AN X-RAY STUDY OF NETTLE FIBRES

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Samples of nettle fibres grown in the wild tracts of Darjeeling, Sikkim and Nepal were lately available for study. These samples are classified under two local names Pooah and Sishnu. Pooah has been identified as *Boehmeria frutescens* and Sishnu as *Boehmeria girardinia heterophylla* by the botanists. Fibres from Pooah are soft and flexible but fibres from Sishnu are definitely coarser than those from Pooah. In this communication Pooah is referred to as sample A and Sishnu as B.

The physical properties of these A and B varieties, as studied earlier (Deb and Sen, 1949), reveal that—

(1) the density of these fibres are nearly that of cotton and much higher than that of jute;
(2) when fully retted and degummed they produce spinnable long filaments finer than the jute filaments;
(3) they possess small amount of pore space;
(4) unlike jute fibres when these fibres are bleached white, the wet strength of the filaments appears to be higher than the dry filaments; and
(5) the tensile strength of these fibres are greater than jute.

So it appears from the earlier studies that the nettle fibres are in many respects better than jute variety. To prove this and to study them fully X-ray pictures of the samples A and B were taken. A small bunch of fibres of 1 mm. thickness was mounted in a cylindrical fibre camera and X-ray pictures were taken in Phillips sealed tube in Cu-radiation. Usually exposures of 4 to $4\frac{1}{2}$ hours were given in each case. The angular co-ordinates of θ and μ of the spots were obtained in the usual way from the X-ray pictures and the glancing angle was calculated from the relation $\cos\theta\cos\mu = \cos 2\theta_B$. The spots were identified on the basis of the unit cell of dimensions $a = 8{\cdot}35$ Å, $b = 10{\cdot}3$ Å, $c = 7{\cdot}9$ Å and $\beta = 84°$, and the space group is P_{2_1} (Meyer and Mark, 1929), of cellulose which is the main constituent of these fibres. The details of the spots, their indices, intensities and characters are given below in Tables I and II and the photographs in Plate VIII.

TABLE I

Sample A: (*Pooah variety*)

Indices	Intensity	Character
101 ..	Sharp (strong)	Like a spot.
002 ..	Very strong	Extended into arc.
002β ..	Medium strong	Extended into arc.
004 ..	Very weak	Extended into arc.
310 ..	Weak	Diffuse and extended into arc.
021 ..	Medium	Like a spot.
131 or 130 ..	Weak	Diffuse.
230 ..	Weak	Diffuse and extended into arc.

TABLE II

Sample B: (*Sishnu variety*)

Indices	Intensity	Character
101 ..	Strong	Broad spot-like.
002 ..	Very strong	Sharp and extended into arc.
002β ..	Medium strong	Sharp and extended into arc.
004 .	Weak	Diffuse.
310 ..	Weak	Bent into arc.
021 ..	Medium	Like a spot.
221 ..	Weak	Broad and diffuse.
130 or 131 ..	Weak	Broad and diffuse.
230 ..	Medium	Broad, bent into arc.
040 ..	Weak	Bent into arc.
042 ..	Weak	Bent into arc. Diffuse.

In the Pooah variety (sample A) the long axis of cellulose unit cell is parallel to the fibre axis. From the fairly sharp characters of the different planes like 101, 002, etc., appearing in the picture it appears that the degree of crystallinity is sufficiently good for a fibre diagram. Clearness of the background indicate that unlike the jute fibres the crystallites in the micellar regions are more closely packed and the amorphous part if present at all must be extremely small.

In the Sishnu variety (sample B) the long axis of the cellulose unit cell is also parallel to the fibre axis. The number of planes appearing in the picture is more than the Pooah fibres. The widths of the spots in this case are practically like the spots in sample A.

The general analyses of these fibres indicate that out of these two types Sishnu (B) shows sharper and stronger spots. However, if all these X-ray diagrams are compared with the standard X-ray diagrams of ramie (Mark and Meyer, 1929) and jute (Banerjee, K. and Roy, A. K., 1941), it becomes apparent that the nettle fibres, as far as general X-ray diagrams and the packing of crystallites in the micellar regions are concerned, are as sharp and clear as ramie, and definitely much sharper and clearer than jute. This conclusion is thus quite in accord with the observations on tensile strength and other physical properties studied by Deb and Sen (1949).

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ABSTRACT

Pooah and Sishnu types of nettle fibres were studied by X-ray method. The general X-ray diagrams were analysed. It is proved that the Sishnu type yields slightly sharper and clearer X-ray diagram than the other, and that the X-ray diagrams of both the types of nettle fibres are nearly as good as ramie and definitely much sharper and clearer than the jute fibres, indicating large crystallite size and low proportion of amorphous content.

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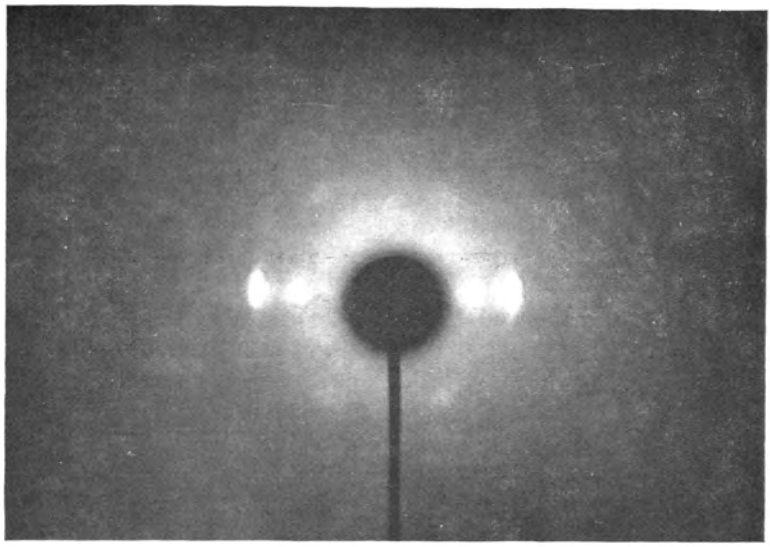
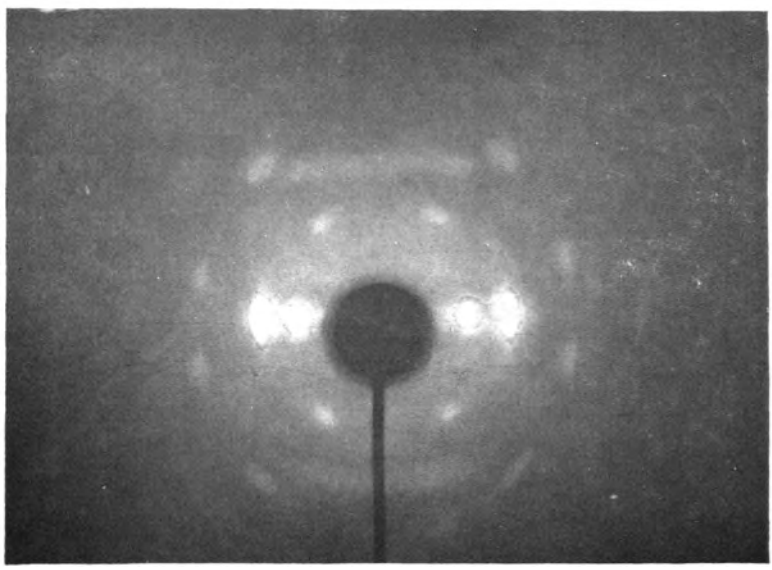


A



B

X-ray diagrams of (*A*) Pooah Fibres and (*B*) Sishnu Fibres