The Present and Future Scope of Waste Paper/Recovered Paper

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INTRODUCTION

Today, all over the world waste paper is an important source of fibre for the Pulp & Paper Industry and will become increasingly important in the future if projection of an impending fibre shortage and a shift towards greater use of recycled fibres in the next 5-10 years comes true.

There have been controversies over the use of the term "waste paper" as some prefer "recovered paper", or "recovered fibre", which emphasizes the idea that instead of wasting paper it is actually recovered for another use. Indeed such as its importance that US pulp, paper and paper recycling industry decided to call it "recovered paper"(RCP) instead of "waste paper"

Recovered paper, ones an after thought for many paper producer, now has a major role in the Pulp & Paper Industry. About 20 years ago, waste paper was not a key fibre source for the Pulp and Paper Industry, with exception of Europe, Japan & to some North America Nevertheless, North American Pulp & Paper manufacturers have almost doubled their use of recovered paper over the last 12 years. Now, major paper producing regions have their reliance on recovered or waste paper.

Waste paper is the start of paper making process for many mills all over the world and as such the latest data will give a fuller picture, how the paper industry is developing not only in a financial/ business sense, but also regarding environmental performance. Both the volume of waste paper collected, as well as recovery rates, continue to follow a generally upward trend since last few years.

Recovered paper (RCP) what we call generally waste paper has reached its utilisation to about 45% globally and is now probably a significant source of fibre for the world of Pulp & Paper industry. Asia, (in particular-Japan) & Europe have ofcourse long been major users of secondary fibre, primarily because of limited forest resourses.

Although the Paper Industry's source of Pulp have not changed in recent years, the percentage of recycled and de-inked fibres used in the paper making process has grown significantly in particular in USA and Canada. Economics and the Environment have been the major driving forces for the increased use of recovered paper in pulp and papermaking. Over the last one decade, North American Pulp & Paper Industries have almost doubled their use of recovered paper.

The Asia/ Pacific Rim region is particularly short on domestic fibre supply and much of the raw material for the expansion of capacity is expected to come in the form of recovered paper, sourced from other regions of the world.

In the early 1980s, most recovered fibre-based paper mills procured their fibre from within several hundred kms. of their operations. Today, it is not unusual now for recovered paper to travel 2000 to 5000 kms. Ocean shipping of recovered paper into Asia from North America and Europe covers distance in excess of 5000 kms. The USA is and will remain, the main source of RCP for the world market . Mean while, Asia will have to rely upon increasing imports of RCP.

PAPER DEMAND AND CONSUMPTION GLOBALLY

From 1994 to 2010, demand for all paper grades is expected to grow, but especially in the printing and writing sector, even accounting for the impact of electronic media. In tissue, coated and uncoated

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grades, growth of around 3.5 to 4% per year is projected, while the newsprint corrugating medium and carton boards, the annual increase is expected to be around 2.5%.

The world population is expected to reach around 10 billion by 2100, more than doubling from the current lavels. Most of the population growth is in the developing countries and in 2050, it is anticipated India will overtake China reaching 1.5 billion. India, Pakistan and Bangla Desh together represent over 20% of the global population, a number equal to China. They offer huge potential for future paper and board demand growth. Aspiring middle classes will grow and literacy rates beyond 50% are already reality in India and China and also for the improved living standard, paper demand in this region is expected to increase by 5-6% per year.

In just 25 years, global paper consumption has increased by over 100%, rising from 125 mtpy in 1970 to 276 mtpy in 1997. Growth to the year 2010 has been forecast at 420 mtpy. This represents a growth rate of 2.8% per year. During the past few decades, the paper industry all over the world, has gone through a period of great change, capacity and quality output have increased to meet strong growth in customer demand.

