The Identification of Textile Fibers

By Dr. Louis J. Matos

In the previous article mention was made of the bast fibers in one of the butter dishes and cover them with nitric that group of plants to which they belong, which give strength to the growing and mature stem. They require for their identification a preliminary chemical treatment to which special attention is directed. The most important operation is to digest the fibers in a test tube with a solution of weak caustic acid at a gentle heat, which will more or less readily remove the fiber binding substance or lignin and enable the individual fibers to become separated.

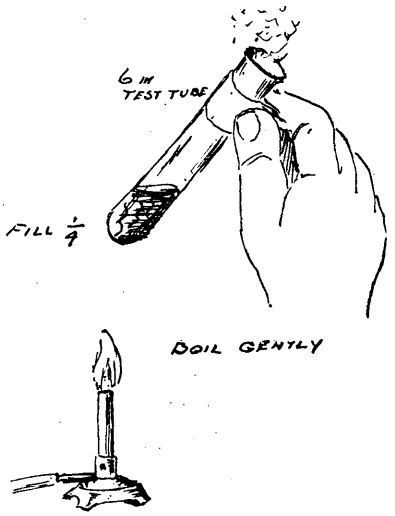

Fig. 11. Heating the Solution.

Heating is best done by means of a bunsen gas flame, or over an alcohol lamp, Fig. 11. Boiling of the fibers to be tested should continue until the original sample appears to be loosened. When this is apparent, the contents of the test-tube is poured into a vessel containing clean water, from which the separated fibers may be lifted with the aid of a glass rod. If permanent microscopic mounts are desired, it is well to repeat the washing of the fibers two or three times in successive portions of water.

There are several other methods that can be used for isolating the fibers, but weak caustic soda does it most effectively. A general scheme that can be followed with advantage in microscopic tests, and covering every property of commercial bast fiber is as follows:

1. Place on a glass slide several drops of glycerine diluted with an equal volume of water, and in these few drops place the digested fibers.
2. Separate the fibers by means of the teasing needle. Some bast fibers are difficult to separate, in which case recourse should be had to more drastic methods. Place the fibers in one of the butter dishes and cover them with nitric acid diluted (1 to 3) with water, to which add 2 or 3 small crystals of potassium chlorate. Stir gently with a glass rod until the lignin appears to be completely dissolved. Drain off the acid solution and carefully wash the fibers in several transfers of distilled water and finally with a little water containing two to three drops of caustic soda. Then wash with pure water. The fibers may now be laid longitudinal on the slide; place upon them one to two drops of glycerine and cover with a thin glass, carefully excluding air bubbles. The slide is now ready for observation.

In using the microscope a high degree of magnification is not essential. Too great a magnification is sometimes responsible for imperfect conclusions. A magnification of twelve diameters is ample for most fibers, while a further magnification up to sixty diameters is sufficient in most cases. In examining the fibers under the microscope two methods of observation are to be followed; one being direct, that is, the pure fiber is examined with various intensities of light, but without the addition of any chemical reagent.

After the peculiar characteristics of the fibers have been noted under these different conditions, they are subjected to the action of certain chemical reagents, the most important and generally satisfactory reagent being that of Vetillard. This investigator employs a test solution bearing his name, which has been previously referred to as Reagent No. 1 (solution of iodine), and Reagent No. 2 (glycerine and sulphuric acid mixture). To use this reagent properly, the fiber to be examined should have been previously isolated according to the method above described and kept for several hours immersed in distilled water. The practical details of applying Vetillard's reagent is as follows:

1. Transfer the soaked fibers to a clean slide and straighten them out as well as possible with the needles.
2. With the aid of the dropping tube, wet them with two to three drops of Reagent No. 1.
3. Allow to stand several minutes in contact with the iodine solution and remove any excess of this solution with the aid of a peace of filter or blotting paper; holding the slide in an inclined position to facilitate draining the fibers. Note that the purpose of this manipulation is to remove the excess of iodine, after which:

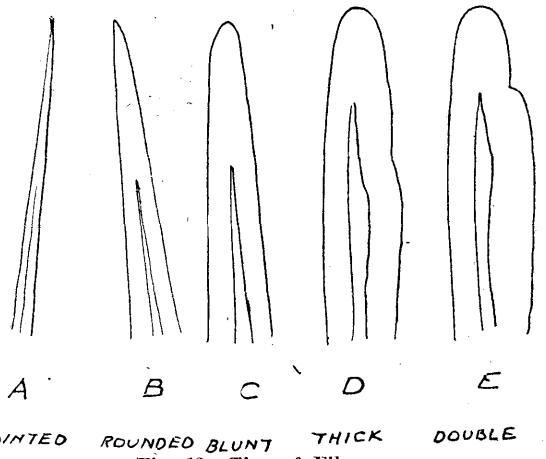

Fig. 12. Tips of Fibers.

