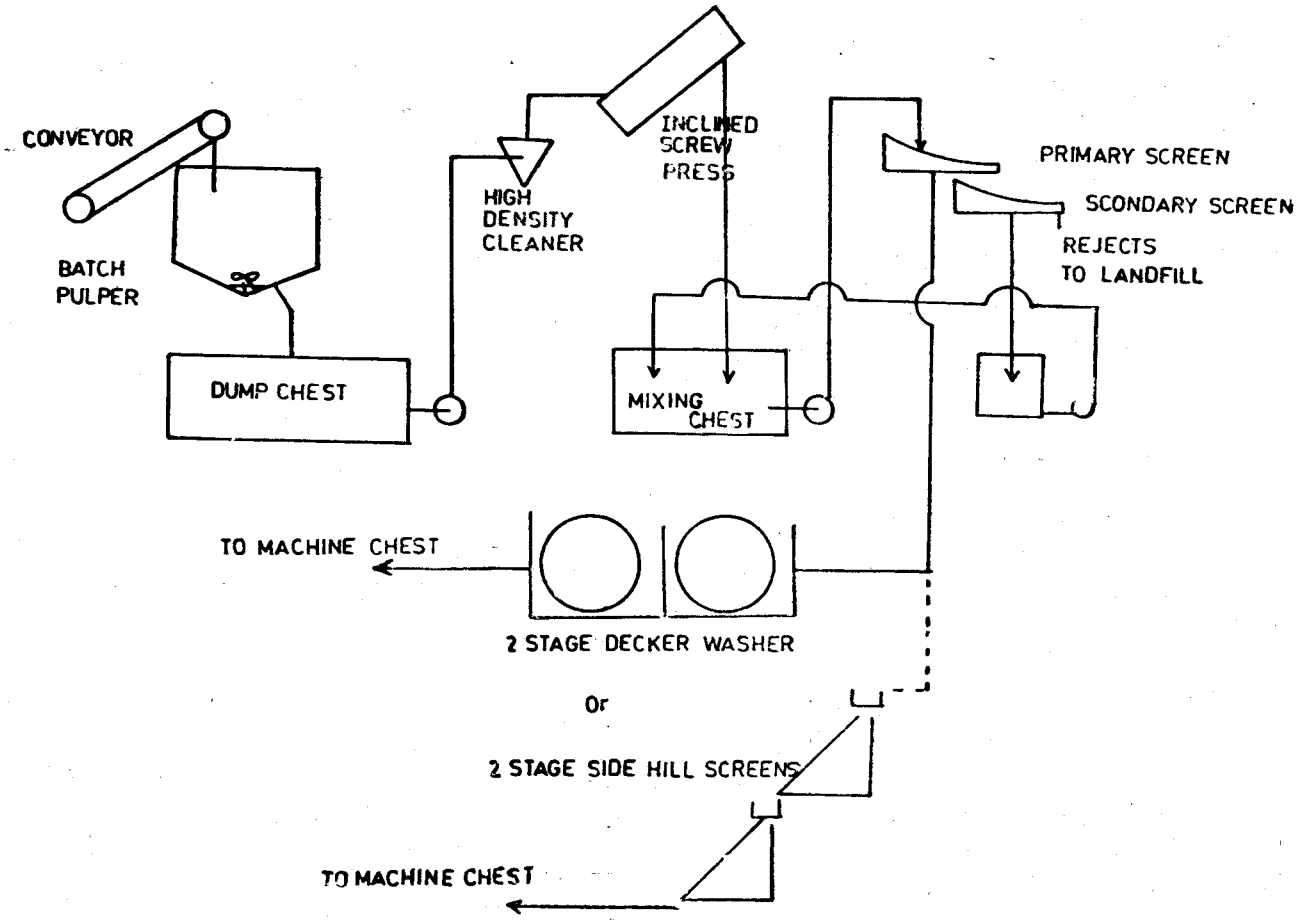

FIG. 3—A SIMPLE DEINKING SYSTEM FOR SMALL PAPER MILL PRODUCING NEWSPRINT

RECENT TRENDS IN WASTE PAPER DEINKING FOR LARGE MILLS

Washing and flotation system of deinking has their own advantages and draw backs. Washing can remove the ink particles of extremely small size (20 um) but fiber losses are more while floation gives significantly lower fiber losses but capital cost and space requirement are greater as compared to washing process. The popularity of the two processes also vary among European Countries and North America. Floatation is widely used in Europe but has not been popular in North America.

For maximum operating flexibility and improved quality of the deinking stock, a system utilizing both washing and floatation can be used. The washing stage serves to remove fillers and fines, alongwith smaller ink particles. Washing also enhances operation of the subsequent floatation stage by removing some elements in the furnish which inhibit the attachment of contaminants to the foam bubbles.

