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THE EFFECT OF MICRONAIRE ON FABRIC BARRÉ

It has long been apparent to textile manufacturers that low micronaire cotton can cause problems in the production of high quality fabrics. In dyed fabrics, barré is often the result, particularly noticeable in circular knits. While low micronaire seems to matter little in certain coarse fabrics and some that are intended for industrial use, the same fiber can create major problems in apparel fabrics.

The International Center recently had an opportunity to evaluate three lots of cotton of the same variety but with different micronaire levels. While these were relatively close in micronaire value, the lowest of the three was well below the accepted premium range (3.5-4.9). The highest was on the bottom edge of the range, but at a level that is considered a mature fiber. A knitted fabric made from the three cottons produced a dramatic barré effect.

An interesting question suggested by this is: What difference in micronaire levels will create barré? Theoretically, if the exact same micronaire were used in all yarn going into a fabric, barré caused by variations in micronaire would be eliminated. Perhaps the following, which was taken from the report prepared at the conclusion of our study, will help answer this question. (Please note that we are not quoting the entire report, but are reproducing portions we believe may be of interest to our readers.)

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Previous research has shown that the color of dyed textile materials comprising cotton can be explained with high correlation by a function of the dyestuff concentration together with the micronaire value of the cotton. In some cases, other fiber properties were found to make a statistically significant contribution to the explanation of the resultant color, particularly fiber color and fiber length.

However, it is difficult to isolate the individual contributions of these variables. Micronaire value is a function of both maturity and fineness. Fiber fineness tends to decrease when fiber length increases. Immature cotton tends to be yellow. Furthermore, it is believed that the resultant color is a function of absolute cell wall thickness rather than the relative wall thickness (i.e. maturity). Micronaire value is a closer approximation to absolute cell wall thickness than to maturity.

An opportunity to demonstrate the influence of cotton fiber maturity arose when the International Center was requested to knit fabrics for Heinrich Otto/Fils Textil, Reichenbach/Fils, near Stuttgart, Germany. Fabrics were to be produced from Texas cottons of the same variety but of different micronaire values.

To achieve this, three lots of cotton, each weighing approximately 80 pounds, were obtained. The variety of the cotton was purported to be the same in all cases and the main difference between the lots lay in micronaire. Samples of each lot were tested by individual instruments including a Stelometer, Digital Fibrograph, Fibronaire and a Pressley strength tester. The IIC/Shirley Fineness/Maturity Tester Model 1a and Motion Control HVI 3000 were used to give additional data. Since there was interest in the maturity of the cottons, increased testing (5 determinations) was performed using the F/MT instrument.

The results of testing the three lots are shown in Table I on the next page. The data show that micronaire values range from 3.0 to 3.5. This change was associated with an increase in both maturity and fineness as would be expected if the cottons were of the same variety. The relative constancy of the standard fineness data substantiates the statement. The trend of increasing maturity between the three cottons was complemented by a tendency for fiber strength to increase and short fiber content to decrease. Fiber length did not show a trend of progressive change with maturity.

After all testing was completed, the remainder of each lot was converted into sliver by opening, cleaning and carding on our Rieter C4 card. Carding was performed at 55 lbs/hr producing a 60 gr/yd sliver.

Using a Zinser drawframe, the linear density of the sliver was reduced to 49 gr/yd in two passes. The resultant sliver was split into two lots. One half was supplied to a 24-rotor Schlafhorst Autocoro rotor-spinning machine equipped with SE-8 spinboxes.

