Developments in Processing of Secondary Fibre - A Dominant Future Raw Material For Paper Industry

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Paper plays a vital role in the cultural development of human beings. One of the yardsticks of development of a country is its per capita consumption of paper, paper boards and news print. The increase in literacy, growing trend of higher ratios of professional and technical jobs in the work force and the growing economic activity are bound to raise the consumption of paper.

The present demand for paper and paper board in our country is around 2.2 million tons/ annum against the actual production of similar quantity. The annual installed capacity of paper and paper boards as at March 31, 1991 stood at 3.3 million tons and the effective installed capacity at 2.5 million tons. As per study by ICICI, the demand for paper and paper boards by the year 1995-96 is likely to be 2.9 million tons/ annum and 3.8 million tons/ annum by the turn of century against an effective installed capacity of 3.22 million tons/ annum and 3.33 million tons/ annum respectively. Assuming 80% capacity utilisation for wood and agro based mills and 70 % for waste paper based mills (same as the current average capacity utilisation) the expected actual production is extimated at 2.65 million tons/ annum by 1995-96 and 2.8 million tons/ annum by the turn of century. This leads to a deficit to the extent of about 2 lac tons by 1995-96 and about 10 lac tons by the turn of century.

The actual demand of news print had been 5.5 lac tons during 1990-91 against a production of 3 lac tons. The anticipated demand by 1995-96 is estimated at 8.5 lac tons and by the turn of century 10.8 lac tons.

Against the above Indian scenario, total world production of paper and paper board was 239 million tons in 1990 which is estimated to go upto 320 million tons by the turn of century. The consumption of paper and paper board co-relates well with the general standard of living in a country and its industralisation. Thus the USA is by far the world's leading consumer of paper and paper board with its total consumption of close to 78 million tons in 1990. With the current US population of some 250 million, the average per capita consumption is about 311 kg, which is the highest in the world. Against this scenario, the average per capita consumption of paper in Asian market block was only 25 kg in 1990, ranging from 228 kg in Japan to some 3 kg in India. This is a clear indication of the good market potential for paper and paper board in this important market block.

During last year, the paper industry has suffered all over the world because of recessionary trends. At the same time, many pulp and paper mills have closed down and mergers and rationalisation between companies have taken place. In a situation such as this, one may think that there would be a slowing down in the rate of technological renovation associated with the processes of pulp and paper industry.

But this is not so. At a time of recession, it is usual for considerable attention to be given to improving the efficiency of existing operations and this has certainly been the case with the pulp and paper industry. There has been an emphasis on modification and improvement of existing equipments.

Because of environmental pressures, there has been

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considerable research and development associated with making pulping processes more environmentally friendly. Worldwide research is being conducted in all aspects of secondary fibre treatment, in particular the deinking process, with an emphasis on wider use on secondary fibres.

Bamboo and wood are the most important and widely used raw materials for paper making in our country. Efforts are on for creation of sustained supply of wood through man made forest, afforestation and social forestry. But these are long term projects and have a long gestation period. Therefore, immediate focus of the paper industry is on the use of secondary fibre, which has been established as a potential source of raw material.

The department of environment and forest plans to stop extraction of major forest produce like bamboo and timber whether by direct felling or on an auction basis by the end of the 8th plan. This is in accordance with the National forest policy which says that substitute for wood will have to be found. The practice of supply of forest produce to industry should cease. For this, the possible source of raw materials are agro based such as straw, bagasse, grass and secondary fibre as well which are the only available raw materials suitable for paper making. Environmental pressures, market forces and the continuing upward trend in the use of recycled fibre will help in restructuring forest product industries on a global scale.

The recycling of waste paper for the manufacture of paper and paper boards is very important as it helps in conservation of conventional raw materials, lessens problems of water pollution and eliminates the requirement of chemical recovery system. It has been possible now to upgrade the quality of waste paper pulp through de-inking and simple bleaching processes, which has helped in its use for producing superior grade paper as well.

Worldwide use of secondary fibre is predicted to increase at twice the rate of original fibre. The advantages of using secondary fibre are well known. Some of them are--

a) Low cost substitute where there is no cheap virgin fibre supply

b) Lower energy requirements in pulping and conversion processes

c) Lowers waste disposal cost

d) Less virgin material required

e) Increases environmental awareness in the general public

However, the biggest obstacle to the production of good quality secondary fibres is the high levels of contaminants they contain. The levels of contaminants are dependent on the original sources of fibre which may be classified into 3 groups:

1. Mill Broke
2. Pre - consumer waste such as the printings and cuttings and
3. Post consumer waste including waste collected from households and supermarkets

The first two groups have been well utilised for many years as reliable sources of clean high quality secondary fibres. But these offer little scope to supply the increased demand for secondary fibres as they are mostly all utilised. The only growth expected in these two groups would be related to increase paper production.