In this two stage system, the floatation step is more effective in hanlding the more difficult to dispense inks. Also, the flotation stage has the ability to remove height weight flotating contaminants other than ink.

The system is shown in Fig. 4.

PRELIMINARY ECONOMIC ANALYSIS ON USE OF WASTE PAPER :

Waste paper can be used with proper processing schemes alongwith virgin fiber for manafacture of bleached paper. Recycled fiber is apparently economical to use and many mills have started using this source, Today's available knowledge and research trends focus on ways to upgrade recycled fiber to achieve desirable product charateristics. The selections are often based on economic analysis[6].

Fiber raw material cost is one of the economic variable in comparing the recycled fiber with Kraft Pulp. Landed values of recycled imported waste paper is about Rs. 2000 to Rs. 3000 per tonne while the cost of wood/bamboo range between Rs. 350 to Rs. 750 per tonne (on AD basis). The cost of wood/bamboo is likely go up sharply with present availability/demand trends in next 3–5 years upto Rs. 1000 to

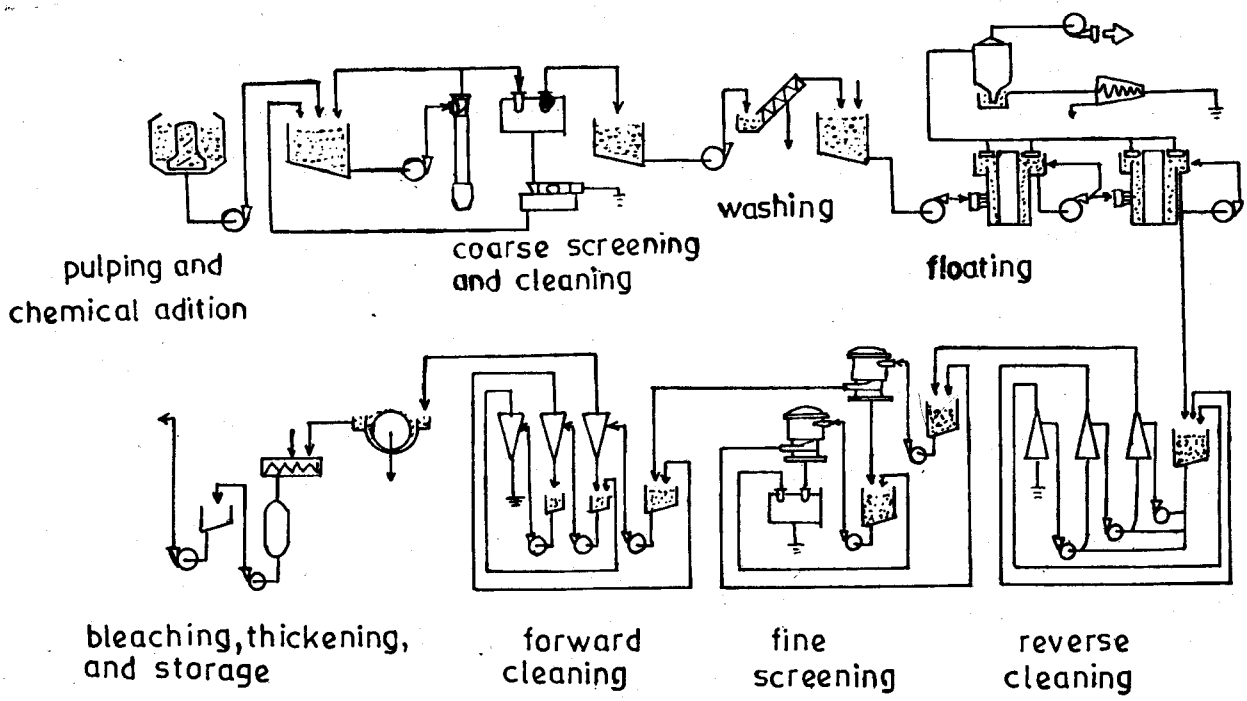

FIG. 4—COMBIND WASHING AND FLOTATION DEINKING SYSTEM

Rs. 2000/tonne. Similarly waste paper landed price is also likely to go upto Rs. 4000 to Rs. 4500 per tonne. The bleached yield from wood/bamboo is likely to be between 35% - 40% while that from waste paper is likely to be 80%—90%. Thus there is every possibility of a substantial price difference in raw material costs.

