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RESEARCH ON PROCESSING STICKY COTTON

Cotton produced in several areas of the United States in 1987 was found to contain a sticky substance that caused problems during textile processing. While some people almost automatically refer to the sticky substance as honeydew, a good portion of that in the 1987 crop was not. An article on this was published in the July 1988 issue of *Textile Topics* (Vol. XVI, No. 11) and it was pointed out that both plant sugars (biological) and those excreted from insects (honeydew) can cause sticking during processing.

The International Center for Textile Research conducted a series of tests to identify the sugars and study the problems they cause. We learned that the substance in the cotton from the Lubbock area was plant sugar, most likely the result of the 1987 crop experiencing a clear, wide-open harvesting season with no rain during the late summer or early fall. We were not aware of this previously, but it now appears that the rain we usually have after the cotton has opened washes excess sugar off the plant. We also learned that the generally accepted threshold limit for sugar on cotton is 0.30%, and above this level processing problems may occur. Below 0.30%, usually no problems are experienced. The higher the percentage of sugar, the higher the likelihood of sticking to machine parts during processing, especially when working conditions are warm and the humidity high.

Our research led to a decision to evaluate an overspray that has been offered as a means to eliminate stickiness. The chemical is applied during the opening process prior to carding. Thinking it would be of interest to determine whether this is effective in eliminating or diminishing the problem, we requested the cooperation of the company that produces the overspray. Subsequently, we were supplied an amount to be used in our research.

We obtained a bale of cotton that was found to have 1.20% of a reducing chemical substance. This is four times as high as the accepted threshold limit for satisfactory processing. We wanted this heavy concentration in order to determine the effectiveness of the overspray. We removed 150 pounds of the cotton and stored it at 75°F and 55% relative humidity. Another 150 pounds were stored at 70°F and 80% relative humidity. In each case, the cotton was left uncompressed to condition for more than 24 hours. Once conditioning was completed, evaluation of the effects of the stickiness was begun.

From the portion of the bale that had been subjected to the high humidity, 50 pounds were removed to be processed separately. The remaining 100 pounds were oversprayed with the chemical on the conveyor belt following the blending feeders. In this way, there were three lots to be used in our research. These were:

1) Normal Relative Humidity (NRH)
2) High Relative Humidity (HRH),
3) High Relative Humidity/Overspray (HRH/OS).

Fifty pounds of the lot subjected to normal relative humidity (NRH) were processed through the Center's standard opening line and chute feed, and then to a high-speed, revolving-flat card. Carding was conducted at 70°F and 52% RH with normal crush roll pressure. The only processing problem observed was a single choke in the chute feed to the card.

The second lot, consisting of 50 pounds of the high relative humidity cotton (HRH), was taken through the same sequence of opening, cleaning and carding. In processing this small amount, the card web partially collapsed on six occasions which were observed and corrected by the operator. On three other occasions the web failed completely.

The third lot (HRH/OS), consisting of 100 pounds of the cotton conditioned at high relative humidity and oversprayed, went through the card with no chokes or web failures.

Reducing substance content determinations were made on bale samples conditioned at 55% and 80% RH, and on the sliver produced from the HRH lot. The results of these tests were 1.25%, 1.20% and 1.12%, respectively, confirming that the presence of a sticky substance on the cotton was very high, indeed.

Before the three lots were carried through draw-

ing, all fiber contact surfaces of the machine were cleaned to remove the possibility of stickiness coming from some previous process. The dry cotton (NRH) was drawn first, followed by 50 pounds of the HRH lot. The next step was to process 50 pounds of the HRH/OS cotton to condition the machine prior to drawing the final 50 pounds of the same lot. In all cases, there were some problems at drawing, but no one lot seemed to be better or worse than the others.

Prior to roving, all rollers on the machine were cleaned, as had been done at drawing, to remove the possibility of retained stickiness from previous processing. Subsequently, the three lots were converted into 1.0 hank roving. No breaks occurred in producing roving from the NRH cotton, although some sticking was observed. However, the fiber that had been conditioned at high humidity (HRH) resulted in eight roving breaks. It was obvious that this lot was sticking to the rollers and aprons.

The cotton that had been stored at high humidity and oversprayed and then used to distribute the chemical onto the machine surfaces before processing the final lot, had five breaks and showed severe symptoms of sticking. When this preliminary run was completed, the final HRH/OS lot was processed through roving with no breaks, no roller laps, and no sign of any sticking.

The three lots of roving were each placed into a set of 30 spindles at a ring spinning machine. Spinning was conducted for a total of five doffs of four hours and forty-five minutes, giving a total of 712 spindle hours for each lot. The number of yarn breaks (ends down) was recorded. It should be noted that a preliminary lot of the HRH/OS cotton was processed just prior to the final spinning of this same material. It is interesting that the highest breakage rate was observed for the preliminary, run-in oversprayed cotton. However, when the machine had been conditioned in this way, the final HRH/OS lot was spun with fewer breaks than any of the others. Spinning performance is given in the table at left.