The group with most potential for supplying future demand is the third source of fibres. Post consumer waste contain large amount of contaminants. These must be sorted and cleaned if they are to reach high standard of virgin fibres.

The need to supply post consumer waste which is already sorted in grades, is becoming a major factor in secondary fibre production. The types of contaminants found in post consumer wastes are--

1. Fillers added during paper making is cheap substitute for fibre, but cause weaknesses on recycling by forming areas of high concentration.
2. Fibre fines which improve the strength of the original paper, but interferes with fibre bonding in recycled paper.
3. Ink particles which produce dull and specky paper
4. Contraries such as staples, baling twine and binders

Use of post-consumer waste to produce high grades of paper requires the removal of some or all these contaminants. Fortunately modern stock preparation processes remove most contaminants. The main methods of contrary removal are--

1. Centrifugal cleaners

2. Screening using slotted plates
3. Wash de-inking
4. Floatation de-inking
5. Bleaching of secondary fibres

Depending upon the type of waste paper pulp to be produced, these methods can be used in various combinations.

Re-cycled fiber is not inferior to virgin fiber - it is just different. However, problems related to recycled fiber run the gamut from new sources of micro biological contimination, increased fines resulting from hot melt adhesives, waxes and other adhesive ingredients. These contaminants, if not removed, result into dificiencies in Sheet quality & difficulties during paper manufacturing. Product quality and difficulties during paper manufacturing. Product quality problems include sheet spots or holes and decreased sheet strength, which adversely affect any subsequent printing and converting operations. Operational problems appear as sheet breaks either due to deposits in the press or dryer sections or in forming zone. These cause slower machine speed or excessive downtime for cleaning.

Effective use of recycled fiber requires proper use of biocides, retention aid, drainage aid and water clarifiers. In addition, it is important to consider felt conditioning and to develop a proper strategy for control of stickies. This can take care of 95% of all problems related to use of recycled fiber.

Since the business world is driven by economic factors, it is necessary to examine the financial aspects of the problem. Hence it is imperative to approach the problem of stickies contamination from both a mechanical remover and a chemical control perspective.

Mechanical contaminant removal is the key stage in the control of problems related to stickies. Good screening and cleaning are necessary to remove the largest percentage of contaminants. A properly designed stock preparation system is critical. Improper installation, placement, or operation of contaminant removal equipment will be detrimental to stock preparation system cleaning efficiency.

Screening typically employs a feed back loop philosophy directing the secondary and tertiary screen accepts to the primary and secondary screening feed. Because of the traditional practice of regressive screen hole sizes, where primary is 1.83 mm and secondary is 1.14 mm, accumulation of stickies within the screening loops may often occur.

There are many techniques which can reduce the accumulation of stickies in a process. One technique is to use a forward feed of accepts during the secondary as well as primary stage by using the same screening design and size in both stages. This forward feed approach will eliminate accumulation between two stages.

Besides, slotted fine screens ranging from 0.15- 0.25 mm will be more efficient for removal of contaminants than traditional hole screens. A typical flow diagram (Figure-1) shows contaminant removal