The other economic variables are less obvious than fiber costs. Process fuel and energy costs per unit of paper product will change as more secondary fiber is used. Specific energy requirements decrease with increasing use of waste paper, so also is the generation of black liquor and internal power generation. This has to be augmented by power from coal at increasing costs. The steam requirements will reduce in pulping and Block liquor recovery side. The process and Chemical costs are likely to reduce significantly when waste paper deinking is used in preference to Virgin fiber pulping. The impact on unit labour costs is marginal and is likely to be lower with inereased use of secondary fiber. Working capital requirement for raw materials inventory may also decrease with increased use of waste papers. An inventory of 4—8 weeks will normally suffice. Due to lower yields from Bamboo/wood, the inventory in that case is likely to be higher. The most significant variable of all is the capital investment requirement and related depreciation, interest and fixed costs impact. Kraft pulping facilities require much higher capital investment than secondary fiber processing facilities for the same capacities. Thus there are a number of prominent economic variables to consider.

An analysis has been made to evaluate the increased use of recycled waste paper and comparing with the alternative which uses kraft pulping. The analysis based on expanded use of recycled fiber upto 50% of furnish assuming technology is available to produce the desired product.

In the analysis the following situations are taken :

1. An existing kraft mill of 100 TPD is using Kraft pulping with bamboo/wood.

Case–I A waste paper deinking street is added to replace wood partly and other sections remain same.

Case–II Additional capacity is added with a deinking street/kraft pulping street.

These alternatives are compared.

The bleached yield of bamboo/wood is assumed around 35% and that for waste paper as 80%. In the existing large integrated kraft mill producing writing–printing grades of paper, the cost variations are as under in Table—4.

TABLE—4 : BREAKE UP OF MANUFACTURING COST IN LARGE INTEGRATED PAPER MILL

	Percent	Taken In Analysis
Raw Material	20–30	25
Salaries and wages	12–15	12
Chemicals & Stores	25–33	28
Power and fuel	17–20	18
Repair and Maintenance	1–5	2
Administrative and other expenses	2.5–6	3
Financial cost (Interest, depreciation)	8.5–15	12
Total :		100

These costs in typical large Indian integrated mill during 1984–85 are around Rs. 8500 to 8800/tonne. The cost wise break up for a typical existing Kraft mill as under in Table–5 ;

TABLE—5 ; ACTUAL COST OF PRODUCTION IN LARGE INDIAN MILL

	Rs.
Raw material (2.8 T/T at Rs. 750/T)	2100
Chemicals/Stores	2400
Power and fuel	1500
Repair, maintenance, wages, salaries and administrative expenses.	1450
Financial costs (depreciation, interest)	1000
TOTAL :	8500

Taxes and other are assumed to be around Rs. 1650/tonne making the per tonne cost of paper without profit Rs. 10150/–.

The present per annual tonne investment in Kraft pulping papermaking is Rs. 25000/–comprising of Rs. 10000/–in pulping, bleaching and recovery and Rs. 15000/–in papermaking, The corresponding costs on a deinking street will be Rs. 5000/–per tonne. The new capital investment will be made from bank loans and the impact of interest and depreciation will be to the tune of 25%.

ALTERNATIVE-I

Existing 100 TPD Kraft mill works with reduced pulping and a waste paper deinking street is added to process waste paper. A comparison is made between Virgin fiber based paper and the secondary fiber based paper. The cost of production of secondary fiber paper is shown in table below. Depreciation is taken on new investment at 25% (on Rs. 5000 per tonne) and old investment at Rs. 1000 per tonne. Similarly in view of excise concessions on use of secondary fiber, the value is taken at 50% of the normal at Rs. 850 per tonne.

TABLE – 6

COST OF PRODUCTION FOR PROCESSING SECONDARY FIBRES :

	Rs
Raw material cost (80% yield waste paper Rs. 2000/T)	2500
Power and Fuel	1800
Chemicals/Stores	1650
Repair, maintenance wages (taken same as Kraft)	1450
Financial costs (due to new investment and existing old plant) (1250+1000)	2250
Total	9650

The taxes and other will be lower due to governmental support and is taken at 50% of normal value as Rs. 850/- making the cost of waste paper processed paper in and old kraft mill as Rs. 10500 per tonne.

The wood prices are taken to vary from Rs. 750/- tonne to Rs 2250/- tonne (a three fold increase) and similarly the cost of waste paper are taken to increase from Rs. 2000/- tonne to Rs. 5000/- tonne (2·5 fold increase) in next 5–8 years. The impact of this rise, assuming other prices remain constant are shown in the table–7 and table–8.)

TABLE—7

COST OF PRODUCTION IN OLD KRAFT MILLS

Cost of wood Rs./Tonne	Cost of Production Rs./Tonne
750	10150
1000	10750
1500	11250
2250	14350

TABLE—8

COST OF PRODUCTION USING WASTE PAPER PROCESSING IN NEW STREET

Cost of waste paper Rs./Tonne	Cost of Production Rs./Tonne
2000	10500
3000	11680
4000	12860
5000	14040

The average costs per tonne paper have been calculated for increasing use of recycled fibres at various raw material costs to go up to 50% secondary fiber in furnish and are listed in the tables–9A–9D.