4. Place the cover glass in position.
5. Hold the slide horizontally. Place at one end of the cover glass a few drops of Reagent No. 2 and apply to the other end a piece of filter or blotting paper, which will soak up some of the solution as it works its way from one end of the cover glass to the other end. This Reagent No. 2 gradually displaces the iodine solution and this displacing action is repeated several times with small fresh additions of the acid, until all of the iodine has been removed, after which the slide is ready for observation. The operator should be cautioned not to allow any of the chemical reagent to drop upon the top of the cover glass.

The characteristics of the fiber are now to be noted, not by examining one fiber, but several fibers; since occasionally there are some individual fibers that do not react. Note particularly the kind of points or tips, Fig. 12, that some of the fibers have.

Should the fibers be terminated by two points, some of which are needle like or very sharp pointed, and the color reaction is blue, *flax* is to be suspected.

If the tip of the fiber is blunt and the color blue, we have *China Grass* or *ramie.*

If the blue has a greenish tint, *hemp* is to be suspected.

If the fiber is somewhat flattish in appearance and the coloration yellowish, *jute* is to be suspected.

Should the fibre, however, be terminated by a single point, the other one being more or less broken, it is without doubt

cotton, since, as stated in the previous article, this fiber is the seed hair, one end of which is broken from the seed while the free end has a sharp point.

One of the most important applications of Vetillard's reagent is to cross sections of fibers. Cross sections or "transverse" sections of fibers are not difficult to make, but to make

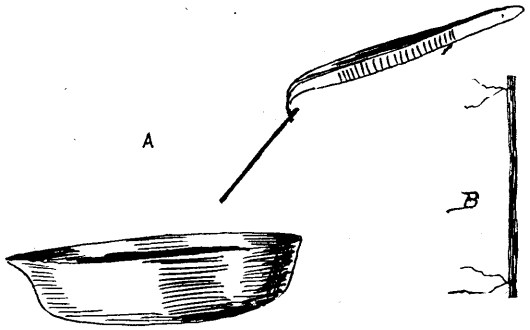

Fig. 13. Dish for Binding Fibers.

them properly requires a little practice. The following is a general outline of the method and should be carefully studied before attempting the work.

Several short bundles of fibers are taken either directly from the plant or from woven textiles. The amount of fiber should be about as much as would make a bundle, say 1/16 inch in diameter, and about one and one-half to two inches in length, A, Fig. 13. The end of this bundle should be tied by means of small loops of sewing thread and then immersed either in melted glycerine jelly or ordinary gelatine, to cause the fibers to adhere together, B, Fig. 13. Set aside for a day

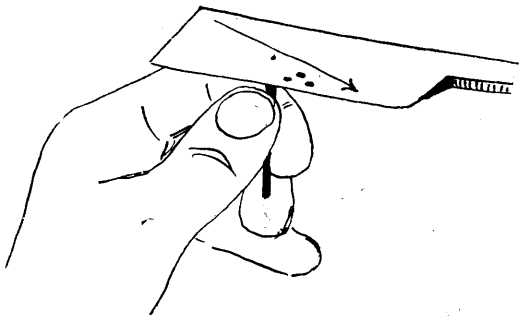

Fig. 14. Slicing Cross-Section.

to harden. These hard bundles are then placed between the thumb and forefinger of the left hand and sliced crosswise by means of a razor, Fig. 14. The razor should be preferably ground flat on one side, but an ordinary razor may suffice. Extremely uniform slices of the fiber bundles may be cut by carefully gauging the position of the razor blade by means of the index finger.

These very uniform slices are allowed to accumulate on the blade of the razor from which they are removed with a few drops of water and the aid of a fine camel's hair brush. They are then mixed with a few drops of a solution of potassium iodide. With the aid of an easily made section lifter, Fig. 15, or a fine pointed brush, transfer two or three of the best

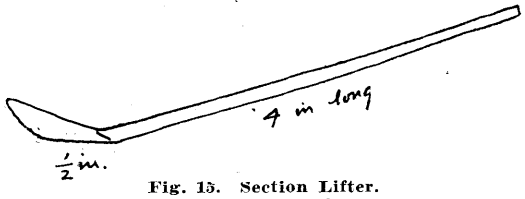

Fig. 15. Section Lifter.

sections to a clean microscope slide and place the cover glass in position. Next displace the iodine solution by means of the glycerine-sulphuric acid solution with the aid of filter paper as previously described, until all the iodine solution has been removed, when the slide will be ready for examination.