Small and Medium Paper Mills - Technological Challanges and Options Using Agricultural Residues as Raw Material

Angadiyavar C.S.

ABSTRACT:-- Though large in number small and medium size paper mills contribute about 40% of total paper and board production in India. Recent projection reveal that by the year 2000 total installed capacity is to increase by 2.6 million tonnes. This increase will be coming out of expansion programme of existing large mills and major additions through new larger installations. Interestingly new additions will be based on latest technology including automation. This will enable large mills to stay fit to meet technical challanges. Therefore, at this juncture more worrying aspect will be that small mills find it hard to keep pace with the changing needs of improved quality, increased efficiency and cost reduction. In the open market policy like ours these can be achieved through capacity expansion or reduced input costs. These in fact, are based on Hi-Tech involving substantial investment. It is not so easy for small mills to meet these ends as justification of such investment on small production is a task by itself.

TECHNOLOGICAL CHALLANGES

A. Raw Material

Technically almost every plant that grows has been examined for pulp and paper making and most of them have shown some desirable properties in each. However, one cannot assume that any vegitation converted into pulp and paper technically is support that it can be generated, collected, stored and processed economically make the operation viable. The one which qualify to become suitable raw material and have been in use for decades by the small mills are listed in the Table-1 with corresponding end products having been produced successfully.

In the present context small mills have been conventionally and largely using agricultural residues such as straw and bagasse and waste paper for the production of common varieties of papers. For selective grades use of cotton, jute, Kenaf, hemp by the small mills is well known. Among agricultural residues straw, and bagasse have received prominent status due to their concentrated availability and promising pulp properties to manufacture reasonably good paper where these can replace conventional forest based raw material to a larger extent.

B. Problems Associated with Straw and Bagasse

These are seasonal raw materials having more than one use. Straw is used as fodder and fuel, therefore straw is controlled some times by the Government to fight draught etc. Similarly the

Rohit Pulp and Paper Mills Ltd.,
P.O. Khadki - 396 185 (Gujarat).

Table-1

General Uses of Non-Wood Plant Fibers for Papermaking

Non-wood plant fiber	Use, by type of paper of paperboard	Furnish percent of named fiber	Balance
Abaca	Superfine, lightweight, bond, ledger, currency and security, tea bags, filter	10-80	Cotton or woodpulp
	Non-wovens	10-50	Synthetic fibers
	Linerboard, wrapping and bag	10-30	Bagasse or straw pulp
Bagasse	Woodfree printing and writing.	20-100	Woodpulp
	Mechanical printing and writing	20-50	20-40% woodpulp, balance groundwood
	Bristol board	50-100	Woodpulp.
	Tissue	60-90	Woodpulp.
	Glassine and greaseproof	30-90	Sulfite pulp.
	Duplex and triplex	20-70	Woodpulp.
	Corrugating medium	50-90	Wastepaper.
	Linerboard	50-80	Kraft pulp.
	Wrapping and bag papers	50-85	Kraft pulp.
	Multiwall sack	30-70	Kraft pulp.
	Newsprint substitute	80-90 (Chemi-mechanical)	Kraft pulp.
	Newsprint substitute	70-80 (Mechanical)	Kraft pulp.
Bamboo	Woodfree printing and writing	70-100	Woodpulp and/or straw or bagasse pulp.
	Mechanical printing and writing	40-60	Groundwood.
	Bristol board	50-100	Woodpulp and/or bagasse pulp.
	Duplex and triplex	30-80	Woodpulp and/or straw or bagasse pulp.
	Linerboard	60-100	Kraft pulp.
	Wrapping and bag	80-100	Kraft pulp.
	Multiwall sack	80-100	Kraft pulp.
	Newsprint substitute	50-70	Groundwood pulp.
Cotton	High-grade bond, ledger, book and writing	25-100	Woodpulp.
Hemp, true	Cigarette paper	50-100	Woodpulp, bagasse, straw or kenaf bast fiber.
	Lightweight printing and writing	20-80	Woodpulp, flax, cotton pulp.
	Condenser	20-60	Woodpulp, Flax or cotton pulp.
	Currency and security	60-80	Flax, cotton or woodpulp.
Jute	Printing and writing	20-80	Woodpulp.
	Tag, wrapping and bag	40-60	Woodpulp or bamboo pulp.
Kenaf, bast fiber	Woodfree printing and writing, printing	20-100	Woodpulp, bagasse, straw, reeds, or bamboo.
	Mechanical printing and writing	20-50	20-40% woodpulp, balance mechanical pulp
	Newsprint	20-30	Mechanical pulp from wood, bagasse or kenaf core material.
	Multi-sack	50-100	Kraft pulp, bagasse or straw.
	Linerboard	50-100	Kraft pulp, bagasse, straw of waste paper.
	Cigarette paper and other light weight specialty paper	50-100	Woodpulp, flax, hemp or abaca.
	Tissue	60-90	Woodpulp, bagasse or straw.
	Bleached paperboard	50-100	Woodpulp, bagasse or straw.