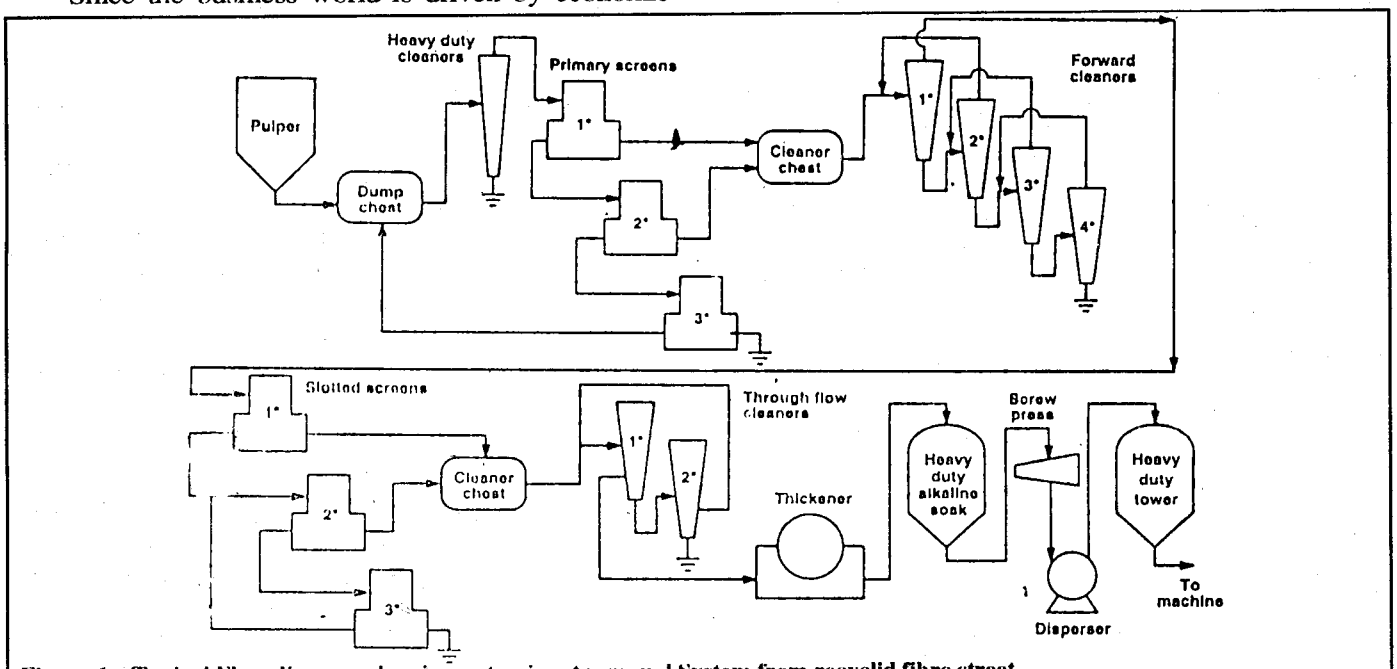

Figure-1:- Typical Flow diagram showing untaminent remoual System from recyclid fibre street.

system from recycled fiber stock preparation street which will allow paper makers to control potential problems with recycled fiber more effectively.

There are many chemical technologies for removing stickies. These include --

a. Dispersion (helps in reduction in physical size)

b. Detackfication (with nonionic polymer, zirconium or talc)

c. Cationic Polymer (low molecular weight, high density addition at machine chest-the aids work as retention aid to hold fines and fillers in the system)

d. Passivation

e. Cleaning Solvents

A combination of any these methods will help in removing stickies effectively.

Although there are no easy solutions to the problems associated with the use of recycled furnish, an organised approach to indentifying and solving these problems will provide economic solution. For all paper grades, the proper utilisation of retention aids, clarification technology, fines management, biocides and control programme for stickies will allow mills to control recycled fiber related problems in a cost effective manner. Contaminant control is the key to successful use of recycled fiber as an economical raw material for paper making.

It is possible to use 100% re-cycled fibre for making products which are equivalent to virgin fibre products. But it would be naive to believe this is likely to continue indefinately. The proportion of secondary fibre in the re-cycling stream field which has been re-cycled more than once, will increase, which will ultimately effect the quality of the final product.

Although the paper industry is conservative and rather static, still using basically the same process as 100 years ago, technological development has speeded up during the last 20 years.

The main driving force behind the development of all pulping processes in recent years have been--

a) Environmental concerns

b) Use of fibre resources

c) Minimisation of energy consumption

d) Product quality, and

e) Techno-economic aspect

The quality requirement of the end product determines the fibre furnish. Re-cycled fibre will no doubt be the main fibre raw material for the paper industry in India and world over. Its contribution will grow rapidly to 40%, and in the long term perhaps to almost 50% of total fibre.

Re-cycled fibre will be the main fibre raw material in newsprint, numerous board grades, housedhold tissues and other products. Infact we can safely say that re-cycled fibre will be the fibre of the Twenty First Century.

Use of waste paper (Secondary Fibre) in India started more or less simultaneously with the establishment of paper industry about a century ago. However, its use was restricted for the production of mill boards, grey boards and duplex boards and other cheaper grades of paper and board. The use of waste paper gradually started picking up with the establisment of small paper mills for whom waste paper constituted the major percentage of cellulosic fibre.

Waste paper has always been used as one of the principal raw materials by small paper mills. Waste paper based paper mills rely on imported pulp and waste paper for making pulp using a hydra pulper. There are large number of small paper mills (5-10 TPD) which exclusively use waste paper. Wood based mills also use waste paper upto 10% in their furnish. Board mills use considerable greater proportion of waste paper. Re-cycling of waste paper contributes to the reduction in the consumption of chemicals as well as environmental pollution. It is estimated that hardly 15% of the total paper produced in India is available for re-cycling against the world average figure of 35%, as bulk of it is used for packaging. With organised collection efforts if this ratio is increased to 35%, the quantity of waste paper, available indigeniously for making paper, would be substantially greater.

