FABRIC ANALYSIS

(Continued from June Issue.)

To Ascertain the Percentage of Silk, Cotton and Wool.

Two samples (each weighing 2 grams) are for this test dried, weighed and boiled for a quarter to half an hour, in 200 c.c. of 3 deg. B. Hydrochloric acid, to remove the size and dye, and are then thoroughly washed and pressed.

One sample is then immersed for a short time in a boiling solution of basic zinc chloride, then washed thoroughly, first in acidified, afterwards in clean water, then dried and weighed, the difference in weight giving the amount of silk.

The second sample is then boiled for fifteen minutes in 60 to 80 c.c. of caustic soda (sp. gr. 1.02), and then washed, dried, and weighed, the difference in weight representing the proportion of wool. The residue is cotton, the dry weight of which must be augmented by about 5 per cent to compensate for the corrosion of the fibre during the operation.

To Separate True Silk, Wild Silk, Wool and Cotton.

To separate true silk, wild silk, wool and cotton in a sample, have the latter first acted on by boiling half a minute with concentrated hydrochloric acid, which immediately dissolves the true silk, the wild silk being dissolved at the end of two minutes further boiling. On treating the remainder of the sample with hot caustic potash, the wool will then be dissolved and the cotton left.

To Ascertain Weighting of Silk.

It is often necessary that the amount of loading material in connection with weighted silk has to be estimated, and as there are now so many different methods of adding weight, the task of finding the correct method and percentage is by no means easy.

With colored silks the weighting bodies are tin, phosphoric acid, silica, alumina, lead, antimony, tannin, tungsten, glue, etc.

Blacks may contain tin, phosphoric acid, silica, oxide of iron, cyanide of iron, lead, antimony, etc.

White Silk.

To determine quickly whether white silk is weighted with tin or alumina, a sample is dyed with alizarine with the addition of chalk, and this sample is compared with standards of which the degree of weighting is known. With pure silk the color is a light rose; if weighted with tin it is colored orange; if weighted with alumina it is colored red, and if weighted with a mixture of tin and alumina it is colored a bluish red. Weighting by tannic acid is indicated if by treating with ferrous salt the color turns black.

As weighting bodies are very difficult to strip completely from the silk fibre, the most accurate method is to estimate the amount of nitrogen by decomposing the fibre, one part of nitrogen by weight being equal to 5.455 parts of fibroin or pure silk. Of course, such weighting bodies as contain nitrogen must first be eliminated before the test is made; these bodies are phosphate of ammonia, glue, Prussian blue, etc.

Colored Silks.

The weighting in colored silks can be determined by the following process: A sample from 15 to 30 grams is weighed and boiled for two hours in a solution of soap of 4 ounces to the gallon, which should remove all grit and as far as possible the coloring materials. It is now treated to a boiling solution of carbonate of soda at a strength of 1½ deg. B. to eliminate the ammoniacal salts, after which the sample is washed and dried, and is then ready for the determination of nitrogen. To effect this, the sample is treated for 4 to 6 hours in 1 to 1¼ ounces of hot concentrated sulphuric acid, to which has been added a small quantity of anhydrous copper sulphate, the process being stopped when the color of the solution becomes green. The heat is now cut off, and permanganate of potash added until the liquid becomes an intense green, when it is then diluted with water and left to cool. The liquor is now transferred to either a flask or a retort and made alkaline with caustic soda, when on being heated, the nitrogen distills over in the shape of ammonia, which is received in a vessel containing a known quantity of normal sulphuric acid. It now only remains to determine the amount of unneutralized acid, which shows the amount which combined with the ammonia, and this in its turn shows how much ammonia was given off and therefore nitrogen in proportion.

Black Silk.

For determining the weighting of black, a sample of dry silk weighing 15 grains is taken for the test. It is treated in a one per cent solution of hydrochloric acid, heated to 60 deg. C. The solution turns a more or less intense red. The sample is removed and the treatment repeated until the solution turns only a faint rose color. The sample is then washed and left to steep in a solution of Prussian blue and iron salts. The sample is now treated for one hour and a half in 50 ounces of a boiling solution of soap, containing 4 ounces of soap per gallon; then thoroughly washed and dried. The nitrogen is then determined as in the previous test.

Mineral matter, if such is used in the weighting of silk, may also be looked for in the ash, *i. e.*, ascertain if the latter contains either silica, tin, alumina, phosphoric acid, etc.

For this purpose mix the powdered ash with fluorspar and conc. sulphuric acid. Warm gently and detect the escaping silicon fluoride by means of a drop of water held in platinum loop. Now treat the ash several times with hot conc. hydrochloric acid and dilute the whole with water, passing in turn hydrogen sulphide through a portion of it, and when tin is then thrown down as a yellow stannic sulphide.

Add ammonium molybdate to another portion of it, and when a *yellow* precipitate indicates phosphoric acid.

Add ammonium hydrate to another portion of it, and when a *white* gelatinous precipitate indicates alumina.