This analysis indicates that if new waste paper deinking facilities are added with existing kraft pulping and no total extra production is envisaged, the average cost of production per tonne of paper is very strongly dependent on wood/bamboo costs on one hand and on waste paper costs on the other. This is shown in Fig. 5.

At Bamboo/wood price of 2750/tonne, the addition of waste paper street increases average cost of paper for all situations. However, as the wood price increase, the effect becomes appreciable requiring close economic analysis.

TABLE—9A

Average Cost/Tonne paper

Wood/Bamboo Price 750 Rs./tonne

Kraft Paper cost Rs. 10150/tonne

Waste Paper Furnish %	Capital investment Gross	Average Cost Rs./tonne Waste Paper Cost Rs/tonne 2000	3000	4000	5000
10	1·65	10185	10303	10421	10539
20	3·30	10220	10456	10632	10928
30	4·95	10255	10609	11963	11317
40	6·60	10290	10762	11234	11706
50	8·25	10325	10915	11505	12095

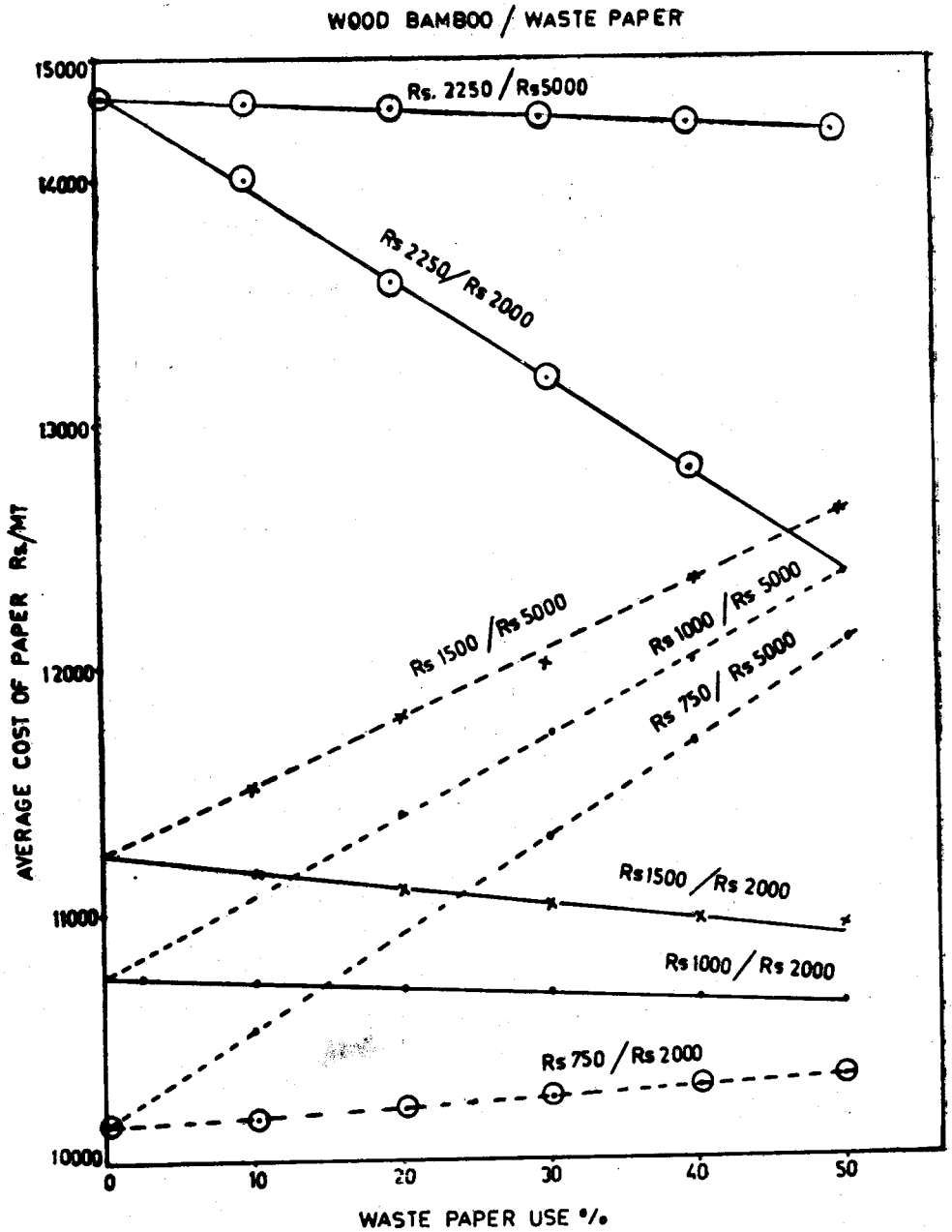

FIG. 5 – EFFECT OE PRICE VARIATION ON AVERAGE PRICE OF PAPER

TABLE—9B

Wood/Bamboo Price 1000 Rs /tonne

Kraft Papər cost Rs 10750/tonne

Waste Paper Furnish %	Average Cost Rs./tonne 2000	3000	4000	5000
10	10725	10843	10966	11079
20	10700	10936	11112	11408
30	10675	11029	11383	11737
40	10650	11122	11594	12066
50	10625	11215	11805	12395

TABLE—9C

Wood/Bamboo Price Rs. 1500/Tonne

Kraft Paper Cost Rs. 11250/Tonne

Waste Paper Furnish %	Average cost Rs./tonne 2000	3000	4000	5000
10	11175	11283	11411	11529
20	11100	11336	11512	11808
30	11025	11379	11733	12087
40	10950	11422	11894	12366
50	11875	11465	12055	12645

TABLE–9D

Wood/Bamboo Price Rs. 2250/Tonne
Kraft Paper cost Rs. 14350/Tonne

10	13965	14083	14201	14319
20	13580	13816	13992	14288
30	13195	13549	13903	14257
40	12810	13282	13754	14276
50	12425	13015	13605	14195

ALTERNATIVE–II :

If additional capacity is planned to an existing 100 TPD Kraft plant, the new facility can be Kraft process based on wood/bamboo or based on Waste Paper deinking. The investment on additional facility for both these are shown in table-10

TABLE–10

CAPITAL INVESTMENT FOR NEW FACILITY INCLUDING PAPER MACHINE

Additional Capacity TPD	Kraft Pulping Rs 25000/annual tonne	Waste Paper Processing Rs. 20000/annual tonne
	Crores	Crores
25	20 625	16.5
50	41.25	33.0
75	61.875	49.5
100	72.5	66.0

