

# Paper making potentiality of arecanut husk

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Major raw material for paper making in the world is softwood. India is unfortunate for not having the softwood forests, other than those in the impregnable Himalayas. Until recently, bamboo was the main raw material for the paper industries in India. Due to high rate of consumption and slow growth rate, shortage of this raw material is increasing. The necessity of other alternatives is making the paper manufacturers to try other cellulosic raw materials. Agricultural residues may become better alternatives. Along with others, we can think of arecanut husk? It may perhaps be employed with longer fibered materials for the production of low grade brown papers and cardboard. (Bull. Imp. Inst. Lond., 1922, 20, 289)<sup>1</sup>.

Arecanut is extensively used as a masticator throughout India, Burma, Ceylon and Malaysia. It is generally chewed along with pan (leaves of Piper Betel) and a little slacked lime to which katha (from Acacia catechu), spices and tobacco are sometimes added. Readymade chewing preparations like these, called beedas, are sold in the bazaar. Chewing develops salivation and the saliva is coloured red. It is supposed to prevent the decay of teeth, but its continued use blackens and loosens them. The constant irritation of the mucous membrane of the mouth sometimes results in oral carcinoma.

Arecanut fruit is generally ovoid, about  $1\frac{1}{2}$ "-2" across and 2"-2 $\frac{1}{2}$ " long and is brightly orange when fully ripe. The pericarp is hard and fibrous and the kernel called the arecanut is about 1"-1 $\frac{1}{2}$ " in diameter and greyish brown in colour. This shelled nut constitutes 35% of the whole fruit and the 65% pericarp is fibrous.

**Cultivation :** The areca palm is considered to be a native of Malaya, where it is cultivated on an expensive scale. It is found throughout the East Indies and the Philippines. In India, it is cultivated in the coastal regions of Southern Maharashtra, Tamil Nadu, Karnataka, Kerala, Bengal and

Assam. It is also grown in Ceylon, Burma and East Africa.

This palm requires a most tropical climate for luxuriant growth and is very sensitive to draught. It thrives in areas with heavy rainfall (200 inches) provided drainage is good and also in drier areas (20 inches) if suitably irrigated. It is a shade loving plant especially in earlier stages and is generally grown as a mixed crop with fruit trees such as the plantain and the coconut. Sometimes, it is also grown in the midst of mango, jack and guava trees.

The areca palm is carefully cultivated in Karnataka and the methods adopted there are generally found throughout South India and on the West Coast. In Karnataka, the palm is grown both in malnad areas (hill tracts) on the Western Ghats which receive a rainfall of over 200 inches and in the irrigated parts of the maidans (plains) where the rainfall is often only 30 inches. In the malnad, plantations are usually located in the valleys of hills adjoining tropical forests, where as in the maidan they are found near tanks and rivers.

In Karnataka, areca takes 10-12 years to come into bearing. In general, the areca palm takes 30 years before a plant reaches maturity. The fruiting life of a tree may be 30-60 years after maturity and a tree may live for 60-100 years.

In Karnataka, the main cropping/harvesting season is from August-January; in Bengal from October-January; in Maharashtra from August-March. In a season, two or three pickings are made. Each tree yields 2-3 bunches a year, contain-

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ing 200-250 fruits weighing 3.2 to 4.9 lb. per 100 fruit. The yield per acre, with 400 trees in bearing is 160,000—200,000 fruits or about 6-10 Cwt. of dried arecanuts. In Karnataka, the average yield per acre of cured nuts is estimated at 7 Cwt. per annum (1 Cwt. = 50.8(2 kgs.).

During the first plucking in August, a quarter of the crop is collected; the major portion is gathered in the second plucking during October or November; and finally a small harvest is collected upto January. Immediately after collection, the fruits should not be left unhusked for more than three days.

**Availability :** A large quantity of husks is obtained during the preparation of kernels for the market. The husk contains 47.6% of cellulose on the dry basis and is composed of a mass of weak woolly fibres, mixed with coarser and stronger bristles-like fibres<sup>1</sup>.

Table No. I<sup>2</sup> gives the state-wise cultivated area and production in India.

