Influence of retting methods on quality of mesta fibres

RK Dhanalaxmi and Jyoti V Vastrad*
Department of Textile and Apparel Designing, College of Rural Home Science
University of Agricultural Sciences, Dharwad-580 005, Karnataka, India

Received 4 March 2011; Accepted 9 January 2012

Mesta is commonly grown in every farmer’s field either as a subsidiary vegetable crop or as a hedge crop or on bunds as wind breakers. The effect of stage of harvesting, method of steeping and the type of retting on the yield of fibre was studied. Fully matured stalks, steeped for four days vertically and 10 days horizontally along with Sunhemp stalks was found to be one of the best methods of retting with respect to yield of the fibre.

Keywords: Mesta fibre, Hibiscus sabdariffa, Roselle, Retting

IPC code; Int. cl. (2011.01) − A61K 36/00

Introduction
Apart from cotton, India has a large variety of other cellulosic fibres obtained from the bark or stem portion of a plant such as jute, ramie, abacca, hemp, kenaf and mesta, etc. Mesta is commonly grown in every farmer’s field either as a subsidiary vegetable crop or as a hedge crop or on bunds as wind breakers, it is also known to improve the soil fertility by the leaves that shed/drop on their own before the crop is harvested. At present mesta is grown in an area more than 26 lakh bales. Mesta is a common word for the fibre of both Hibiscus cannabinus L. (Hindi-Ambari, Patsan) and H. sabdariffa L. (Hindi-Ambari, Patsan). The plants are tall, flowers cream to light yellow, having a scarlet to magenta throat and green or slightly reddish stem depending on the variety. These species are mainly grown for fibre purpose and also known as Roselle, Java jute, Thai jute, Tengrapat, Lalambadi, Chukair, Yerragogu, Palechi, Pundi, etc.

It is a practice to stack mesta stalks vertically in the fields after harvesting until farmer fetches sufficient water and time for fibre extraction. Fibre are extracted by retting methods, viz. chemical, water, microbes and microbe-chemical retting. Among all these methods, fibre extracted by chemical retting was the most effective method yielding least gum, whereas microbial retting had higher residual gum content. The fibre extracted was utilized for agro-based fibre utility. Introduction of synthetic fibres like polypropylene and nylon cords proved to be cheaper, durable and labour saving. Thus the popularity of traditional utility of mesta fibres went on decreasing.

There is a need to create new vistas for production and diversification of mesta fibre so that farmers are encourage to produce and process mesta fibres for better returns. The quality of bast fibre however depends upon the variety of plant, agro climatic conditions, time of harvesting, method of steeping and retting procedures.

The present paper is an outcome of the primary study conducted to know the effect of stage of harvesting, method of steeping and type of retting on the fibre yield of mesta H. sabdariffa L. cv. ‘AS73CP560’.

Materials and Methods

Sample
Mesta (H. sabdariffa cv. ‘AS73CP560’) plants grown in University of Agricultural Sciences, Dharwad, Karnataka were collected and utilized for the study.

Stage of harvesting
Mesta stalk were harvested at two different stages (Plate 1):

Fifteen days prior to physiological maturity (135-140 days)
The stalks of mesta plant starts gaining red colour at this stage. Fruits start setting during 135-140 days
of the plant life. By 140-149 days almost all the pods are set. Hence, the plants were harvested at this stage by cutting the stem at its bottom.

**Physiological maturity stage (150-160 days)**

By 155-160 days, more than 90% of pods burst open, the stalks are completely deep red in colour. The harvested stalks were stacked vertically in fields for one month to dry and leaves to drop. Later seeds from both the stages of stalks were collected and the side branches were manually removed, by the process called rippling. The deseeded and cleaned stalks were then taken for retting process.

**Treatments**

The harvested stalks were stacked vertically in the field for one month to dry. Leaves dropped and stalks were free from vegetable matter (Plate 2a). Stalks were bundled weighing 20 kg stalk each. Following two methods of retting were carried out:

**Biological retting**

Eight to ten fresh sunn hemp stalks (Plate 2b) were placed between dried mesta stalks while bundling. Fresh sunhemp stalks rot faster and the microbes that are developed hasten the retting of its co-stalks, mesta and aid in easy removal of woody matter from the barks.

**Chemical retting**

Two per cent of urea was sprayed to 20 kg stalk bundle before bundling (Plate 3) because urea is an organic compound that is highly soluble in water and non-toxic also. It is commonly used fertilizer for most

---

Plate 1—Stages of harvesting mesta stalks: a-Fifteen days prior to physiological maturity, b-Physiologically matured crops

Plate 2—Preparation of mesta stalks for biological retting: a-Stacking mesta stalks vertically for drying, b-Bundling dried mesta stalks with fresh sunhemp stalks in between

Plate 3—Preparation of mesta stalks for chemical retting: a-Spraying of 2% Urea on dried stalks, b-Bundling of mesta stalks
of the agricultural crops since it aids the growth of bacteria in soil and water. Addition of nutrient like urea accelerates the process to last for only 40-50 hours\(^4\). Therefore, urea was used for the present study with an idea that it increases the wetting action of water and enhances the growth of microbes in water.