The cost of production in new Kraft mill and new waste paper mill and the average cost of production including old mill have been worked out for various raw material costs for wood/bamboo and waste paper. The costs in new mills are shown in tables-11A and 11B respectively.

TABLE–11A

COST OF PRODUCTION OF PAPER IN NEW KRAFT MILL

Wood/Bamboo Price Rs./Tonne	Cosr of Paper Rs./Tonne
750	15650
1000	16350
1500	17750
2250	19850

TABLE–11B

COST OF PRODUCTION OF PAPER IN NEW WASTE PAPER PROCESSING SYSTEM

Waste Paper Price Rs./Tonne	Cost of Paper Rs./Tonne
2000	12850
3000	14030
4000	15210
5000	16390

The average cost of paper in both old and new facilities have been worked out for various combination of 25, 50 and 100 TPD new plants in additiou to 100 TPD old plant. These are summarised in tables–12, 13 and 14

TABLE–12

AVERAGE PRICE OF PAPER FOR 25 TPD NEW MILL AND 100 TPD KRFT MILL

O'd Capacity	—	100 TPD
New Capacity	—	25 TPD
TOTAL	—	125 TPD

Waste Paper Price Rs./MT	Average Price Rs./MT Wood/Bamboo cost Rs./Tonne			
	Rs. 750/ MT	Rs. 1000/ MT	Rs. 1500/ MT	Rs. 2250/ MT
2000	10690	11170	11570	14050
3000	10926	11406	11806	14286
4000	11162	11642	12042	14522
5000	11398	11878	12278	14758
New Kraft Mill+Old Kraft Mill	11250	11870	12550	15450
Old Kraft (100 TPD)	10150	10750	11250	14350

TABLE—13

AVERAGF PRICE OF PAPER FOR (50 TPD NEW MILL AND 100 TPD OLD KRAFT MILL)

Old Capacity	—	100 TPD
New Capacity	—	50 TPD
Total Capacity	—	150 TPD

(100 TPD KRAFT OLD)

Waste Paper Price Rs./MT	Average Price Rs /MT Paper Wood/Bamboo Price Rs./MT Wood 750	1000	1500	2250
2000	11050	11450	11783	13850
30 0	11443	11843	12177	14233
40 0	11837	12237	12570	14637
5000	12230	12630	12963	15030
New Kraft Mill + Old Kraft Mill	11983	12617	13477	16183
Old Kraft (100 TPD)	10150	10750	11250	14350

TABLE—14

AVERAGE PRICE OF PAPER FOR 100 TPD NEW MILL AND 100 TPD OLD KRAFT MILL

Old Capacity	—	100 TPD
New Capacity	—	100 TPD
Total Capacity	—	200 TPD

Waste Paper Price	Average Price Rs./MT Paper Wood/Bamboo Price Rs /MT Wood			
Rs /MT	750	1000	1500	2250
2000	11500	11800	12050	13600
3000	12090	12390	12640	14190
4000	12680	12980	13230	14780
5000	13270	13570	13820	15370
New Kraft Mill + Old Kraft Mill	12900	13550	14417	16183
Old Kraft (100 TPD)	10150	10750	11250	14350

Fig. 6, 7, 8 and 9 show the average price histograms based on the above data.

