

Paper Making Experience in Recycled Fibre

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INTRODUCTION

The mill is a pioneer producer of recycled newsprint and printing writing paper. The company started its commercial production in 1996 based on 100% recycled newsprint known as ONP. Company's Annual Production capacity is 1,50,000 MT. There are two deinking process adopted in the mill one is washing deinking processes and another is combined process i.e. Flotation with washing. Washing process is capable of producing newsprint paper while writing and printing paper is made with combined process.

It must be remembered that the efficiency of paper machine and quality of product is based basically upon the percentage removal of the stickies. Therefore greater the degree of contamination, the higher is the amount escaping to the finished sheet. Ultimate control of the stickies problem lies in maintaining high Raw material quality that is the quality of recovered fibre. Recovered fibre can not be said as the waste paper because waste does not have any quality specification but used fibre suitable for deinking process certainly have come internationally accepted quality standard, hence the recovered fibre.

From the initial stage of deinking process, stickies have posed a challenging problem. Stickies of various forms get synthetic labels, coating of various paper, hot melt adhesive and tacky inks entry in the deinking process with the raw material.

Such as binding gum, pressure sensitive With the use of more and more recycling process, the quality of recovered fibre is getting greatly deteriorated day by day resulting in greater amount of stickies and contamination in the system, thereby resulting in high inflow of anionic trash and polluting the paper making system.

Quality aspect

Paper mills based on recycled fibre must be fully attentive for the quality of end product. The following doubt abouts the product quality are being normally raised where secondary fibre pulp is used.

Strength: Tensile, Tear, Burst, Stiffness.

Optical Properties: Brightness, Dirt or ink specks count, Opacity.

Contaminants: Stickies, Plastics and Styrofoam, Metals, Clips and pins, Colour contents.

It is seen that when recovered paper is pulped, fibres are shorter and have lower water absorbency capacity resulting lower flexibility. Secondary fibres are generally stiffer compared to virgin fibre. In view of these characteristics, options available to the paper maker to improve strength properties of the product are by Refining and Chemical treatment

For refining of secondary fibre we should keep in our mind that secondary fibre has already been refined at least once and may be more also. Therefore refining should be gentle, refining intensity or specific edge load should be kept low. It can be fulfilled by refining at higher consistency or by reducing plate bar and groove widths or by operating refiner at lower rpm. Another way of refining is at higher consistency at about 28-30% consistency. This can be done up to great extent by hot dispersing equipments also. Addition of chemicals like various additives and retention aids etc. help in forming a good bond between fibre - fibre or fibre - chemicals - fibre etc. In manufacturing either newsprint or printing and writing papers, the brightness and ink specks count is the major consideration. The ash retention is another important factor not only for quality stand point of view but also due to yield consideration.

Deinking essentially involves two steps :

1. Detaching ink from the fibre
2. Removal of ink from the pulp fibre.

Of course screening and cleaning are other essential stages to complete the deinking process. After removal of ink and ash, nonchlorinated bleaching is done to improve the brightness of the secondary fibre pulps. Peroxides, hydrosulphite and FAS (Formamidine Sulphonic Acid) are effective in most of the cases. However certain dyes like used in telephone directory, financial

newspapers are difficult to bleach without the use of chlorinated bleaching agents. The major process data are depicted in Table 1.

Table 1: Process Data

Pulping Consistency, %	15-16
Specific pulping energy, Kwh	20-25
Reductive bleaching Agent, %	1-1.2%
Oxidative bleaching Agent, %	1.5-2%
Flotation additives	Depends on quality of product.
Overall specific dispersion energy	40-50 Kwh/MT

Contaminants removal

The necessary system efficiency and finish product requirements are shown in Table 2.

Few commonly used equipments are given below with their specific function.