DEMAND AND RESOURCES OF SECONDARY FIBRE (RECOVERED PAPER)

In 1970, global RCP consumption for paper making was slightly over 30 millions tonnes, RCP accounted for approximately 23% of total paper making fibre and it was not traded globally to any singnificant extent. By 1994, RCP had become a major factor in global trade and its consumption had increased by a factor of moe than 3.5 times, to nearly 110 million tonnes. This figure represents almost 40% of the total global paper making fibre consumption. Looking ahead, RCP consumption is expected to increase nearly 200 million tonnes by 2010, which would account for almost 50% of the total paper making fibre. In this respect, RCP will be as the dominant source of paper making fibre.

This decade will see the emergence of recovered paper as the largest source of fibre supply. Almost all fibre types (Chemical & Mechanical pulps and non-wood fibres) demand will grow, but non as fast as recovered paper, reaching 47% recovery rates by 2010.

It is significant that many of the top 20 most populated countries are already wood fibre deficit. To meet this deficit will clearly require an increase in supply of other types of fibre, and especially recovered paper. The Pulp & Paper Industry's dependence on virgin fibre must be reduced by an expansion in the use of recovered paper (RCP) and moderate growth in the Asian region in the use of non-wood fibre, besides the increasing use of RCP because the world's forest areas is diminishing rapidly. Forests are scares in India and is covered by only 12% and Paper Industry access to forests is very limited and this has to led to the development of large-scale non-wood paper making, more suitably using waste paper or RCP.

Residential mixed paper (RMP) is one of the recovered grade available from USA. RMP could be a challenge for the world of paper industry as a fibre source. The material is a bonafide recovered paper grade generated as a source - separated recycable stream from the residential sector. The composition of the grade varies greatly depending on how the collection programme is structured. Using RMP as a substitute for other type recovered paper could make sense in the future as economic factors swing in RMP's favour. RMP sourced from the USA can be an excellent source of fibre for the world's paper industry' particularly Asia/Pacific Rim Regions and more significantly for Indian pulp and paper industries.

Major paper-producing regions in the world have continued their reliance on RCP. The European industry has maintained its high level of RCP usage. The phenomenal growth in demand of paper and board over the last decade and half in the Asia Pacific region has been based on substantial quantities of secondary fibre or RCP

Waste paper utilisation rates in Asian countries (1995)

Japan	53%	Malaysia	83%
China	37%	Singapore	107%
South Korea	70%	Hong Kong	112%
Taiwan	96%	Philippines	76%
India	32%	Pakistan	51%
Indonesia	54%	Other Countries	29%
Thailand	76%	Asia	53%

Asia is the Largest fibre deficit region and is also main focus of fibre demand growth for pulp and paper industry

The sources for recycled pulp mainly waste paper collected domestically in India is very limited. and waste paper recovery rate is very less compared to other highly developing Asian countries. It indicates that imported RCP are vital for Indian paper Industries.

FUTURE OF INDIAN PULP AND PAPER

The multi-client study evaluates the rapidly growing Indian markets and present views on the potential and the constraints. 'India is the world's 11th and Asia's 3rd largest economy. There have been resulted in accelerated economy growth, leveling today at 6-7% per year compared to with only 1% in 1991. Several paper industries are now basing their business plans on a growth rate of 7-10%.

The demand for paper & board is expected to rise from the present 3.5 million tpy to 9.7 million tpy by the near 2010, corresponding to an average annual growth of 7%. The major factor accelerating demand are :

- rapid economic growth, accompanied by the development of the retail market and increasing purchasing power, consumption and urbanisation.
- the increasing literacy rate, newspaper readership and paper base advertising.
- higher paper quality requirements and increasing industrialisation.

The Indian paper industry consists of 380 to 400 paper mills with mill capacity ranging from 1500-200,000 tpy. The average capacity of paper machine in India is less than 11,000 tpy and even the largest companies are considered small by international standards. The large companies HPC, BILT, CPP, TNPL, JK, West Coast, MPM and OPM account for at some 40% of the country's total capacity.

India is considered to have a serious growth potential as the better organised mills develop their processes and expand capacity by investing in new technology and machinery.

