The Identification of Textile Fibers

By Dr. Louis J. Matos

[The object of these articles is to give mill men in a concise form free from unnecessary technicalities, a complete description of the testing of fibres. The illustrations will consist of original drawings made by the author from actual mounts forming part of an extensive series of tests. Dr. Matos' high reputation as a textile chemist and chemical engineer is a guarantee as to the value of this work. He will be pleased to co-operate with anyone interested in making tests, and reply to any questions regarding the subject.—Ed.]

The fibres used in the textile industry have increased greatly in number during the last twenty years. From time to time there have been discovered and gradually developed to commercial importance fibres of various kinds that adapt themselves to certain specific uses in the manufacture of fabrics. This multiplicity of fibres has been the prime cause for the development of methods which enable one

FIG. 1

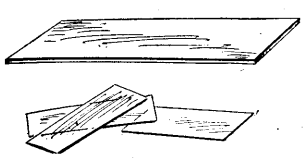

FIG. 2.

FIG. 3.

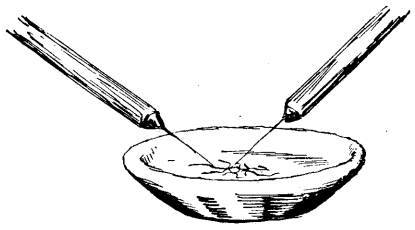

FIG. 4.

to identify with more or less exactness the more important fibres and to compare one fibre with another.

Three important groups of fibres are recognized at the present time, vegetable, animal and artificial. The vegetable fibres most commonly used are cotton, flax, hemp jute, ramie and a few others of lesser importance. The animal fibres comprise wool, hair and natural silk, that is, silk from the silk worm, of which there are several varieties. The artificial fibres are artificial silk of various kinds and artificial hair, which is in fact a very coarse artificial silk.

The identification of fibres presents no great technical difficulty, but the methods should be thoroughly understood at the beginning. The operator should have experience in identifying fibres of known origin by methods that have been thoroughly worked out beforehand. For example, if one has never studied the physical or chemical properties of cotton, it would be impossible for him to state with certainty that a given fibre is cotton. The same applies to other fibres. It becomes necessary, therefore, for one undertaking fibre work to make a more or less thorough study of the important fibres of each group and to make a careful comparison of one with the other.

Two methods that are used jointly in identifying fibres are based upon the use of the microscope and a few simple accessories. The compound microscope is commonly employed for fibre work. For the ordinary work of the mill it should be equipped with a quarter-inch and a one-inch objective, together with a one inch and a two inch eye-piece. The microscope should be equipped with a fixed stage and a concave mirror. The principal accessories for microscopic work consist of glass slides 3" x 1", Fig. 1, of which a dozen will be a sufficient supply. There will also be required a number of thin oblong cover glasses ¾" x 1½", a few teasing needles, which may readily be made by taking a few fine sewing needles and carefully inserting the eye end in a piece of soft wood about the size of a lead pencil, Fig. 2, a pair of fine pointed steel tweezers, Fig. 7, and a number of plain white china dishes, which serve for wetting the fibres under examination.

The chemical reagents for testing the various fibres include the following, which may be com-

FIG. 5.

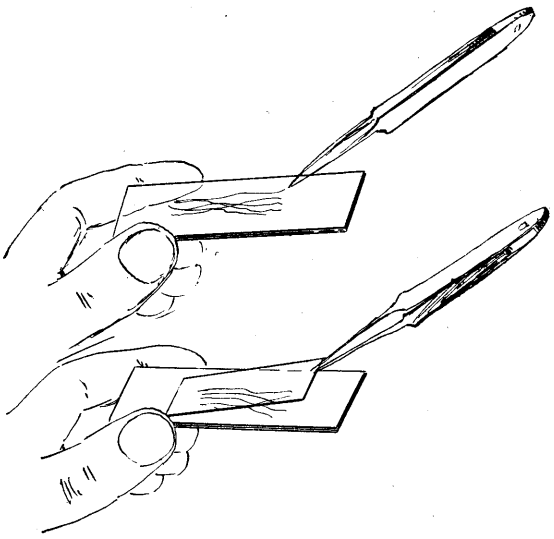

FIG. 7.

FIG. 6.

pounded by a friendly druggist if the operator does not feel sufficiently qualified to prepare them. These reagents should be contained in two ounce glass stoppered bottles, Fig. 3, with the exception of No. 6, the stopper of which should be rubber:

LIST OF REAGENTS.

No. 1.	**Solution of Iodine:**	
	Potassium iodide	1 gram
	Water	100 c.c.
	Iodine	5 grams
No. 2.	**Glycerine and Sulphuric Acid Mixture:**	
	Concentrated sulphuric acid	30 c.c.
	Pure glycerine	20 c.c.
	Distilled water	10 c.c.
No. 3.	**Zinc Chloride and Iodine Solution:**	
	Iodine	2 grams
	Potassium iodide	10 grams
	Zinc chloride	60 grams
	Dissolved in water	28 c.c.