TABLE I

FIBER PROPERTIES

Lot Number	800-4927			821-9745			826-2960		
Property			Mean			Mean			Mean
Individual Instruments									
Tenacity (g/tex)	26.81	27.86	27.335	27.19	27.92	27.555	28.57	28.58	28.575
Elongation (%)	5.58	6.33	5.955	6.58	6.42	6.500	6.17	6.25	6.210
2.5% Span Length (in)	1.160	1.172	1.166	1.180	1.187	1.183	1.168	1.157	1.162
Uniformity Ratio (%)	42.7	43.2	42.95	44.2	44.7	44.45	44.7	47.0	45.85
Short Fiber Content (%)	10.68	9.52	10.10	6.13	7.35	6.74	2.78	2.77	2.77
Micronaire Value	3.00	2.93	2.965	3.20	3.27	3.235	3.47	3.53	3.50
Pressley Strength (Mpsi)	94.1	97.0	95.55	87.7	89.9	88.80	95.6	95.9	95.75
Non-lint Content (%)	2.43	3.00	2.715	4.00	3.67	3.835	5.31	5.30	5.305
IIC/Shirley F/MT									
Micronaire Value	2.99	2.95	2.970	3.25	3.32	3.285	3.48	3.50	3.490
Maturity (%)	70.6	72.4	71.5	78.7	76.7	77.7	80.1	80.3	80.2
Fineness (mtex)	129	124	126.5	129	136	132.5	138	139	138.5
Standard Fineness (mtex)	152	161	156.5	153	154	153.9	162	152	157.3
High Volume Instrument Data									
Strength (g/tex)	26	27	26.5	27	27	27	30	27	28.5
Elongation (%)	5.8	6.2	6	6.8	6.8	6.8	6.4	6.6	6.5
Length (in)	1.14	1.16	1.15	1.15	1.17	1.16	1.14	1.10	1.12
Length Uniformity (%)	81	81	81	84	83	83.5	85	84	84.5
Micronaire	3.0	2.9	2.95	3.4	3.3	3.35	3.5	3.5	3.5
Leaf	2	2	2	4	3	3.5	4	3	3.5
Reflectance, R_d (%)	75	74	74.5	76	76	76	73	74	73.5
Yellowness, +b	9.2	10.4	9.8	9.8	9.6	9.7	9.4	9.4	9.4

The remainder formed feedstock for spinning the same yarn number on another Schlafhorst Autocoro which was fitted with SE-9 spinboxes. The yarn was a N_e 30/1 that was spun at very high speed with a twist multiplier of less than 4.0.

Table II shows the results obtained by testing the yarn spun from each cotton. The data suggest that the yarn strength increased as the micronaire value of each cotton increased. It should be recalled, however, that the fiber strength of the cottons was associated with the change in micronaire value.

Table II also gives spinning performance data. There was a tendency for the cotton of lower micronaire to give a higher breakage rate. The breakage rate was also less when using the machine equipped with SE-9 spinboxes. The majority of the breaks were entanglement related.

An earlier study showed it was unlikely that barré would arise from mixing of yarns rotor-spun from the same cotton using the same combination of navel and twist multiplier. Consequently, it was deemed safe to combine the yarns produced from the same cotton although spun on different machines.

The fabric was knitted on a Supreme MJ20 22-gauge machine. Normally used with 32 feeders, the machine was converted to knit with only 24 feeders. The three lots formed by combining the yarns spun from the same cotton, although on different machines, were creeled in blocks of eight packages. Single jersey fabric was knitted from the 24 packages with a machine tightness factor of 15.0 $tex^{0.5}$ cm^{-1}. After knitting, the fabric was scoured and dyed with 1.0 percent C.I. Direct Blue 80.

Two stripes were easily discernable. The lighter stripe was half the width of the dark stripe. Closer examination of the broader dark stripe showed it to be composed of a slightly lighter half and a darker half. The lightest stripe was that produced from the cotton with the lowest micronaire.

This study indicates that a change in micronaire value of 3.0 to 3.3 produced a very visible stripe in a circular knitted fabric. A change of micronaire from 3.3 to 3.5 produced a barely discernable change.

The IIC/Shirley F/MT data in Table I demonstrates that the fibers were essentially all the same variety, since the standard fineness was constant. The fibers in each lot were of the same parameter. Within these cottons, a change in micronaire value indicated a change in both maturity and fineness.

In this case, it can be stated that the barriness found in the fabric was caused by a change in micronaire, or maturity, or fineness, without fear of reproach. It can be concluded, therefore, that to avoid barré in dyed fabrics arising from variation in the micronaire of the cottons from which the yarns were spun, the difference in micronaire value should be

TABLE II

YARN PROPERTIES

t Number	800-4927		821-9745		826-2960	
Machine	SE-8	SE-9	SE-8	SE-9	SE-8	SE-9
YARN PROPERTIES						
Skein Test:						
Yarn Number (Ne)	29.74	29.69	29.63	30.05	29.68	29.87
CV% of Count	0.8	0.5	1.6	0.5	0.9	1.1
Count-Strength-Product	1993	1950	2058	2029	2146	2081
CV% of CSP	3.2	2.6	2.1	2.0	3.6	3.0
Single Yarn Tensile Test:						
Tenacity (g/tex)	12.46	12.01	12.42	12.48	13.11	12.97
Mean Strength (g)	247	239	248	245	261	256
CV% of Strength	7.0	9.6	7.9	8.4	8.6	8.7
Elongation (%)	5.07	4.75	5.58	5.33	4.97	4.80
CV% of Elongation	6.4	8.3	8.1	7.5	7.7	7.8
Spec. Work of Rupture (g/tex)	0.344	0.319	0.383	0.375	0.353	0.343
CV% of Work of Rupture	13.0	16.6	14.8	14.9	15.3	15.1
Initial Modulus (g/tex)	261	246	244	290	273	298
Uster Evenness Test:						
Non-Uniformity (CV%)	15.47	15.72	15.94	15.77	16.16	16.16
Thin Places/1,000 yds	40	57	70	63	77	71
Thick Places/1,000 yds	117	136	191	162	190	179
Neps/1,000 yds	460	649	758	757	563	782
Spinning Performance:						
No. of Spinning Breaks	9*	3	4	2	6	2
Breakage Rate/Rotor Hour	103.3	30.1	40.2	20.1	60.2	20.1