CAPACITY EXPANSION IN INDIA

Several major paper mills are planning or already carryingout upgrades and capacity expansion and it is expected to achieve 7% annual growth to reach a total of six million tonnes by 2004.

ITC Bhadrachalam plans to expand capacity to 3,00,000 mtpy of paper and board by 2001 and to 5,00,000 mtpy by 2005. TNPL, producer of newsprint, printing and writing paper, has scaled down its expansion plan. According to the revised plan, TNPL will setup a de-inking plant to produce 40,000 mtpy of newsprint and a new paper machine and upgrade the mill's present utilities. Seshasayee Paper and Board (SBP) has expanded capacity to 115,000 mtpy with a new 60,000 mtpy re-conditioned Voith paper machine from Germany. Ballarpur Industries (Bilt) after its acquisition of Sinar Mas (115,000 tpy), together with its own capacity of 2,50,000 tpy will boost its capacity to a total of 3,65,000 tpy. Bilt is also planning to boost the capacity of its Serval paper mill in Tamil Nadu to 100,000 tpy from the current 40,000 tpy. The Waste Coast paper in Dandeli will expand its pulp capacity with a new line for 350 bone dry tpd of washed eucalyptus and bamboo pulp, replacing the exiting process with new Delta Screening and Twin Roll washing system. Sirpur paper mills will boost capacity from 59,000 tpy to 82,000 tpy of paper and board adding a new paper machine to the existing seven paper machines. Costal papers in Andra Pradesh has increased its capacity from 20,000 tpy to 60,000 tpy adding a second hand paper machine and de-inking plant.

NON-WOOD FOCUS IN INDIA

The most important non-wood rawmaterials used in India are : bagasse, cotton stalks and linters, jute, kenaf, mesta, rice straw, wheat straw, sarkhanda and other reed grasses. Non-wood base paper is typically produced in integrated mills. The existing 380-400 paper mills in India have a total about 570 paper machines. From this about 190 machines are in integrated straw or bagasse pulp based mills. Further about 210 paper machines are more or less used for recycled fibre and about 100 paper machines for both agro based and waste paper. The rest 70 machines use bamboo as a major furnish component, together with wood pulp and / or straw or recycled fibre (RCP).

The existing 380-400 paper mills in India are relatively small; 250 produce less than 10,000 mtpy and many of them use RCP as their raw-material, while only 130 can make more than 30,000 mtpy and mostly of them use bamboo,. bagasse and RCP as

their raw-material and the rest around 1,00,000 mtpy or above. The installed capacity in the country is about 6 million tonnes.

THE RECYCLING FIBRE CHALLENGE AND ITS EFFECTS IN THE RECYCLING PROCESS

As the percentage of recycle pulp used in the paper industry continues to grow, wet-end chemistry strategies are shifting with more pulp and paper mills using recycled -fibre, and with fibre reuse growing, strength limitations have become a critical challenge for wet-end chemistry, programmes.

As the amount of recycled pulp and paper increases, its quality decreases. Due to level of fines in these systems increases, their has been adverse effect, on strength and retention and more importantly on drainage. As such retention aids, strength aids and drainage aids have been brought into mills where this type of chemistry has never been used before. New chemistries for retention and drainage have been and are being developed and it has been experimented that water soluble oilfree polymers performs better than conventional retention aids.

The heart of the paper mill is a high -quality, cost-effective paper machine. The recycled pulp should be manufactured keeping this in mind. There should be no negative effect of recycled pulp used on the paper machine system.

New re-cycling chemistries are being developed especially in the de-inking arena. Flotation additives and enzymatic chemistries are highly effective in removing ink particles allowing to use lower grades of waste paper while increasing the quality of the finished recycled paper.

