Measuring the Absorbency of Cotton

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Water absorbency is a quality of great importance in cotton materials. It is desirable in underclothing, washcloths, diapers, towels, napkins, gauze, and bandage materials, but it can be troublesome during processing. If it varies from place to place in the same roll of cloth, printing will not be uniform and the shades in dyeing will differ. Cotton is one of the best known absorbent materials, yet the manner in which absorption takes place and its measurement has been largely a matter of speculation. Absorbency tests employed thus far are considered inadequate, because usually they answer only indefinitely the questions of most importance—how fast and how much?

One of the earliest tests that gave more satisfactory answers to the questions was perfected by P. Larose in 1938. He measured rates of absorption by weighing pieces of toweling before and after placing them in contact with a wet earthenware plate for varying intervals. The test was laborious in comparison with more popular test methods, but it enabled him to answer the question "how fast?" with great exactness and represented the first step toward the precise test so universally needed.

Eleven years later, James H. Kettering got around the tedious operation of weighing by adding to the apparatus that Larose used a calibrated side arm as a source of water for the porous plate. This permitted the more convenient operation of timing the passage of water past marks on the supply tube. Kettering's method was successfully used for evaluating the effects of bleaching operations on the absorbency of print cloth.

Several mathematical developments, together with further modifications of the apparatus, have provided means of evaluating the forces involved and have led to a new understanding of water absorption and a reasonable theory of how it progresses. The improved test is based on the use of automatic devices that indicate continuously the rate of the passage of water through the porous plate and also the total amount taken up by a fabric sample, which has been pressed on the plate by means of a bag containing fine lead shot. The apparatus can be assembled from glassware readily available in any scientific laboratory and meets the requirements, so common in the testing of textiles, of wetting a fabric or other absorbent material quickly from one side while it is under pressure, and permitting measurement of rates and amounts of absorption by different fabrics in a readily understandable manner.

Under ordinary conditions, when a fabric is pressed against a wet surface, it first gets wet only at the points where the yarns cross, where the fabric is thickest. At these cross-over points, the water is drawn into the bundle of fibers making up a single yarn, filling the spaces among the fibers in the bundle rapidly. Because of the small volume of the spaces, however, the observed rate of absorption is still quite small. As absorption continues among the yarn fibers, the fibers surrounding the spaces between the yarns become wet and those spaces, too, fill by capillary action. This marks the beginning of an appreciable flow. These different phases of absorption may be taking place at the same time in different parts of the cloth.

The improvement in absorbency of a fabric upon laundering is readily measured by the new test.

In a series of test fabrics, the initial rates of absorption and total absorptions before laundering varied by more than 2 to 1. Repeated home launderings, about 20, improved both the rate of absorption and the total absorption, the rates being improved more than 10 to 1. More important is that the differences among the samples were evened out, so that after laundering they all behaved almost alike. Larose noted the same effect upon comparing undyed samples with the same materials dyed by different procedures. Samples which initially varied as much as 6 to 1 also behaved alike after laundering.

This shows that home laundering, besides its usually considered cleansing action, is another mechanical treatment, which redistributes the yarns and fibers more uniformly throughout the fabric. So for a given type of weave, fabrics containing the same amount of cotton become practically identical absorbers upon continued laundering.

Because laundering reduces the size of the larger spaces and increases the size of the smaller ones, there is less waiting of the larger capillary spaces on the filling of the smaller ones. With all tending to act simultaneously, the delay is less and the initial rate of absorption is greater. Whether or not total absorption changes with laundering depends upon the type of weave of the fabric. In a very open fabric, some spaces are at first too large to fill completely, whereas after laundering they are small enough to fill. If the fabric is laundered enough times to even up the spaces, further laundering will give no more improvement in total absorption.

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CHINESE WOMEN'S, and men's, long hair once was sold to exporting firms, which compressed it into small bales and shipped it to textile mills in various parts of the world for making press cloths, used in the extraction of oil-bearing materials. Even in 1940, in the middle of hostilities in the Orient, Japanese textile mills sent letters to American textile mills informing them that because of the "restoration of peace and order" in China, only the Japanese had human-hair press cloth available for immediate shipment.

The lack of normal supplies of human hair in countries outside Japanese-controlled territories actually was beneficial to industrial users. It stimulated American research workers to use their ingenuity in a search for some material with qualities comparable to those of human hair. As a result, nylon press cloth has been introduced as a probable replacement for human hair. Synthetic fibers, glass fibers, and woven metal wire also have a possible future in making press cloth.—*William A. Wellborn, Southern Regional Research Laboratory.*