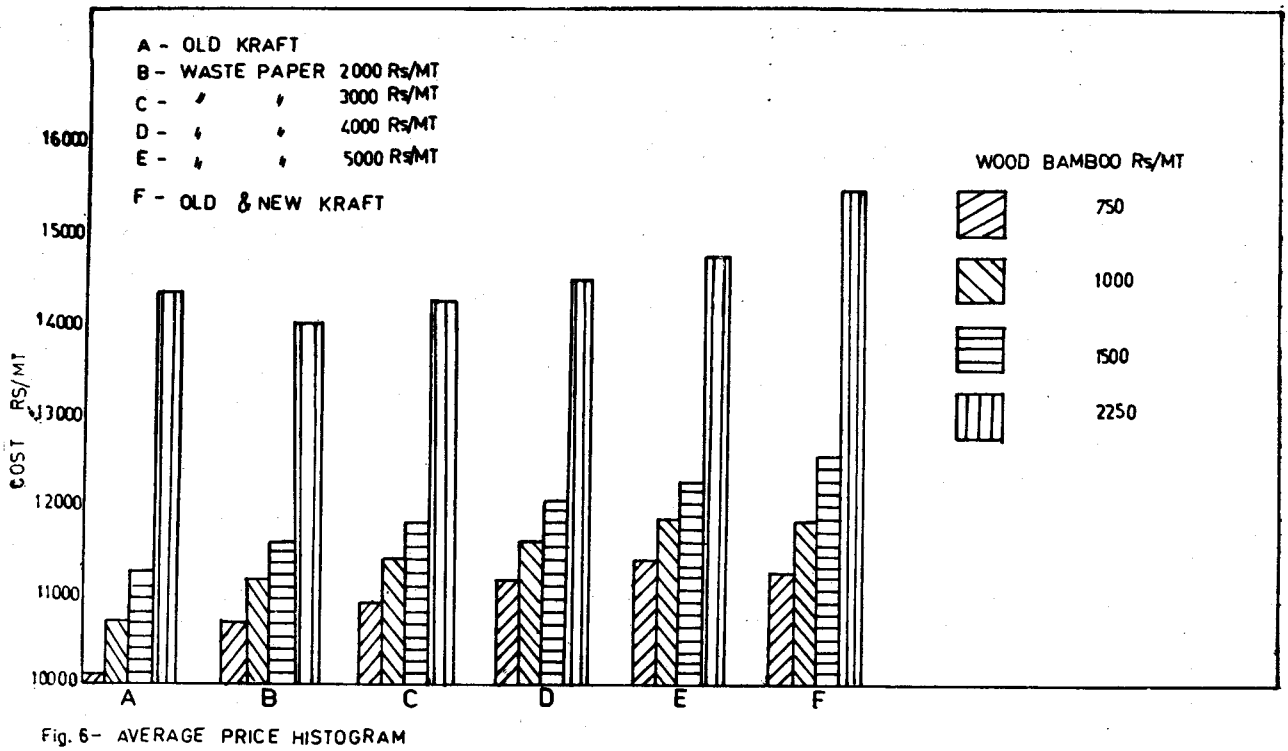

Fig. 6- AVERAGE PRICE HISTOGRAM
100 TPD OLD PLANT (KRAFT) + 25 TPD NEW PLANT (WASTE PAPER/KRAFT)