Increased use of recycled pulp creates more risk of contaminants on the paper machine. According to the new wet-end chemistry and research clarifies, there are two different treatments which can reduce the effect of contaminants. In the first, dispersants break down stickies and tackies to small particles early in the pulping or refining process of the recycled pulp. Coagulants are used to attach the particles to the fibre, effectively removing the contaminants from the system and reducing deposition potential Mills using this technology are able to optimise the use of recycled fibe. Another treatment rids the system of contaminants that cause paper machine wire plugging, which in turn causes reduced drainage on the wire and production losses. Chemicals treatment of wire can reduce plugging, improving runnability. Wire treatment programmes consists of spraying low molecular weight, highly charged coagulants on to the wire, creating a "sacrificial" layer and preventing deposition of contaminants.

Optical properties and machine efficiency are important considerations when recycling paper is used to produce writing, printing paper. Consequently, there have been considerable developments in de-inking and bleaching technologies and in increasing the efficiency of the removal of stickies and other contaminants.

At the beginning of a recycle process, the pulp recovered paper stock contains a mixture of fibres and chemicals, as well as various non-fibrous contaminants, including mineral fillers, inks and ofter stickies. The fibre blend is further complicated by the presence of an increased proportion of fibre fines relative to virgin fibre, from all types of fibre present. The properties of these recycled fines are very different from virgin fines, whereas changes in the properties of long fibres are relatively small.

As the stock progress through the recycling process, changes in relative proportion occur as various contaminants are removed by screening, centrifugal cleaning, de-inking etc. As well as non-fibrous materials, fibres and fines are also lost during these cleaning stages. The mechanical action of pumps, agitators, screwpresses and dispergers cause further changes through a beating action, possibly producing fresh fibre fines with different properties from recycled fines. In very general terms, during the recycling process freenes increases and strength properties improve. At the end of the recycling process usually there is only a relatively small proportion of non-fibrous materials.

NEW TECHNOLOGY IN PROCESSING WASTE PAPER OR RCP

Regenex RCF system: Regenex L.L.L.C. of Kenner, Louisiana, USA have developed lates ideas for adding value to recycle fibres.

The technology is based on ideas developed by Pellerin Milnor corporation, in the industrial

laundry business. It was almost by chance that the company entered the paper industry when a laundry experimented with some of its own office waste paper as well as several other grades of furnish and the experiment appeared to be successful.

The system is based on cells within units that can be extended and added to depending on the end products required. Idealy two four cell units are joined together for a capacity of 7-8 tpd of RCF and six four cell units for a capacity of 25 tpd of RCF.

Mixed office waste (MOW) and other grade of recycled fibre (RCF)is loaded in to the first cell using lifts and conveyors. The cells are divided within a rotating drum which has a sequence and starts with an oscillation of the drum through about 200°. Once this part of the process is complete the drum rotates a full 360° transporting the first load to the next cell while the first cell receives a new load. This continues until the expected fibres, in the form of pulp, are discharged through an extraction plate in the bottom of the final four-cells. Contraries such as paper clips, metal binders, plastic and even polystyrene laminates are discharged during 360° rotation of the final cell.

Majority of the ash is washed out and discharged in the first cell and the larger ink particles, which can be suspended in the waste waters, are progressively removed at each succeeding cell. The pressure screening and cyclones are really only needed to remove the much finer stickies and particles of laser ink. It is also not necessary to remove metal and plastics prior to loading of the dry waste peper.

Washing chemicals can be added and discharged from each individual cell as required. The load is maintained at a temperature of about 160°C, the temperature requried for dispersion of some of the chemicals. If bleaching is required, bleaching chemicals can be aded in the final cells. With the use of krofta dissolved air flotation (DAF), clean water is received from the waste waters, enough to either re-use in the first cell or discharge to the sewer.

The primary aim behind the Regenex's technology is to provide mini recycling paper mills close to the source of waste paper. The equipment is not intended to be the basis for a large RCF mills but rather to add value to smaller quantities of the valuable resource of the so-called 'urban fibre', of capacity 3-250 tpd. The technology is not intended to complete with the larger RCF facilities integrated into large paper mills.