There are 210 mills in the country which are waste paper based, with an installed capacity of 9.18 lac tons/ annum as on 31st March, 1991. It is estimated that by the year 1995-96 there will be addition in the capacity on waste paper based mill by 1.8 lac tons/ annum.

New techniques in processing secondary fibre have

in recent years resulted in a boom in waste paper based news print manufacture.

Recycling of newsprint has been a high profile area with an increasing commitment towards the use of secondary fibre. Improved de-inking and fibre processing have aided this procedure. The process is now so well defined for waste paper based news print that experts declare that even if the present boom economy weakens, producers will be able to hold their positions against virgin fibre based competition.

Waste paper based news print mills are being built now world over which itself indicates the huge role that recycled fibre in tomorrow's news print production will play.

Similarly there have been developments to make use of secondary fibre in manufacturing writing and printing paper. Technological break through in the growth area of tissue manufacture will increase the demand of secondary fibre. The UN food and agriculture organisation predicts that over the next 10 years waste paper use will grow at a rate of 4.8% per annum whereas pulp usage will grow only 2.8% per annum.

Countries which are having raw materials shortages are presently using 50-60% secondary fibre as raw materials in their furnish. Even countries which are having enough forests and can afford to utilise forest products for converting into pulp, like Sweden, Finland, and the U.S. etc., are using waste paper in furnish upto 35% and there is an increasing trend in its utilisation. Even in countries where very large forest resources are available, paper mills are being actively encouraged to recycle waste paper and use larger quantities of waste paper in furnish as this not only helps in preservation of ecology but reduction of environmental pollution, saving of heat and power and better input-output ratio. In South Korea and Taiwan, the paper industry is entirely depending on secondary fibre as primary raw material.

Countries like Japan and China have started utilising secondary fibre on a large scale to save their forest resources.

With this scenario of raw material for paper industry, it is expected that Govt. Of India will also encourage the utilisation of secondary fiber for paper making by allowing fiscal benefits which have been allowed for use of bagasse, jute waste, rice and wheat straw if they are used to the extent of 75% in fibre furnish. Waste paper being environmentally friendly raw material, it is still more necessary to encourage its use.

Waste paper has been categorised as unconventional raw material and the finished products manufactured out of this raw material is being cleared on payment of concessional Excise Duty as applicable to other unconventional raw materials. Majority of the paper units in the country are using waste paper in the furnish for usual grades of paper such as writing and printing paper, kraft paper, poster paper, duplicating paper, duplex board, triplex board, etc. Even better grades of paper such as poster, tissue, ledger paper, high strength extensible kraft paper etc. are also being manufactured now with secondary fibres as main raw material in the furnish.

All this has been possible due to improvement in stock prepartion processes where the fibre can be properly developed not only to give desired strength properties but also a close formation and smooth finish.

Same is the case of the newsprint industry, where based on 100% deinked newsprint, larger capacity plants have been and are being established in the developed countries. In India also, this should be a possible source of raw material for putting up new large capacity newsprint plant, still producing a quality of paper which will be quite comparable with newsprint quality manufactured by using conventional raw material anywhere in the world. Small and medium size paper mills are already producing newsprint paper by using 100% waste paper in furnish and the same is being supplied to various national and local dailies, who find the quality to be quite workable.

Keeping in view that the newsprint must have good opacity, the ink should dry by absorption faster, the paper should have a good printing surface and overall the sheet should be acceptable to the printers for use on high speed printing machine, it has been made possible to produce a newsprint sheet meeting all the above requirements by adopting improved deinking process and using 75% imported newsprint either over issue or old as the raw material alongwith 25% TMP or CTMP as virgin fibre. By technological upgradation of existing paper machines, available with medium size and larger paper mills, it has become possible to produce acceptable quality of newsprint by using the furnish mentioned above.

In terms of fibre raw material supply, the paper industry has to return to its roots. Hundreds of years ago recycled fibre such as rags were the main fibre source. The proportion of recycled fibre will approach within next few years to 50% of the fibre supplies worldover and it will be the dominant future raw material for paper industry in our country as well.

REFERENCES

1. World Pulp & Paper Technology (1993)
2. PPI International Fact & Price Book (1991)
3. TAPPI - March 1993