Non-wood plant fiber	Use, by type of paper of paperboard	Furnish percent of named fiber	Balance
Kenaf, whole stalk	Newsprint	80-90 (Chemi-mechanical)	Woodpulp
	Woodfree printing & writing	20-80 (Chemical)	Woodpulp
	Mechanical printing & writing	20-50 (Chemi-mechanical)	Woodpulp
	Corrugating medium	50-100	Waste paper.
	Linerboard	40-50	Kraft pulp and waste paper.
	Mult-wall sack	20-40	Kraft pulp.
	Tissue	50-60	Woodpulp.
	Bleached paperboard	40-50	Woodpulp.
Straw, cereal and rice	Woodfree printing & writing	20-100	Woodpulp.
	Mechanical printing & writing	20-50	20-40% woodpulp, balance groundwood.
	Glassine and greaseproof	30-90	Sulfite pulp
	Duplex and triplex	20-70	Woodpulp
	Corrugating medium	50-90	Wastepaper
	Strawboard	80-100	Wastepaper
	"B" quality wrapping	50-60	Wastepaper and/or woodpulp.

SOURCES: Joseph E. Atchison's Article.
Tappi Non-wood plant fiber pulping progress reports.

bagasse prime use is fuel for boiler. Availability of these are not fully assured as need of paper industry is placed at the end, and price fluctuation is considerable. Negotiations with Sugar mills for sustained supply of bagasse have not been so successful as they themselves are not sure of surplus bagasse available with them and such surplus is not uniform. Since most of Sugar mills operate on co-operative basis decisions are not firm.

Technical problems associated with the use of straw or bagasse are,

* Though considerable improvements have been made still lot to be improved in raw material preparation. Depithing and dedusting (dry cleaning) at paper mills are associated with intensive air pollution.

* About 25 to 30% solid waste is generated in the process of depithing. Today disposal of such solid waste is a big problem. Most of existing conventional boilers are not suitable to burn pith beyond 20 to 30% of coal used. Sugar boilers are designed to accept such fuel. therefore, if depithing is done at Sugar mill pith disposal and air pollution problems could be eased considerably. Alternatively the Sugar cane separation process known as Tilbay seperator process, may be thought of standardising. This should be useful for Sugar mills as well as Paper Mills. In this respect initiation has to come from Sugar mill, which is doubtful, but worth persuading. Due to these problems many small paper mills use bagasse without depithing for the manufacture of unbleach varieties. No doubt that products made in such manner cannot compete in the present open market and the waste paper for recycling generated out of such paper will have hardly any desirable strength.

* These raw materials have inherent problems of short fibre nature, high ash in straw, considerable carryover of pith with the depithed bagasse. Synergistic effect of these make equipment less efficient. Therefore, process

equipment from digester house onward will have output of only 25% when compared to bamboo or wood pulping. Therefore, endup with high specific energy and water consumptions.

Chemical Recovery

* Due to the nature of black liquor from straw chemical recovery technology has not made headway. However, MKCR process technology developed by M/s. ABC has given some results and it bears number of practical problems. It seems it will take some time to establish its acceptability. Some bagasse based mills have successfully implemented chemical recovery. Problem in the adoption of chemical recovery by small mills appear to be more of commercial nature. Any large investments needs justification. This can go through only when there is attractive breakeven point. This is unlikely in small mills because of low tonnage. Therefore, should we make the change in the definition of small mills with respect to minimum economic size of chemical recovery? In that case we will have to call the mill as economic size mill rather than small. Therefore, it is a matter of concern when 300 to 400 Kgs of caustic used in pulping per tonne of paper produced is going to drain and causing ample pollution.

Process Problems

* Poor process control ability, particularly in absence of continuous digester it is hard to produce uniform quality pulp.
* Low output due to lower drainage property of fibre.
* Low energy efficiency and higher chemicals and water consumptions.
* High foam formation during washing making washing inefficient also bottleneck in aeration of effluent.
* Scale deposit in the process equipment resulting higher preventive maintenance.
* Poor fibre balance due to lack of controls.
* Invariably large variations occure in the final product quality, which is not acceptable by the market.
* Furnish nature demands reduced speed of machine operation.

Pollution Problems

* It is imperative that in absence of chemical recovery the pollution generated by such mills is extremely high. In case of bagasse processing BOD load shall be as high as 350 Kg/t of bleached pulp whereas it will be about 250 Kg/t of straw pulp. Without physico chemical application COD cannot be brought down as lignin is present in dissolved form in the effluent. Therefore, treating of such effluent to meet the standards laid down by the Pollution Control Boards is an herculean task for small mills. Apart from water pollution processing of bagasse inherit high air pollution and solid waste gereration. These can be eliminated by depithing bagasse at Sugar mills or adoption of Tilbay separation method while procesing Sugar cane by the Sugar mill.

Promising Inventions

The following can be the hope for future upgradation of small mills performance though constant effort by supplier and user is warrented,

* Organosolve pulping
* Oxygen delignification
* Chemical recovery from M/s. Chellam, Madras
* Cost effective continuous digester by M/s. Chellam, Madras and TMT
* Cost effective SAICA digester to produce liner paper pulp
* MKCR chemical recovery process
* Tilbay method of separation of rind from pith.

Options

Open market system has taken small mills by storm. Some of options before such mills may be,

* Mills having capacity to invest, to think of expanding the production to an economical size where chemical recovery, improved pulping, improved bleaching, paper making and some amount of automation emerge as possibility. This will enhance the quality of product and techno-economical stability. Such innovations can open up revenues for export too.
* Mills facing constraint of major investment to think of switching over to recycled fibre with minimum automation through minor investment and manufacture gereral grades of papers such as packaging, W and P papers, poster papers etc. which can be sold at a cheaper price.
* Use market pulp or recycled fibre to produce value added products which are in demand but in smaller quantity.

Finally review the decisions time-to-time and sense market sensitivity for sustained stability and competetion.