No. 4. Ammoniacal Copper Hydroxide Solution:
Copper hydroxide is precipitated, filtered off and dissolved in concentrated ammoniacal. Keep in the dark.

No. 5. Beta-Naphthol Solution:

Beta-Naphthol	2 grams
Alcohol	40 c.c.

No. 6. Caustic Soda Solution 10%:

Caustic soda	10 grams
Water	90 c.c.

No. 7. Nitrating Acid:

Concentrated nitric acid	50 c.c.
Concentrated sulphuric acid	50 c.c.

No. 8. Rosaniline Solution:

Crystal fuchsine	½ gram
Water	50 c.c.

Boil and decolorize by adding either a few drops of caustic soda solution or concentrated ammoniacal, and filter.

No. 9. Glycerinated Ammoniacal Copper Solution:

Sulphate of copper	10 grams
Water	100 c.c.
Glycerine	5 grams

Add caustic soda until the precipitate which forms is redissolved.

No. 10. Aniline Sulphate Solution:

Aniline sulphate	1 gram
Water	100 c.c.

No. 11. Phloroguicine Solution:

Phloroguicine	½ gram
Distilled water	100 c.c.

No. 12. Iodine and Sulphuric Acid:
A fragment of iodine is dissolved in alcohol and water is added until the solution is light yellow. The fibre to be examined is moistened with a solution of sulphuric acid 1:2, and then with the iodine solution.

No. 13. Fuchsine Solution:

Fuchsine crystals	5 grams
Alcohol 95%	100 c.c.

No. 14. Lead Acetate Solution:

Lead acetate	5 grams
Water	100 c.c.

No. 15. Picric Acid Solution:
A saturated water solution of picric acid.

No. 16. Basic Zinc Chloride Solution:

Zinc chloride	100 grams
Water	85 c.c.
Zinc oxide	40 grams

Boil until the solution is complete.

Boil until the solution is complete.

To this list of reagents there may be added a few others, mention of which will be made in subsequent articles.

The method commonly adopted for examining fibres is to separate the fibres by the aid of the testing needles and tweezers until several fibres are isolated. This is best done in a few drops of water in one of the china dishes, Fig. 4. In the case of yarns a short section should be untwisted while wet with water or a little glycerine, and the thread then pulled apart with the needles while immersed. A glass slide is then carefully cleaned and by means of the tweezers one or two of the fibres are removed from the butter dish and laid lengthwise in the centre of the glass, Fig. 5. With the aid of an ordinary medical dropper, Fig. 6, a few drops of reagent No. 2 are placed upon the slide and one of the thin cover glasses carefully placed over the fibres, lowering it so that no water bubbles appear, Fig. 7. Any excess of solution that is squeezed out may be removed by means of a small piece of filter or blotting paper, as shown at Fig. 8. The slide is then ready to be placed on the stage of the microscope and examined.

After repeating the operations above described several times, the operator will acquire facility in isolating fibres for examination, since it is manifestly impossible to arrive at any reliable conclusion in examining fibres when they are placed on the slide in compact bunches. It is better to make several slides of suspected fibres rather than to overcrowd a single slide with a large number of fibres.

When chemical reagents are to be applied to a fibre two methods are commonly used. One is first to isolate the fibres in a butter dish with the aid of pure water and the testing needles. When a sufficient number have been separated, they may be removed to a second butter dish in which the several reagents are added. The other method is to isolate the fibres in water as above indicated, transfer a few of them to the glass slide, place the cover glass in position, then apply successively a few drops of the desired chemical reagent at one end of the cover glass and by means of a small triangular clipping of filter paper soak up the reagent from the other end

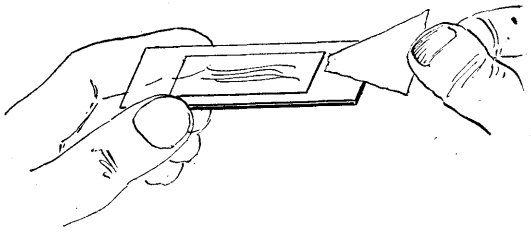

FIG. 8.

of the cover glass. By this means the water originally on the slide is gradually displaced by the reagent. It should be noted that in making tests with chemical reagents, the fibres are tested with each reagent separately instead of adding one reagent after another to the same fibre. In adding chemical reagents to textile fibres the principal point to note is the influence that the reagent has on the physical properties of the fibre and also whether or not the fibre is changed in color.

The preceding remarks apply to all fibres. The specific reagents are applied as occasion requires. For example, if a fibre dissolves completely in caustic soda, the conclusion arrived at at once is that it is not a vegetable fibre, since vegetable fibres do not dissolve in caustic soda. If, however, the fibre is treated on the microscope slide with reagent No. 4 (ammoniacal copper hydroxide solution) and is seen to swell up, becoming thoroughly distorted and afterwards dissolving, the conclusion arrived at at once is that it is a vegetable fibre and not an animal fibre.

Some fibres, for example, cotton, when viewed under the microscope are identified at once without any specific tests. When the physical properties are recognized under the microscope, it is best to identify the cotton fibre by its characteristic twist and by the fact that one end of every cotton fibre is pointed while the other end is always open.