- Coarse Screen - Staples, gravel, thermo coal, Magazine, Binders, Plastics, like material
- Fine Screen - Grit, rust, flakes, stickies and sand up to certain extent.
- Cleaners - Sand, grit etc.
- Flotation cell - Large ink particles, clay, stickies.
- Reverse cleaners- Stickies, ink, air, oil like lighter particles.
- Washers - Small ink particles, clay/tape etc.
- Bleaching - Dye stripping.

Clarifier and washers operation affect the pulp quality to a large extent. On the other hand, yield of the pulp is also affected by these two equipments since the clarifier generates a large amount of reject in the form of sludge. The use of high ash content recovered fibre in the furnish also affects yield drastically. Therefore increase of

magazine/coated book in the furnish lowers the yield. Depending on the rejects quantity, flotation, screening and cleaners also affect yields substantially. Therefore operation of these equipment must be optimized in order to have optimum quality product maintaining proper process parameters with minimum fibre loss.

The experience at Rama Newsprint and papers mills confirm the following important factors for designing the deinking plant for selecting the plant, machinery, equipments etc.

1. Type of Raw material being used i.e. quality of recycled fibre available.
2. Requirement of the finished product.
3. Affordable yield/ amount of reject material.
4. Control instruments and availability of skilled personnel.

It has also been experienced that personnel cost can be reduced to a great extent if plant is designed with better automatic control and instruments system for which the initial investment shall be marginally on higher side.

Optical Properties

As far as brightness is concerned, the mixed office paper has an average brightness value $58\% \pm 4\%$. These large variation are because of varying level of ash and self adhesive content in recovered paper. The typical average ash content of recovered paper in ONP remains $8\% \pm 5\%$ and in mixed office waste along with coated stock is $25\% \pm 5\%$. In flotation deinking plant the reputed plant suppliers claims the absolute increase of brightness in the range of 20-22%. However at RNPL this figure is being achieved in the range of 18-20% against 10-14% in most of other new deinking plant in India. The reasons of this difference are obviously the same as explained earlier. The stickies and ash reduction is another criteria of the system efficiency. As far as increase in brightness is concerned the flotation and bleaching stages are the most effective equipment. The main components for achieving a high degree of cleanliness are flotation and dispersion

Table 2: Determining the Necessary System Efficiency

Technological criteria	Raw Material	Finished stock requirement	Required system efficiency
Brightness without UV Luminance	58-60% ISO	80-85% ISO	18-22% Points
Dirt specks area	3000-3500 m ² /kg	10 mm ² /m ²	95-99% reduction
Stickies size	< 2000 m	< 50 m	98% reduction
Ash	35-30%	5%	80-85% reduction

while for an efficient reduction in stickies, the important equipment are screening and dispersion. Deashing is most effectively done by the washers. To get the satisfactory finished stock quality, all above equipment/modules need to be installed because of their very specific efficiency. Following tables (Tables 3 and 4) show absolute efficiency values of these modules which can be expected in the preparation of recovered mixed office papers.

Experience shows that it is not easy to achieve very good specks free cleanliness and reduction in stickies even with the use of all available system and equipments. Therefore to get good cleanliness, it is essential to compensate these requirements either by the use of better and cleaned recovered fibre or by the use of additional flotation cell modules. In fact for achieving the required efficiency, installation of the additional modules is right system integration but it affects yield. The hot dispersion

Table 3: Efficiency range of the process modules

Modules	Technological parameters	Brightness	Dirt Specks	Stickies	Ash	
Screening	Heavy contraries Light contraries	--	*	+	--	
Flotation		#	+	*	#	
Washing		#	--	--	+	
Centrifugal cleaning		--	#	*	#	
Dispersion		--	--	#	--	
Reductive bleaching		+	+	--	--	
Oxidative bleaching		+	#	--	--	
+ High, # Average, * Low, -- No efficiency						