**TABLE NO. I—ALL INDIA FINAL ESTIMATE OF ARECANUT (ARECA CATECHU) 1978-79**

| State            | Area<br>(Thousand<br>Hectares) | Production<br>(000 tonnes dried<br>nuts without<br>husk) (Processed<br>nuts) |
|------------------|--------------------------------|--|
| Andhra Pradesh   | 0.2                            | 0.2  |
| Assam            | 46.4                           | 40.4   |
| Karnataka        | 50.0                           | 61.5   |
| Kerala           | 62.7                           | 51.1   |
| Maharashtra      | 2.1                            | 2.5  |
| Meghalaya        | 6.5                            | 0.9  |
| Tamil Nadu       | 4.2                            | 2.9  |
| Tripura          | 0.6                            | 0.4  |
| West Bengal      | 3.1                            | 0.8  |
| Goa, Daman & Diu | 1.4                            | 1.5  |
| Mizoram          | Nil                            | Nil  |
| All India        | 117.2                          | 116.3  |

In India, 1,66,300 tonnes of processed arecanuts are produced. per annum. Approximately 4,75,140 tonnes of husk is produced.

The production of arecanut in India is not sufficient to meet the internal demand and large quantities are imported from Ceylon, Java, etc. There is also a small export of the nuts from India.

Karnataka is the state where arecanut production is highest. About 76% of the country's arecanut production comes from Karnataka and Kerala

states, each contributing about 38%. Approximately about 1.25 lakh tonnes of arecanut is grown in these two states and we expect to have about 60,000 tonnes of arecanut husk which could be actually made use of for the manufacture of paper which is called Chali husk (white variety) which is not boiled but sundried and dehusked and brought to the market. The husk does not have any value as such and it is used as fuel and for mixing manures. It is said that one MT of husk may cost about Rs. 100/- to Rs. 150/-<sup>3</sup>.

District wise arecanut cultivated area and production in Karnataka state is given in Table No. II<sup>2</sup>.

| District         | Area<br>Hectares | Production<br>(tonnes dried nuts<br>without husk) (pro-<br>cessed nuts) |
|------------------|------------------|---|
| Bangalore        | 504              | 846   |
| Belgaum          | 2                | 3   |
| Bellary          | 10               | 14  |
| Chikamagalur     | 6,889            | 8,413   |
| Chitradurga      | 3,036            | 3,014   |
| Dakshina Kannada | 12,923           | 16,441  |
| Dharwad          | 226              | 326   |
| Hassan           | 1,422            | 1,615   |
| Kodagu           | 539              | 691   |
| Mandya           | 636              | 916   |
| Mysore           | 878              | 504   |
| Shimoga          | 9,741            | 14,339  |
| Tumkur           | 5,350            | 6,657   |
| Kolar            | 62               | 89  |
| Uttar Kannada    | 7,820            | 7,579   |
| Other Districts  | —                | —   |
| Total            | 49,971           | 61,457  |
| Approx.          | 50,000           | 61,500  |

In Karnataka, for 61,500 tonnes of processed arecanut production, about 1,75,714 tonnes of husk will be produced per annum.

**Production of Paper :** In Kerala state, the Punalur Paper Mills Ltd., has manufactured M.G. Plain Kraft paper with 25% arecanut husk pulp in admixture with reed pulp 50%, waste paper pulp 25%. Strength properties of this 78 gsm. M.G. Plain Kraft paper sample have been listed in Table No. III<sup>4</sup>.

**TABLE NO. III**

|                   |     |      |
|-------------------|-----|------|
| Basis weight      | gsm | 72.0 |
| Burst factor      |     | 20.4 |
| Breaking length   | M   | 2774 |
| Tear factor       |     | —    |
| Folding endurance | DF  | 26   |

### Experimental Results and Discussion :

Mysore Paper Mills Ltd., Bhadravathi, has evaluated the pulping and paper-making characteristics of arecanut husk. The MPM laboratory investigations have been explained below.