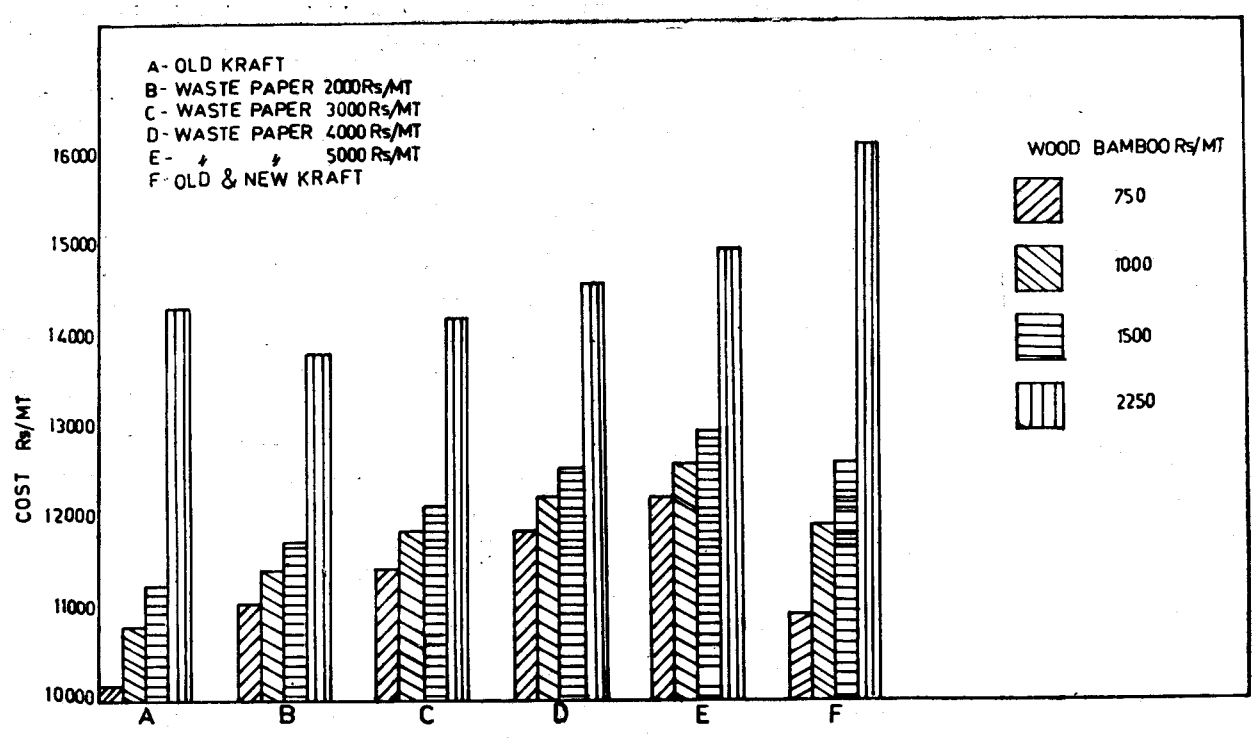

Fig. 7. AVERAGE PRICE HISTOGRAM

100 TPD OLD PLANT (KRAFT) + 25TPD NEW PLANT (WASTE PAPER/KRAFT)

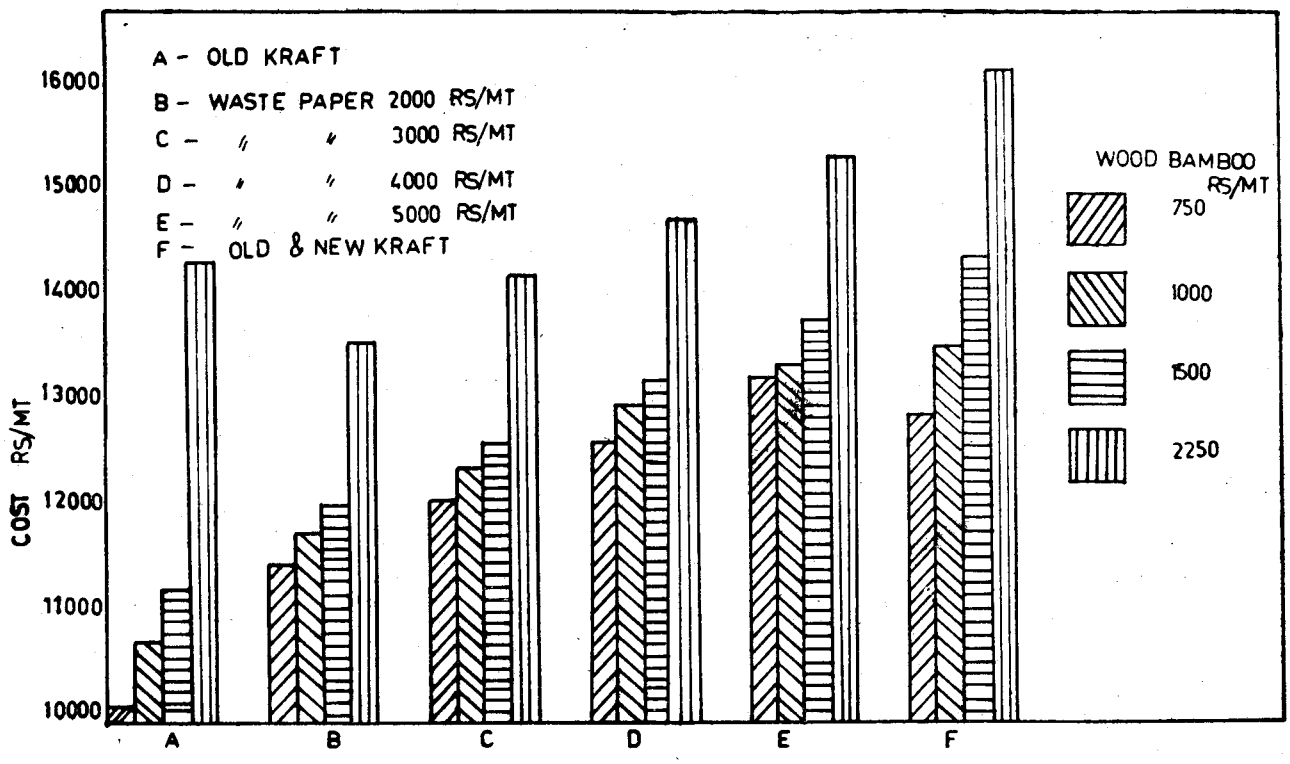

Fig. 8- AVERAGE PRICE HISTOGRAM

100 TPD OLD PLANT (KRAFT) + 100 TPD NEW PLANT (WASTE PAPER/KRAFT)

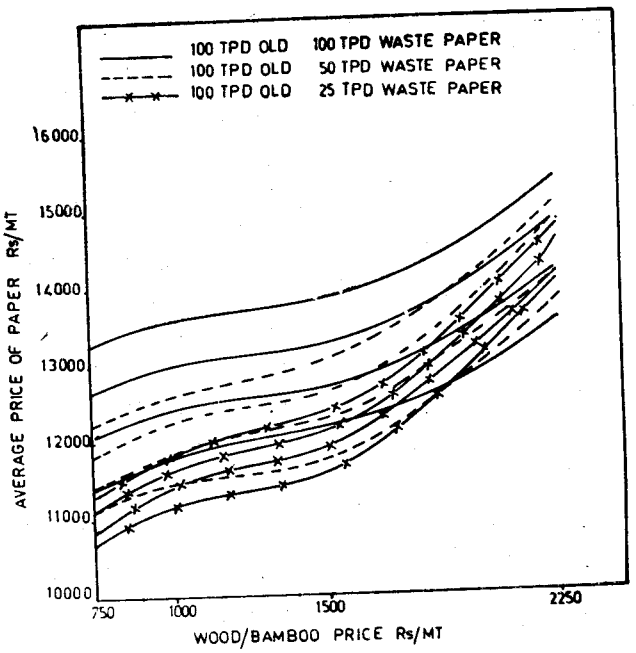

Fig. 9- DEPENDENCE OF PAPER PRODUCTION PRICE ON PRICE OF WOOD BAMBOO AND WASTE PAPER

These analysis clearly show the regions where secondary fiber processing has economic advantage. The advantage depends on relative prices of wood/bamboo and waste paper. For example for 25% extra capacity waste paper processing will give advantage till a price of Rs. 4000/MT when wood price is Rs. 750/-MT. For this capacity, for any increase in wood price beyond Rs. 750/-MT, all prices up to Rs. 5000/MT for wastage paper, the later will be more beneficial. Such situations can be easily identified. The advantage is mainly due to lower capital investment in waste paper processing compared to kraft pulping. Thus the economic advantages can be availed if technology is available.

CONCLUSION :

If we analyse the secondary fiiber availability with respect to the procurement methods, till 1970's the industries of U.S. was engaged in developing the process of higher secondary fiber recovery from all kinds of waste. However, this scenerio has changed because the municipality recognise the energy value of street sweeping under "garbage to energy" project where it is used as fuel[7] consequently the waste paper available for recycling will be only from the offices, school yards, church grounds and shopping places giving a better and uniform quality of waste paper at comparatively high initial cost and low energy requirement for processing. This changing trend will reduce the available imported waste papers at a higher price in the country. The situation is likely to occur, quite, quickly demanding almost an immediate attention of industry in India. The rise in price of waste will perhaps encourage greater use of indigenous waste, though it may be of poorer quality, particularly by the smaller mills. The price sensitivity of finished paper on raw materials, is very well established. Thus close economic analysis is necessary in working out optimal strategies for choosing the raw material mix. The property variation, with number of recycles, has to be established for different types of wastes both indigenous and imported. This will demand an immediate attention of R & D establishment to indicate the correct furnish to achieve desirable end properties. Thus the perspective for next 5 to 8 years on secondary fibres has to be close technoeconomic monitoring in the following areas :

1. Prediction of finished paper properties with number of recycles.
2. Economics of waste paper collection, segregation and processing strategies.
3. Dynamic economic evaluation of raw material price variations on profitability.

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