Table 4: Effectivity of process modules in removing disturbing components

Process Moudle Disturbing components	Screening	Flotation	Washing	Centric. Heavy	Cleaning Light weight	Dispersion weight	Bleaching Qxid	Redu.
Conventional printing inks	--	+	#	*	*	+	*	*
Non-Impact Inks	*	+	--	*	*	+	--	--
Flexo Inks	--	*	+	--	*	--	--	--
Fibres with undetached inks	--	--	--	--	--	+	#	*
Unbleached fibres	--	--	--	--	--	--	+	--
Coloured fibres	--	--	--	--	--	--	--	+
- High, # Medium, * Low, -- No efficiency								

even disposes the toner ink make particles which results in better flotability. Hence paper makers need to install all available system modules along with double dispersion modules. The Kemsley palnt of great Britain (UK Paper) does not have any stickies problem because they have 4 stage fine slot screening with 0.1 mm slot width and two dispersion stages.

Yield is primarily a funcation of the quality of recovered paper for example. European recovered mixed office grades have an ash content between 22% to 30% while in American grades, it remain normally in the range of 12-15%. The reason of this wide difference is the higher share of coated elements in the European material. Therefore difference in yield remains about 8 points or more. However it is recommended to collect data of the different recovered paper grades and their suppliers by checking the quality of incoming recovered paper and test its deinkability in the laboratory. With these data, it will be easier to identify grades which are critical for getting required efficiency of the system e.g. with respect to dirt, specks as well as yield.

Paper Making and Paper Quality

With more and more usage of recovered fibre furnish, RNPL is capable to manufacture almost all variety of printing and writing paper up to the respectable level of quality standard. Today Rama Newsprint and Papers, Ltd., is manufacturing. Following grades of paper which is well established in the domestic and international markets in the GSM range of 45 to 120.

- Cream wove.
- Super printing.
- Coated base paper.
- Water mark printing.
- Maplitho.
- Surface sized Maplitho.
- Security grads of papers.
- Computer Stationary and record paper.
- Copier paper.
- Ink jet printing paper.

The quality standard of all these papers are excellent and at par with any virgin 'A' grade mills. The breaking length, tear strength, bursting strength, bulk, smoothness, brightness etc. can be maintained as per customer requirement. The most important quality requirement for copier paper is a good runnability in the copier machine. One of the key parameters for good runnability in the

copier machine is the Curling behaviour under heat because all the available copier machines and office laser printers fix the toner by heating. The curling behaviours can be controlled mainly in the wire section and in the post dryer section of paper machine. These are other experience available to control curl on the paper machine but it depends on various conditions of individual machine. RNPL has developed their own action plan for curl control applicable to their individual situation of raw material and equipments. It is therefore essential to record all relevant parameters like speed, pressure, vacuum, temperature, slice opening, jet/wire ratio, head box consistency, freeness etc. It will help to develop a standard to set the PM and to take immediate action when curl is out of targeted range.

It is an advantage if the curl behaviour can be adjusted in a way that the curl remains towards the image when copying on the top side first. This will reduce danger of paper jamming when using paper with wrong side first. Today copier paper has to perform on inkjet printers also because users normally buy just one office paper for copying, laser prints and standard inkjet printers. A good inkjet performance is a brilliant sharp picture with low drying time and minimum strike through to the back side. The copier paper manufactured at RNPL performed well in both discipline and compares very well with other Indian competitors.

CONCLUSION

Paper production from recycled/ recovered fibre depends largely on the quality of recovered fibre used, design of equipments used, personnel skill and chemistry of the chemicals used in the individual plant. Experience and results at Rama Newsprint shows that any type of paper ranging from newsprint to cultural grade can be manufactured up to the specified quality standard. A strong database and laboratory support are essential to upgrade the product.

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REFERENCES

1. IPPTA J., (Vol. 1) (2001).
2. Paper Technology J., (Vol. 6) "Together".
3. Doshi and Dyer, Paper Recycling Challenge (Vol. 1) stickies.
4. Experience at Ram Newsprint and papers and Laboratory work.