**Methods of steeping**

It is observed that the stalks are harder at the bottom end and require more time to ret/rot. Therefore, two steeping methods were followed and are shown in (Plate 4).

**Vertical and Horizontal steeping method**

The bundles were placed in upright position in the retting tank for 4 days and later placed horizontally. As the stalks are harder at the bottom end require longer time to ret than the thinner parts and consequently, if the butt (thicker) ends of the stems are fully retted, the top ends are over-retted and damaged. This can be avoided by stacking the bundles of stems upright with the butt ends in water for few days, before immersing the whole stem. Care was taken to see that all the stalks were completely immersed in water.

**Horizontal steeping method**

This is a traditional method followed by most of the farmers. Stalks were properly steeped into water horizontally. Care was taken to immerse the stalks in water by tying stones to the bundles. The stalks were immersed in water for 14 days for fully matured stalks and 12 days for 15 days prior maturity stalks.

**Retting**

Retting is the process which helps in removing of fibre from the stem with the help of chemicals or microbes present in the retting water\(^5\). Retting of mesta was carried out separately for different treatment (urea, control and sunhemp). A constant period was maintained for all the treatment. Duration of retting was 14 days for all the treatments in the study.

**Scutching**

Scutching was done by using wooden beaters that breaks the core into shives and simultaneously the rotten sheath or softened bark was removed. Extracted fibre was thoroughly cleaned, rinsed and dried properly.

**Observations**

The plant physiological details like the height, number of branches, leaves and pods and girth were recorded. The yield of the fibre after retting was also recorded and the extraction percentages calculated. Fibre length, fineness, strength, elongation were assessed.

**Results and Discussion**

The height of mesta plant harvested 15 days prior to maturity is 182.7 cm and 198.2 cm at physiological maturity stage (Table 1). However, the number of branches is 6-7 in both the stages of plant growth. On complete maturity, the number of leaves reduced from 37-38 to 20-22. This phenomenon of mesta plant is responsible to improve the soil fertility. Secondly the increased dropping of leaves aids in less laborious process of retting i.e. it simplifies the manual rippling process before retting. The circumference or girth of plant top is 0.485 cm at 15 days prior to maturity and 0.480 cm at fully matured stage. Similarly, girth of stem bottom is 0.890 cm and 0.910 cm at 15 days prior and fully matured stage, respectively.

The yield of fibre without any treatment was higher (1300 g) which was extracted from fully matured stalks that were steeped vertically and later horizontally.
followed by the stalks steeped horizontally (1020 g). The yield of pre-matured stalks was 960 g for Vertical-Horizontal steeping and 720 g for horizontal steeping on retting of 20 kg of mesta stalks (Table 2).

Similarly trend was observed for the chemical and biological retted stalks also. The fully matured, vertical-horizontal steeped stalks yielded 1240 g and 1360 g of fibre, respectively, followed by 1040 g and 1200 g for the horizontally 1240 g and 1360 for the vertical-horizontal steeped stalks. The stalks harvested 15 days prior to physiological maturity yielded 720 g and 800 g on chemical and biological retting with vertical-horizontal steeping, respectively followed by 640 g and 760 g on horizontal steeping.

In general, the fibre yield from fully matured stalks was higher. The translocation of photosynthates is totally complete by this stage and the fibre (lignocellulose) is completely developed. Hence, the fibre output has to be higher at this stage compared to the 15 days prior to maturity stage. Wherein the stalks were still in the stage of development that produced lesser fibre yield.

At the physiological maturity stage the plant stem is harder at the bottom end as compared to top end that is still growing. Therefore, steeping the stem bottom first in the vertical position loosens the hardy substances present in the stem bottom. Thereafter placing the stalks horizontally would result in uniform and efficient retting action. It is hence observed that the vertical-horizontal method of steeping exhibited higher fibre extraction percentages as compared to the horizontal steeping method only.

On observing the effect of treatment (retting method) on fibre yield, it is evident that the biological retting using few fresh sunhemp stalks in between the bundles enhances the yield of fibre. Fresh sunhemp stalks rot faster than the dry mesta stalks that inturn accord the microbial growth required for softening the bark and loosening the fibres in retting tank. However, the application of urea hardly improved the fibre yield significantly. Table 3 exhibits the physical parameters of mesta fibre extracted by stalk harvested at different stage and different steeping methods.

