Various Approaches to Enhance The. Fibre Resources-A Review

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ABSTRACT

This paper describes the steps to be taken for exploring the conventional, non-conventional and agricultural fibrous raw materials to overcome the possible shortfall of fibre resources in near future. An attempt has been made to describe the following points, in view to enhance the fibrous materials required to the paper industry:

1. *Role of farm forestry/social forestry for improving plantations.*
2. *Whole tree pulping aspect with more stress on bark utilisation.*
3. *Utilisation of non-conventional and agricultural raw materials.*
4. *Developed pulping technologies.*
5. *Ecofriendly and low shrinkage bleaching.*
6. *Conservation of fibres in papermaking process.*

INTRODUCTION

Due to shrinkage in forest cover and ecological imbalance, difficulty is arising even to meet the required fibrous raw material to the paper industry. The rapidly growing industry and the demand for higher requirement of paper will make this situation still worst. To avail the cellulosic raw material for more production of paper by maintaining proper environmental conditions is a challange which has forced us to give a new look at this problem to avoid the scarcity of cellulosic raw material.

The present requirement of all varieties of paper and paper board in the country is 2.5 million tonnes and is expected to rise to 4.2 million tonnes by the end of this century. The rate growth of demand of paper is 9.5% per annum. To meet out this challange, there should be enhancment in the fibrous raw material to be made available for paper production much economically keeping in mind the environmental protection of our forests.

Bamboo and various kinds of hardwoods are the main conventional raw materials used in our country. Apart from this some agricultural residues like Bagasse, Rice straw, wheat straw and non-conventional raw materials like waste paper are also in use. However these are insufficient to cater the present and future demand of the market. It is the need of the time to explore the possibilities of enhancing fibrous raw materials, judicious use of present raw material along with new policies on plantations as well as technological developments to produce substantial amount of product with conservation approach.

Hence an attempt is made here to study and examine the possible ways and means to augment the fibre resources. Adoption of any of the following ways will depend on the specific location and existing condition of the concerned paper industry.

ROLE OF FARM FORESTRY/SOCIAL FORESTRY IN IMPROVING PLANTATIONS

Efforts are necessary to step up the green cover in India with improving land productivity and

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production of pulpwood and other forest products. Innovative policy changes and sound strategies are required for improvement of land productivity.

There is a need of change in the Government policy towards social forestry and should also encourage large scale industrial plantations as being done in the developed countries (1). Some of the measures to be taken are as follows:

- Urgent replanting of degraded forest areas with suitable wood species for their healthy growth in the environment of the forest location.
- Drastic changes in the Government policies regarding social forestry and industrial plantations
- Technological and R & D support to develop new species which are fast growing, disease resistant locality specific clonal planting.
- Plantations outside the forest area on vacant Government lands, marginal agricultural lands, rail road and canal strips, community lands etc. is essential. Government should encourage for such plantations.
- Encouragement to agroforestry plantations with finance, service management, advanced technology.
- The selection of species for pulpwood plantation development has to satisfy variety of requirements. In this connection, Acacia auriculiformis has shown the tremendous potentiality. The nitrogen fixing capacity of this specie has found a value based and ecofriendly. With the introduction of best seed source in plantation development, the productivity of Acacia could be enhanced further by about 20%.
- To overcome the shortage of long fibred raw material, the plantations of such materials like Bamboo and tropical pine will play an important role. Some mills on their own have already developed these plantations and are expected to get the potential yield at the rotation period of 12 years.

In view of the above facts, if Government, Industries and farmers work in co-ordination with each other, there will be tremendous enhancement of fibrous raw material with environmental protection and ecological balance.

WHOLE TREE PULPING ASPECT WITH MORE STRESS ON BARK UTILISATON

The concept of whole tree pulping has arisen in view to make use of maximum possible raw material grown per unit area. Not only the stem portion of the tree but the bark, branches etc, of the tree are required to be utilised to the maximum extent which in turn will give more cellulosic raw material per acre.