Autoclave experiments conducted in the Mysore Paper Mills Ltd., Bhadravathi<sup>4</sup> :—

Airdry arecanut husk equivalent to 200 gm. O.D. weight was taken for each cook in the laboratory autoclave. The average moisture content of husk was 10.5%. Bulk density was found to be 128.3 kgs. OD/m<sup>3</sup> at 10.5% average moisture. The husk pulped by Sulphate process. Pulping particulars were as follows :

|  |       |       |
|--|-------|-------|
| Active Alkali (NaOH + Na <sub>2</sub> S) | %     | 20    |
| Sulphidity                               | %     | 13.15 |
| Bath Ratio                               |       | 1 : 4 |
| Cooking temperature °C                   |       | 160   |
| Time to raise to 160°C                   | Mins. | 20    |
| Time at 160°C                            | Hrs.  | 2     |
| Blowing time                             | Mins. | 20    |

Pulp was washed on a 44 mesh wire sieve and yield per manganate number were determined. These results are given in Table No. IV<sup>4</sup>.

TABLE NO. IV

|                                  |     |       |
|----------------------------------|-----|-------|
| Unbleached yield (on dry husk)   | %   | 43.0  |
| Permanganate number              |     | 19.5  |
| Bleached yield (on dry husk)     | %   | 41.02 |
| Bleach consumption (Cl, on pulp) | %   | 12.9  |
| Loss in bleaching                | %   | 4.6   |
| 1% cupromonium                   | %   |       |
| Viscosity of unbleached pulp     | Cp. | 12.5  |
| —do— bleached pulp               | Cp. | 10.5  |
| Brightness of bleached pulp      | %   | 80-81 |

Standard sheets of unbleached pulp were prepared on British standard sheet making machine after beating in the laboratory voith beater to freeness

level of 45° SR. The sheets were air dried and tested for strength properties. The results are tabulated in Table No. V<sup>4</sup>.

TABLE NO. 5

| Particulars          |       | Unbleached | Bleached |
|----------------------|-------|------------|----------|
| Beating time         | Mins. | 75         | 20       |
| Freeness             | °SR   | 45         | 46       |
| Basis weight         | Gsm   | 63.1       | 63.1     |
| Burst factor         |       | 8.8        | 19.5     |
| Breaking length      | M     | 1884       | 3097     |
| Tear factor          |       | 45.2       | 65.8     |
| Folding endurance DF |       | 2          | 27       |

The unbleached pulp was bleached using Calcium hypochlorite by single stage at 30-40°C in waterbath for 1.5 hours, to brightness of 80-81% (MgCO<sub>3</sub> 10%). Bleaching details are given in Table No. IV above.

Standard sheets of bleached pulp also were prepared as before after beating the pulp to freeness level of 45°SR and tested for strength properties. Results are given in Table No. V above.

Also, standard sheets of blended unbleached and bleached arecanuts husk pulp with different quantities of unbleached and bleached bamboo pulp were prepared for further investigation.

Pulps were mixed in the following ratio to study the possible change in strength properties. Pulps were beaten to the same level of freeness of 45°SR.

| Arecanut husk pulp | Bamboo pulp |
|--------------------|-------------|
| 100                | 0           |
| 75                 | 25          |
| 50                 | 50          |
| 25                 | 75          |
| 0                  | 100         |

Strength properties at different blending levels are tabulated in Table No. VI a & b.

TABLE No. VI—(a) UNBLEACHED FURNISH

| Particulars          | Arecanut husk pulp 100% | 75%+<br>25% | 50%+<br>50% | 25%+<br>75% | Bamboo pulp 100% |
|----------------------|-------------------------|-------------|-------------|-------------|------------------|
| Basis weight gsm     | 63.1                    | 61.5        | 61.5        | 59.2        | 60.7             |
| Burst factor         | 8.8                     | 14.7        | 20.6        | 25.1        | 30.0             |
| Breaking length m    | 1884                    | 2227        | 3231        | 3453        | 4039             |
| Tear factor          | 40.3                    | 58.5        | 78.0        | 97.9        | 152.8            |
| Solding endurance DF | 2                       | 8           | 27          | 37          | 74               |