Calculations as to Percentages of Weighting Silk.

The weighting on a black silk may vary from zero to 250 per cent. Thus if 100 pounds of raw silk yield 75 pounds of boiled-off silk, the dyer must add 25 pounds of weighting in order that he can return 100 pounds to the mill. If now the mill requests that the silk be weighted 50 per cent, the dyer applies an additional 50 pounds of weighting, making a total of 150 pounds. From this we see that a weighting of 50 per cent may actually represent a silk containing $(25 + 50 =)$ 75 pounds of foreign matter in each 150 pounds of dyed silk.

Example: Ascertain weight of dyed (and weighted) silk the dyer has to deliver to the mill which has sent him 100 pounds of raw silk and wants 50 per cent weighting; the silk to lose 25 per cent in the boil-off. (Permissible moisture 11 per cent not taken into consideration.)

To find the weight of the finished goods:

$$100 + (100 \times 0.50) = 150 \text{ (pounds)}$$

To find the weight of the fibroin in the raw silk:

$$100 - (100 \times 0.25) = 75 \text{ (pounds)}$$

To find the percentage of fibroin in the finished goods:

$$100 \times \frac{100 - (100 \times 0.25)}{100 + (100 \times 0.50)} = 50 \text{ per cent.}$$

To find the percentage of weighting in the finished goods:

$$100 - 50 = 50 \text{ per cent.}$$

The weighting of silk is indicated by stating the ounces of weighting which have been added to each pound of raw silk. The charge or quantity of weighting material which silk takes up can be easily regulated by the dyer; it has become a trade custom to allow a variation of two ounces.

For example, if we speak of 24/26 weighting it is understood that 16 ounces of raw silk have been loaded until the weight has reached approximately 25 ounces. Such a weighting is known as 50 per cent above par, *i. e.*, 24 ounces represent an increase $(16 + 8)$ of one-half more, or 50 per cent above 16 ounces.

The results of the chemical analysis will show the amount of actual silk fibre present.

From this the amount of weighting is calculated by difference and reported in ounces per pound. This can be done with the aid of the following table:

Per cent Weighting.	Ounces.	Per cent Weighting.	Ounces.
0-13	12/14	125-142	28/30
13-29	14/16	142-158	30/32
29-45	16/18	158-174	32/34
45-61	18/20	174-190	34/36
61-77	20/22	190-206	36/38
77-93	22/24	206-222	38/40
93-109	24/26	222-238	40/42
109-125	26/28	238-254	42/44

To illustrate the use of the table let us consider we have submitted to us a sample of weighted silk, that dried at 105 deg. C. weighed 0.50 grams. After the weighting was removed and the remaining fibroin dried at 105 deg. C. it weighed 0.30 grams.

Question: Ascertain percentage of weighting.

Weighted silk = 0.50 grams
Fibroin = 0.30 grams

Weighting = 0.20 grams

$\frac{0.20 \times 100}{0.30} = 66.66 +$ *i. e.*, 67 per cent weighting was done.

Consulting table we see that this corresponds to 20/22 ounces, *i. e.*, an average of 21 ounces. These 21 ounces of weighted silk represent 16 ounces of raw (unweighted) silk, or 12 ounces of pure (fibroin, or boiled-off) silk, and by subtraction we find that 21 ounces of the commercial silk contain (21 — 12 =) 9 ounces of foreign matter.

Scroop of Silk.

Scroop is the peculiar crackling sound which silk emits when rubbed or compressed. As a matter of fact, however, scroop is not a natural property of silk, but is the result of passing the silk, after having been deprived of its natural gum, through a bath containing a small percentage of some acid, preferably tartaric acid, although many silk dyers and finishers prefer to use commercial lime juice, claiming that the results obtained from the use of the latter substance are more lasting.

No satisfactory explanation has as yet been given as to the cause of this peculiar rustling sound emitted from silk so treated, but the assumption is that the surface of the silk fibres are somewhat roughened by the acid and that the noise is due to the increased friction upon the application of pressure. It is certain, however, that the acid present is responsible for the peculiar sound. One ounce of tartaric acid dissolved in one gallon of water is found to be a good strength to work with. The silk is simply immersed in the bath for a short time in the cold, then lift, drain, wrap in cotton cloths and whizz or squeeze on the peg. The silk is not subjected to any further treatment.

The scrooping of weighted silks is always the last operation.

Processes have been devised for the purpose of imparting a scroop to mercerized cotton, and this with some measure of success.

Wool acquires a similar property when treated with a solution of a caustic alkali, apparently through its surface being hardened in the same way as that of silk, by acids.

Distinguishing Vegetable Fibres.

Vegetable fibres are soluble in sulphuric acid; this fact is taken advantage of in the operation of carbonizing wool for the removal of vegetable matter.

The action of iodine and sulphuric acid serves to some extent to distinguish the fibres. Cotton, linen, and China grass are stained blue; hemp a bluish green or dirty yellow, and jute a dark yellow.