*Omitting data from a rogue unit

less than 0.2 units per lot, particularly if critical colors are to be used.

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The report from which the preceding information was taken was prepared by John B.Price, asistant director of the International Center. We have mentioned that Heinrich Otto/Fils Textil requested that fabric be knitted from yarns made from cottons of different micronaire levels, and therefore a full report will be sent to that organization. We would also like to point out that the Texas Food and Fibers Commission co-sponsored this project and is to receive the same report. We are grateful to both organizations for their interest and support.

USDA COMMITTEE MEETS AT CENTER

USDA's Committee on Cotton Quality Measurements met at the International Center on December 13. The purpose of the meeting was to review various studies that have been made on improving measurements for cotton quality. Although high volume instrument systems provide accurate information that was not available prior to their use, it is always the desire to improve the method of making various tests.

Those attending the meeting were Preston Sasser, Cotton Incorporated, Raleigh, NC; Jesse Moore, USDA, Washington, DC; Mack Bennett, Jerome Boyd, Dennis McNabb, Hob Ramey and Wendell Wilbanks, USDA, Memphis, TN; Ken Bragg and Ross Griffith, USDA, Clemson, SC; Lester Smith, Cone Mills Corporation, Greensboro, NC; David Adams and Larry Teague, Motion Control Inc., Dallas, TX; H. Ghorashi, Spinlab Inc., Knoxville, TN; Fred Johnson, National Cotton Council, Memphis, TN; Jan Verhage, Staplcotn, Greenwood, MS; Emerson Tucker, Plains Cotton Cooperative Assn., Lubbock, K; and Harvin Smith, ICTRD.

We were pleased to have this committee meet with us, and we look forward to a time when it will return. Not only is it good to have the group use our facilities, it is also a pleasure to visit individually with committee members.

CONTRIBUTION FROM TEXTUBE CORPORATION

We recently received a donation of cones for our automated rotor-spinning machines from the Textube Corporation of Greer, South Carolina. These will be used in our many research projects and in cooperative programs with academic departments at Texas Tech University.

Contributions of this nature are important to a university-related organization with a limited budget. We are greatly appreciative to the Textube Corporation for their generosity in making these cones available to us.

VISITORS

Visitors to the International Center during December, in addition to those previously mentioned, included Roger Bolick, Allied Fibers, Hopewell, VA; Kurt Masurat, George A. Goulston Co., Monroe, NC; Pat Danahy, Lester Smith and John W. Markham, III, Cone Mills Corporation, Greensboro, NC; H. M. Simpson, Russell Corporation, Alexander City, AL; Robert D. Mackey, Burckhardt America Inc., Greensboro, NC; Ted Morley, Hohenberg Bros., Memphis, TN; Lee Powell, Video Images Placement Service, Dallas, TX; K. Michael Conaway, Texas Commerce Bank, Midland, TX; Lawrence Hahn, Midland, TX; David Aiken, Memphis Cotton Exchange, Memphis, TN; David M. Warner, E. I. DuPont de Nemours & Co., Richmond, VA; Clyde W. Driver, E. I. DuPont de Nemours & Co., Old Hickory, TN; and Dale McDougal, Western Equipment & Supply, Loraine, TX.

Other visitors were Rob Jarvis and Robson Dzviti, Cotton Marketing Board, Harare, Zimbabwe; Peter Dove, Mashonaland Holdings Ltd., Harare, Zimbabwe; Brad Lane, Brisbane, Australia; Brian Welsh, Sydney, Australia; Damaso Rosas O., Alfa en Fibras Sinteticas, Mexico City, Mexico; and Pedro Lozano G. and Fernando L. Guerra, Una Empresa del Grupo Industrial Alfa, Monterrey, Mexico.