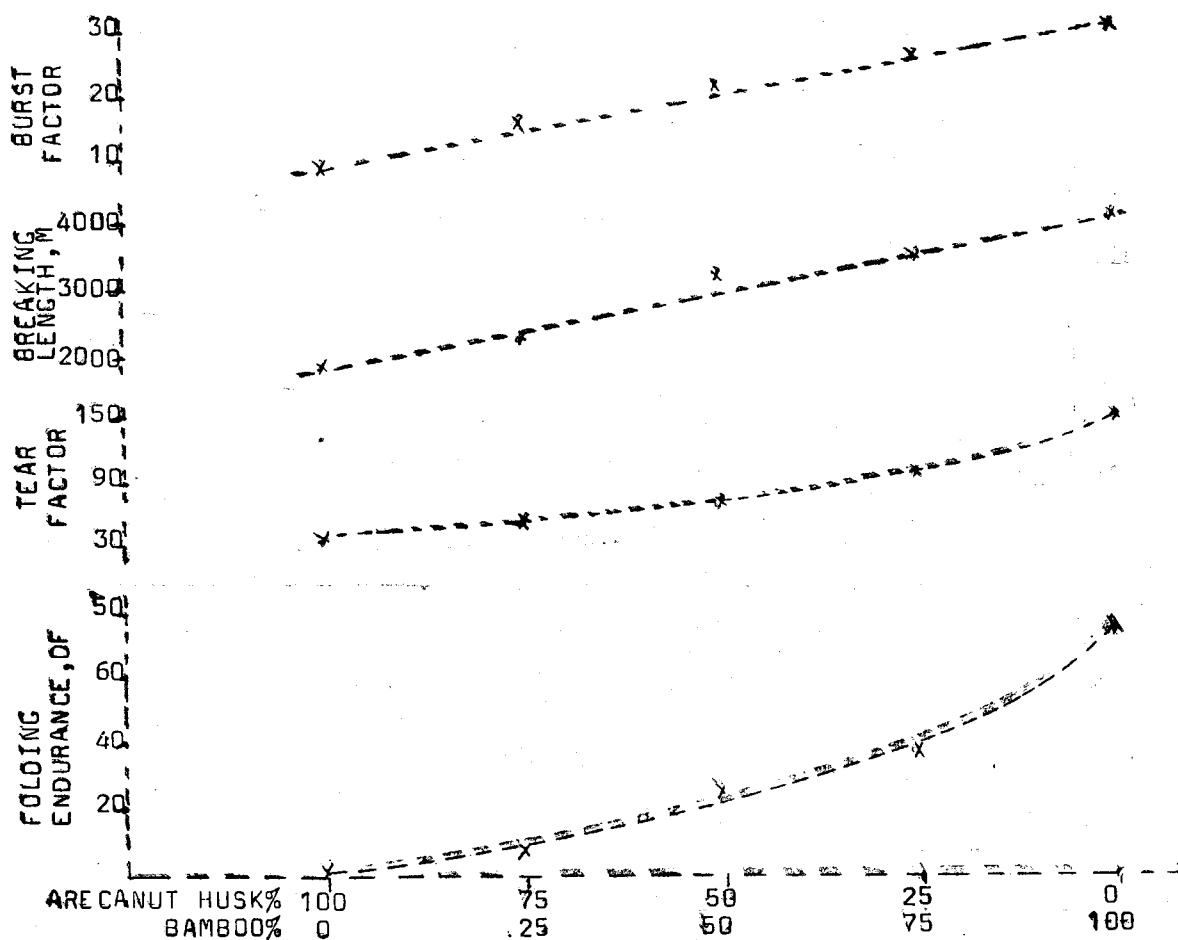
(b) BLEACHED FURNISH

|                      |      |      |      |      |       |
|----------------------|------|------|------|------|-------|
| Basis weight gsm     | 61.5 | 67.4 | 60.0 | 60.7 | 60.7  |
| Burst factor         | 20.5 | 25.6 | 30.3 | 32.6 | 32.5  |
| Breaking length m    | 2786 | 3234 | 4255 | 4489 | 4270  |
| Tear factor          | 65.0 | 65.2 | 80.0 | 88.9 | 110.7 |
| Folding endurance DF | 27   | 55   | 56   | 82   | 82    |