The system provides high dilution for de-inking. It separates fibre from polyester film used in cartoons, drink boxes, polycoated cups and similar items. Continuous batch technology is a system of connected modules each with an outer shell and rotating inner screen. Each module or cell has an integrated transfer scoop, which transfers the stock from one stage to the next without the use of pulps or screens. The outer shell and inner cylinder enable the machine to create two distinct material transfer paths, one for rejects and the other for to clean secondary fibre. The system resolves one of the most difficult problems in processing polycoated materials-separating poly-film from fibre and the brake down of wet-strength resins. The low mechanical action of rotating cyclinder enhances contaminants separation. The performance of the system has surprised even its developers, particularly where the polystyrene laminates are being removed and discharged through the end cell.

The perforated transfer scoop provides an intermediate de-watering and dilution at each transfer stage. Energy consumption is less than 60 kwh per daily tonne of production, because the transfer does not require numerous stages of pulps and screens. The latest units have a drive system with just two 5 HP motors for rotating the central drum, which has several individual cells making up the central core of the technology. As the process water is in a closed loop, consumption is estimated to be less than 4500 liters per tonne of pulp.

URBAN FIBRE PROCESSING

The first urban fibre process is a 500 tpd 100% post-consumer deinking pulp mill started operation in January, 1996 in USA and stands out among the next generation of process for its extensive ability to handle a wider variation in supply.

The process design for mixed office waste (MOW) of extreme variability including wider variety of waste paper began in the Black Clawson Research and Technology Centre. The process is flexible enough to handle the extreme variability that was seen in MOW and waste paper. From the beginning, the process has anticipated the use of very low grades of unsorted waste and is therefore suited for the extremely contaminated waste paper.

Initial inspection of waste paper is carried out prior to charging the two side - by - side high consistency pulper. Each pulper is fitted with its own detrasing screen, with a common drum screen to de-water the light rejects from each unit. The timing cycle is controlled by the distributed control system (DCS) so that the two de-trasing screens do not discharge simultaneously and flood out the drum screen. Heavy rejects are dropped on to a de-watering conveyor and transported to a compacting extruder, which prepares the materials for eventual disposal.

The major portion of the debris is removed in these fast few steps of what can be characterised as a two loop float/disperse/float de-inking system.

The process then becomes continuous through high-consistency cleaners and multi-stage coarse (perforated) pressure screens and to medium consistency cleaners and multi-stage fine (slotted) screens.

Following the fine screening step are the first stage froth flotation cells. The flotation cells are known generally as a Higher Rate or HAR flotation cell which has been the single fastest growing de-inking technology. The flotator introduces significantly more air-up to ten times the stock volume than other cells. This high air addition rate creates more bubbles that are widely distributed over the broad range of sizes that are needed for highly efficient flotation of ledger grade furnishes. The de-inking of MOW, however is dependant on the removal of somewhat larger ink particles, sometime as large as 350 to 400 microns. Because of the high air addition rate and the wide range of bubble sizes, the flotator has been proved to be effective in achieving 95% plus removal of all particles, even those which are hard to remove 350 to 400 microne size range.

Light weight cleaners and forward cleaners are installed for small particle size sticky removal and dirt/grit removal. From there the stock is thickened on gravity deckers and twin-wire presses, in preparation of dispersion at 35% consistency. From the kneaders, the stock is oxygenated and passed through up - flow second step bleaching towers.

Next the process, flotation removes any residual inks that have been freed or reduced in size as a result of the kneading step. Second stage of high efficiency forward cleaners Black Clawson, DNT separates any small dirt specks and the two stage high speed belt washer, is designed to wash fine strips of stock that are laid down on a wire travelling at a very high speed. The two hydraulic nips of the washer act to promote high efficiency washing that approaches the theoretical maximum obtainable. Because the effluent from the washer can be 100% clarified, the control of the final wash can be maintained to balance the necessary yield loss.

The last two stages of bleaching, peroxide and reduction are designed to achive an 85° ISO brightness. The pulp former and dryers produce the sheet at its final dryness of 90% while preserving fibre strength.