**Fibre length (cm)**

It was observed that length of mesta fibre extracted without urea treatment by vertical-horizontal steeping was found to be higher 102.66 cm than horizontal steeping 98.83 cm. Among urea treatment, length of mesta fibre extracted by vertical-horizontal steeping was longer 118.33 cm than horizontal steeping 105.00 cm. Mesta fibre extracted by biological retting, steeping in vertical-horizontal exhibited longer 108.14 cm fibre than horizontal steeping 102.00 cm. It is

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Measurement</th>
<th>Mean value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Harvested at 15 days prior to physiological maturity</td>
<td>Harvested at physiological maturity stage</td>
</tr>
<tr>
<td>01</td>
<td>Height (cm)</td>
<td>182.7</td>
</tr>
<tr>
<td>02</td>
<td>Number of branches</td>
<td>6-7</td>
</tr>
<tr>
<td>03</td>
<td>Number of leaves</td>
<td>37-38</td>
</tr>
<tr>
<td>04</td>
<td>Number of pods</td>
<td>33-34</td>
</tr>
<tr>
<td>05</td>
<td>Stem girth (cm) Top Bottom</td>
<td>0.485 0.890</td>
</tr>
<tr>
<td></td>
<td>(circumference)</td>
<td>0.480 0.910</td>
</tr>
</tbody>
</table>

### Table 1—Mean physiological readings of mesta plants at different stage of harvesting

### Table 2—Yield of fibre (g) on retting 20 kg stalks

<table>
<thead>
<tr>
<th>Steeping method treatment</th>
<th>15 days before maturity</th>
<th>Fully matured stalks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H</td>
<td>V-H</td>
</tr>
<tr>
<td>Control</td>
<td>720</td>
<td>(3.60) 960</td>
</tr>
<tr>
<td>Chemical retting</td>
<td>640</td>
<td>(3.20) 720</td>
</tr>
<tr>
<td>Biological retting</td>
<td>760</td>
<td>(3.80) 800</td>
</tr>
</tbody>
</table>

H: Horizontal steeping; V-H: Vertical and horizontal steeping; Figures in parentheses indicate fibre extraction percentage
observed that, irrespective of the treatment, the vertical-horizontal method produced longer fibre than the horizontal steeping method. The vertical-horizontal steeping method involves steeping the bottom ends of the mesta stalks vertically first wherein the microbial growth is initiated that is evenly and effectively completed when the stalks are laid horizontal steeping successfully loosens the fibres that can be proficiently separated during washing without breaking or damaging the fibres. Among the treatments, it is observed that urea treated stalks produced longer fibres followed by biological method and control.

**Fibre fineness (tex)**

Mesta fibre produced from vertical-horizontal steeping without urea treatment was finer 3.008 tex than horizontal steeping 3.425 tex. Among the urea treatment, mesta fibre extracted by vertical-horizontal steeping was finer 3.005 tex than vertical-horizontal steeping 3.172 tex. On biological retting, mesta fibre obtained from vertical-horizontal steeping was found to be finer 3.010 tex than horizontal steeping 3.217 tex. Therefore, it is observed that irrespective of the treatment, horizontal steeping produced a better fibre strength than vertical-horizontal steeping method. This is again because of coarser characteristic of fibre that is due to presence of impurities, waxes and gums. Among all the treatment, strength of mesta fibre extracted without any treatment (control) was higher than biological method followed by urea treated stalks.

**Fibre elongation (mm)**

Mesta fibre produced without urea treatment by vertical-horizontal steeping exhibited higher elongation 0.46 mm. On urea treatment elongation of mesta fibre extracted by vertical-horizontal steeping was higher 0.39 mm than horizontal steeping 0.35 mm. Among biological retting, elongation of mesta fibre produced by vertical-horizontal steeping was higher 0.41 mm than horizontal steeping 0.38 mm. Therefore, it is observed that, irrespective of the treatment, elongation of mesta fibre produced by vertical-horizontal steeping was higher than horizontal steeping. This is because of lack of elasticity in the fibre structure as the fibre is more linear and more crystalline that gives minimum slope for steady disalignment within the structure. Among all the treatment, it is observed that, mesta stalks without any treatment (control) produced higher elongation followed by urea treated stalks and biological method.

**Conclusion**

Fully matured mesta stalks yielded more fibre as compared to stalks harvested fifteen days prior to physiological maturity. Biological retting using fresh sunhemp stalks placed in between rippled and dried mesta stalks before bundling exhibited higher fibre extraction percentage. Steeping bundles vertically for four days followed by immersion of bundle of stalks

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>Urea/Chemical</th>
<th>Biological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steeping</td>
<td>V-H</td>
<td>H</td>
<td>V-H</td>
</tr>
<tr>
<td>Length (cm)</td>
<td>102.66</td>
<td>98.83</td>
<td>118.33</td>
</tr>
<tr>
<td>Fineness (tex)</td>
<td>3.008</td>
<td>3.425</td>
<td>3.005</td>
</tr>
<tr>
<td>Strength (gf/tex)</td>
<td>131.41</td>
<td>134.13</td>
<td>73.96</td>
</tr>
<tr>
<td>Elongation (mm)</td>
<td>0.46</td>
<td>0.41</td>
<td>0.39</td>
</tr>
</tbody>
</table>
horizontally proved to increase the fibre yield. Significant results were observed in length of mesta fibre extracted by urea treatment and vertical-horizontal steeping. Among the steeping method, vertical-horizontal steeping contributes finer fibre than horizontal steeping. Whereas in contrast, horizontal steeping produces better strength than vertical-horizontal steeping. Significant results were also observed in elongation of fibres that were extracted without urea treatment and vertical-horizontal steeping methods. Further studies, to know the quality of the fibre extracted by various methods would help in deciding the applicability of the fibre for various end uses.

References