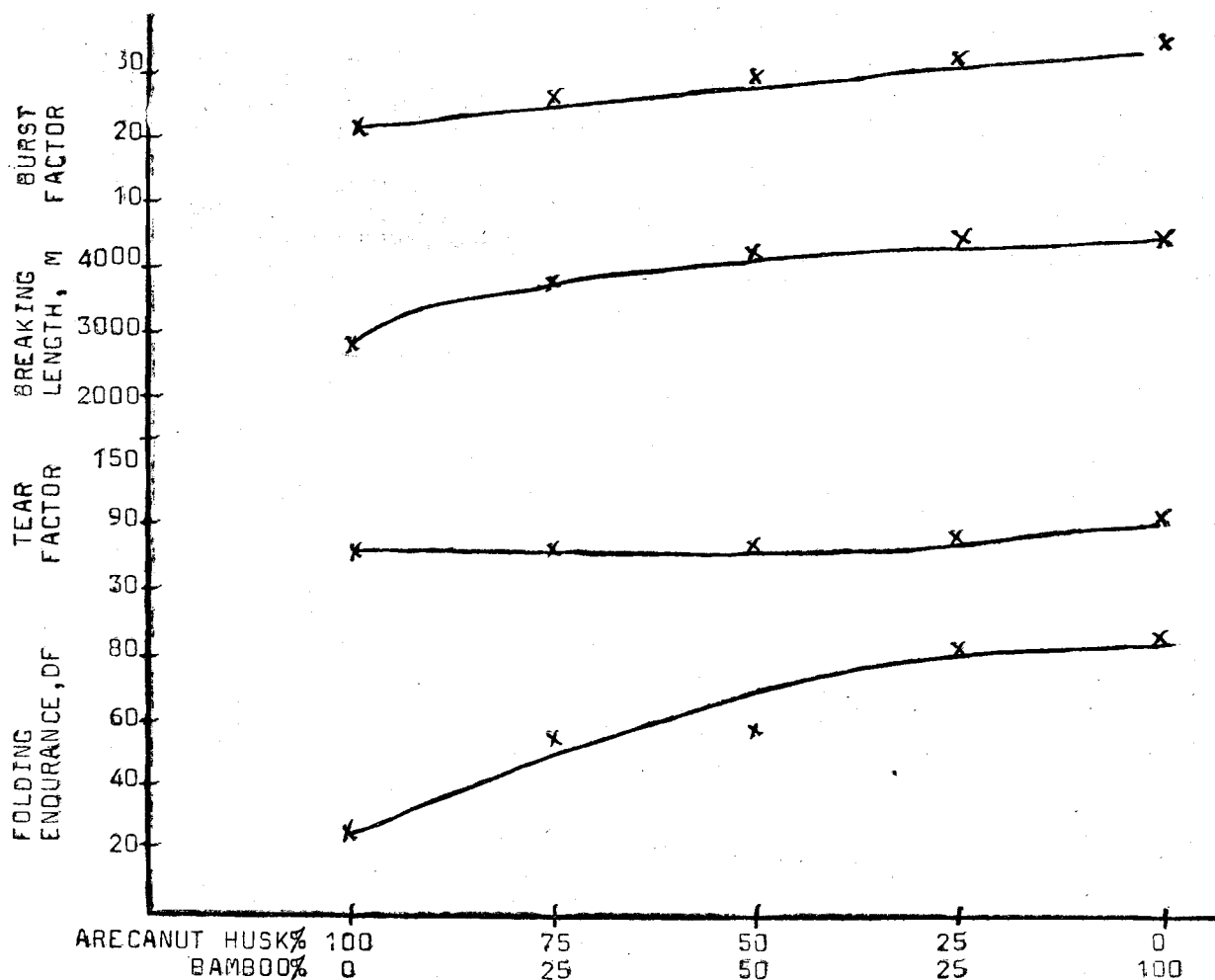
In the unbleached furnish, strength properties of 100% arecanut husk pulp are low. As the bamboo pulp content increases from 25% to 50% to 75%, there is gradual increase in strength properties because of increase in bamboo pulp in the furnish. According to the results tabulated in Table No. VI (a) and Graph-I. In the bleached furnish, there is remarkable increase in strength properties of a recanut husk pulp after bleaching particularly in DF. But the strength is found to be still lower compared to 100% bleached bamboo pulp. There

is gradual increase in strength prooerties of bleached arecanut husk pulp, as the bamboo pulp percentage increases from 25 to 50 and to 75 as unbleached furnish. It may be noted that there is no appreciable change in strength properties of 75% bamboo pulp and 25% arecanut husk pulp in the bleached furnish, from results of Table No. VI (b) and Graph-II

According to the microscopic examination of arecanut husk pulp fibres, it is a short fibred pulp with average fibre length being 0.3 to 0.4 mm.



GRAPH - I UNBLEACHED FURNISH



GRAPH - II BLEACHED FURNISH

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