To Distinguish Cotton and Linen Threads.

(1) An alcoholic solution of fuchsine (1 gram fuchsine in 100 c.c. of alcohol) stains linen and cotton red, but if the fibres are then steeped for three minutes in ammonia the cotton is decolorized, while linen has a permanent rose red color.

(2) By immersing a sample in a boiling mixture of equal parts of hydrate of potassium and water, and allowing to dry, flax turns a deep yellow, cotton becomes white or pale yellow.

(3) Macerate a small piece of the material in a tepid alcoholic solution of the dyestuff cyanine; wash free from excess of the dyestuff with water, then immerse in dilute sulphuric acid. Cotton is completely decolorized by this treatment, but the linen fibres retain the blue tint. If the material is then washed with water, and immersed in a solution of ammonia the color of the flax fibres is intensified.

(4) Treat the sample submitted with a solution of caustic potash (1 : 6). The flax will become more curly than the cotton, and the latter finally turns grayish white, whereas the flax is dyed orange.

(5) Treat the sample with a stronger solution of caustic potash (1 : 2) and boil for two minutes, then wash and dry between blotting paper; flax becomes of a deep yellow color, compared to the cotton which assumes a whitish or straw color.

(6) Boil the sample in water and then steep it in concentrated sulphuric acid for two minutes, when the cotton is dissolved while the flax remains white and unaltered, and can be separated by washing with a weak solution of caustic potash.

(7) Steep the sample in a solution of magenta in spirit, and after rinsing, dip in a bath of ammonium chloride. Flax will retain a pink color, while the cotton becomes colorless.

To Distinguish Jute from Hemp.

Aniline sulphate stains jute a dark yellow, while concentrated nitric acid gives a red-brown stain, distinguishing it from hemp, which is turned yellow.

To Distinguish Jute from Flax.

When treated with dilute chromic acid, to which a little hydrochloric acid has been added, jute turns blue, while iodine and sulphuric acid produce a dark yellow stain, which may be used to distinguish jute from flax.

In connection with another test, moisten the fibres, yarn or fabric, as the case may be, with an acidulated alcoholic solution of phloroglucine. Jute will stain an intense reddish-brown whereas flax will remain practically unchanged; a slight yellowing may be noticed. The stain is not permanent—therefore a lighter color will result in the course of time.

To Distinguish Jute from Flax or Hemp.

The threads are placed in a solution of nitric acid and a little potassium chromate and warmed, then washed, and introduced into warm alkaline water, and washed again; when the water is evaporated from the slide, a drop of glycerine is added, and after a short time the characteristic structure of the jute will be seen, under the microscope, if jute is present.

Jute can be distinguished from flax or hemp also by the following test: Soak the threads in a solution of bleaching powder, then add hydrochloric acid, which bleaches the threads, and an effervescence takes place. Wash the threads in water, then dry, and afterwards immerse them in ammonia. Jute is dyed a deep and pure blood-red color, linen and hemp take a pinkish yellow color. Both colors soon fade, leaving a dirty green.

Another test to distinguish whether a fabric is linen, hemp or jute is thus: Spill upon the cloth muriatic acid and wash several times in clear water to purify, and then spill ammonia over; if linen it will become a gray-brown, if hemp it will turn pink, and if jute blood-red.

Ramie is stained a purple by sulphuric acid and iodine, but aniline sulphate gives no coloration.

Hemp: Iodine and sulphuric acid stain hemp a greenish yellow with a mottled appearance, while Schweitzer's reagent, beyond causing the fibres to swell, has no further action.

Hydrochloric acid and caustic soda give a brown color to hemp, and sulphuric acid gradually dissolves it.

(*To be continued.*)

Mule-Spun and Ring-Spun Yarn.

Cotton yarn may be produced on two different types of spinning machines, the mule or the ring frame. Eighty per cent of all English yarn is mule spun, and 80 per cent of all American yarn is ring spun. Mule yarn, whether warp or filling, is usually loftier but not so strong as similar counts of ring-spun yarn. For this reason English cloths, while often having a better cover, are not so strong as American cloths. On the mule, yarn is spun in the shape of *cops* on a bare spindle or on paper tubes and is shipped in this condition. *Warp cops* are usually somewhat larger than the *pin cops* that are to be used as filling, the latter must be made smaller to fit into the shuttle. On the ring spinning frame the yarn is spun onto wooden bobbins, and, owing to the expense of shipping and returning these wooden bobbins, the yarn before shipment is usually reeled off into skeins on a swift of 54-inch diameter. Cops from the mule are usually shipped in wooden cases, skein yarn in burlap-covered bales of 400 pounds. American skeins are usually packed all together in a bale; English and Japanese skein yarn is usually put up in 10-pound paper-covered bundles, and then 40 of these are baled together. For special purposes either mule or ring yarn may be put up in special shapes, as for example tubes or cones.