With the scarcity of bamboo, it has now become a normal practice to utilise young hardwood from social forests because of their availability and commercial reasons. Several studies have been undertaken to find out the impact of use of bark along with the stem, branches in pulping and paper making. The bark content of wood varies from species to species and also with the age. Young hardwoods have thinner bark and hence less problematic in pulping and papermaking. The bark content of various Indian hardwoods varies from 8-20% depending on the species, age, girth etc. This bark gives an additional source of fibrous raw material. However, this requires the pulping studies of individual species with bark for assessing their usefulness. The detailed study carried out at Research Centre of West Coast Paper Mills (2,3,4) regarding pulping and papermaking of various wood species with bark in general has given encouraging results. Kraft pulping of wood with bark require about 2% extra chemicals than for those with debarked wood to produce pulps of identical Kappa number. Presence of some barks produce specks and hence efficient screening is required. The black liquor produced will have slightly higher viscosity. However various wood species with bark can be effectively used. It has become a common practice to utilise the yound species like Eucalyptus hybrid, casurina (Casuarina equilifolia), Subabul (Leuceana leucocephala) etc. with bark at our mills.

After wood chipping, the screening is done to avoid oversize chips and dust. Here the normal

practice is to consider the chips size below about 5 mm as dust and is not used as pulping raw material. It is practicable to use the chips upto 3 mm size bringing down the accept chips size from 5 mm level to 3 mm which will increase the availability of raw material without any adverse effect and will help in increasing a better fibre value. If this portion of dust is utilised for pulping, the additional fibrous material will be available.

NON-CONVENTIONAL AND AGRICULTURAL RAW MATERIALS

As the resources of conventional forest raw materials are fast depleting the Indian pulp and paper industry should seriously make efforts in the direction of using non-conventional, non-forest based fibrous raw materials. These are bagasse, rice straw, wheat straw, Agave, Hemp, Esparto, banana stem, sabai grass, kenaf (mesta), sugarcane rind etc. Various other wood species which are rarely in use at present for pulping, can also be considered depending on their availability.

Bagasse is used mainly as a fuel in sugar industry. Surplus bagasse is utilised in pulp and paper industry. Bagasse is still to be accepted as a conventional pulping raw material because of various problems like transportation, handling, storage and depithing.

If the sugar industry adopts the recent technology to separate the outer skin of sugarcane-Rind, prior to juice extraction, this sugarcane fibre in the form of rind, free from pith, will be available to the pulp and paper industry.

This will eliminate the problems faced with bagasse. This will save the installation cost of depithing of bagasse and space required for unit. Apart from this, the handling, transportation and storage of sugarcane rind will be much economical. The pulp obtained from rind is much stronger than that obtained from depithed bagasse (6). The better utilisation of sugarcane fibre in the form of rind will fetch more fibrous raw material to paper industry. If every sugar mill adopts this modern technology of cane separation system, both sugar and paper industries will flourish.

The availability of sugarcane fibres is continuous as it is an annual crop when compared with the conventional woods. Moreover higher the use of rind, better will be the conservation of forest. The wood yield is 25 to 30 BD tonnes per acre in 20 years. The sugarcane production is about 40 tonnes/acre/annum. 6% of dry rind will be available from this sugarcane. If this rind is fully utilised we will get 48 tonnes of BD rind (2.4 tonnes of rind annually for 20 years) during 20 years. This means that apart from the conservation of forests the paper industry will get 60-90% of extra sugarcane fibres as a better fibrous raw material in 20 years as against wood.

Jute is another agricultural produce-mainly used for gunny bags-where only bast fibres are used. Bast fibres with sticks can directly be used to get acceptable pulp by normal kraft pulping process. It is much stronger than that of bagasse and can be effectively used as a substitute for bamboo or softwood pulp.

Kenaf (Mesta) and Banana (Musa cavendish) are two more fibrous raw materials; but because of their bulky nature and high moisture content, their handling becomes a prime problem. If the mobile field chippers are used, then the chipping of these raw materials can be carried out at site, spread for water removal and then can be easily transported to paper mill site after baling.

In Jalgaon District (Maharashtra State) alone, more than 16,000 hectares of land is under banana cultivation. There are about 4000 plants per hectare (7). Hence a new thought can be given to explore this huge amount of fibrous raw material as these plants are mostly thrown away as a waste and only a small portion is used in making ropes. The mucilaginous and gummy material present in the banana plants makes it difficult in producing good pulp. Hence a chemical method has been developed at WCPM Research Centre (7) to remove this material and separate the fibres. Thus banana plant pulping involves two stages. The first stage being mild acid hydrolysis to remove mucilagenous material and second stage being the kraft pulping of crude fibres obtained after acid hydrolysis. The pulp thus obtained is of good quality and has a better strength.

MODERN PULPING TECHNOLOGIES

With the development of modern pulping technologies such as rapid displacement heating-RDH (8), high yield pulping (9), oxygen delignification, kraft pulping with very little quantity of additives such as anthraquinone (10), organosolvent pulping etc. it is possible to perform the pulping with minimum degradation of cellulosic fibres which in turn will give better yield.

Biotechnology in pulp and paper industry makes use of lignin degradation enzymes which can be used for pulping (biopulping), bleaching (biobleaching), etc. but the process is still in infant conditions and needs wide attention (11).

ECOFRIENDLY AND LOW SHRINKAGE BLEACHING:

Various bleaching sequences have been developed which enable us to give the pulps of higher brightness with less shrinkage during bleaching. These include elemental chlorine-free bleaching, total chlorine free bleaching sequences etc. Use of chlorine dioxide, hydrogen peroxide, oxygen, ozone is done with or without chlorine and hypochlorite bleaching stages. Use of various enzymes such as Xymase during bleaching is also done in enzyme bleaching or biobleaching.

Apart from high brightness and low shrinkage by the use of such chemicals, the environmental protection is also achieved. The lower the shrinkage during bleaching, higher is the pulp yield- in turn the augmentation of cellulosic fibres.

CONSERVATION OF FIBRES IN PAPERMAKING PROCESS

With the development of superfilled papers, it is now possible to manufacture papers of as high as 30% ash content without hampering the properties. More the use of 'ash' in peper, better is the conservation of fibres. The effective use of various drainage and retention aids, flocculating agents etc. will further improve the potential.

Proper utilisation of waste paper in paper manufacture will give additional source of fibres. Qualitywise separation of waste papers and then giving the proper treatment so as to convert in slush form is of prime importance for the effective utilisation of waste paper.

CONCLUSION

There is a wide scope for exploring various raw materials for augmentation of cellulosic fibres required for the paper industry. New look and technological developments will definitely overcome the possible scarcity of fibres with the use of such raw materials in near future.

ACKNOWLEDGEMENT

The authors are thankful to M/s. The West Coast Paper Mills Ltd. for giving us the permission to publish this paper.

REFERENCES

1. Piare Lal-IPPTA, Vol. 6, No. 4, Dec. 1994.
2. Unkalkar, VG, etal-IPPTA, Vol. XIV, No. 4, 1977.
3. Unkalkar VG, etal-IPPTA Vol. XIV, No. 3, 1977.
4. Rao BR, etal-IPPTA, Vol. 6, No. 1, March 1994.
5. John Budnik-Puip Testing Programme utilising sugarcane ring (Oct. 1989).
6. Unpublished work-Research Centre, WCPM.
7. Fernandes JD, etal-TAPPI non-wood Plant-fibre pulp-Progress report No. 11.
8. Pu Q etal-APPITA, vol. 46, No. 4, July 1993.
9. Unkalkar etal-TAPPI Nonwood plant fibre pulp-Progress Report No. 17.
10. Nayak RG etal-TAPPI, Vol. XVII, No. 1, March 1980.
11. Bajpai Pramod-4th National Convention of Chemical Engineers (Roorkee), 1988.
12. Kariyappa, G.S. etal-Papers presented at Ippta Seminar, July 1996.