After spinning, samples of the yarn from the three test lots were wound onto dyetex tubes, scoured, and dyed with a reactive dye. The yarn was then measured for color and

RING SPINNING RESULTS

FIBER DATA (HVI)			
Tensile: Strength (g/tex)		27	
Elongation (%)		8.4	
Length (in)		1.04	
Length Uniformity (%)		81	
Micronaire		3.4	
Leaf		2	
Reflectance		76	
Hunter s +b		8.4	
SPINNING DETAILS			
Machine		Saco Lowell SF–3H	
Nominal Yarn No (N_e)		26.00	
Ring Diameter (in)		2.0	
Spindle Speed (rpm)		11 000	
Traveller		#3	
Roving Size		1.0 hank	
Draft (Break)		1.77	
Draft (Total)		27.9	
Twist Multiplier (α_e)		3.81	
Yarn Speed (yd/min)		15.74	
Ambient Conditions		72°F/55% RH	
Test Duration (Spindle Hours)		700+	
YARN PROPERTIES	NRH	HRH	HRH/OS
Skein Test:			
Yarn Number (N_e)	25.12	25.32	24.84
CV% of Count	1.9	1.9	1.7
Count-Strength Product	2096	2190	2179
CV% of CSP	5.9	4.6	2.7
Single Yarn Tensile Test:			
Tenacity (g/tex)	14.83	14.21	14.75
Mean Strength (g)	346	334	351
CV% of Strength	9.9	10.4	11.2
Elongation (%)	5.99	5.75	5.83
CV% of Elongation	9.9	11.9	10.6
Spec. Work of Rupture (g/tex)	0.471	0.441	0.464
CV% of Work of Rupture	15.6	18.0	18.2
Initial Modulus (g/tex)	262	267	290
Uster Evenness Test:			
Non Uniformity (CV%)	20.42	20.83	20.09
Thin Places/1000 yds	301	403	309
Thick Places/1000 yds	934	968	850
Neps/1000 yds	232	247	263
Hairs/100 yds	1085	1181	1219
ASTM Yarn Grade	C+	C	C
PERFORMANCE			
Number of Breaks	10	14	3
Break Rate/1000 Spindle Hrs	14.0	19.7	4.3

the color difference was computed. The total color difference (ΔE) was 0.26. This is not a visible change and may well be ascribed to sampling error. (It is generally accepted that a total color difference of 0.5 is barely visible.) The dyed yarns were then woven as filling across an undyed warp for further examination and display purposes.

We want to point out that in conducting this project one of the main concerns was to ensure that the conditions chosen were not atypical of the processing of cotton, yet sensitive enough to reveal differences between treatments. This appears to have been achieved by storing the cotton in humid conditions.

In looking at conclusions, it can be stated that the untreated cotton which was stored at high relative humidity did tend to give more difficulty than the dry, untreated cotton. The best performance was noted when using cotton which had been stored at high humidity and then oversprayed.

There were obvious differences in spinning performance. The break rate of the HRH lot was almost five times higher than that of the HRH/OS cotton, and the break rate of the NRH cotton was three times higher. Unfortunately, these data were collected in a relatively short period of spinning, only slightly more than 700 spindle hours. Normally our research will include spinning tests of 5,000 spindle hours or more.

Finally, it would appear that the overspray may have had a positive influence on certain areas of processing, although we are not yet ready to endorse the use of a chemical for the elimination or reduction of stickiness. In fact, a repeat of this small-scale study gave varying results and caused us to question the limited quantities of cotton evaluated. Most certainly, credibility would be improved if larger-scale trials were conducted. At the present time, however, our laboratories are extremely busy, and we will have to wait until sometime in the future before we can repeat this program with larger amounts of cotton and longer processing times

This research was sponsored by the Natural Fibers and Food Protein Commission of Texas. The complete study was more extensive than we have presented here and included rotor spinning. We have had to condense the report for presentation in *Topics*, but if anyone would care to have the entire report, we will be pleased to make it available upon receiving your request.

John B Price, ICTRD's Assistant Director, was project coordinator and report author. Edwin R. Foster, head of carding and ring spinning, and William D. Cole, manager of our open-end spinning department, supervised the processing and made significant contributions to the study.

DONATIONS

We wish to thank the Textube Corporation, of Greer, South Carolina, for their recent donation of plastic cones for use on our Schlafhorst and Rieter rotor spinning machines. We are most grateful for contributions of this type. Assistance of this nature is important to non-profit organizations that are involved in research and education, and we appreciate the generosity shown by Textube Corporation.

VISITORS

Visitors to the International Center during December included Mr. & Mrs. Wesley Masters, Amarillo, TX; Claude Hill, Bogle Farms, Dexter, NM; Buddy C. Logsdon, Memphis, TX; Robert Brown, Brown Sheep Co., Mitchell, NE; Mike T. Rodriguez, American Schlafhorst Co., Charlotte, NC; George Smith, John D. Hollingsworth on Wheels, Inc., Greenville, SC; Allen Terrell, Hollingsworth Service Co., Ltd., Forney, TX; Manfred Schobert, Louis P. Batson Co., Greenville, SC; Peter D. Shalek, Los Alamos National Laboratories, Los Alamos, NM; R. H. Pusch, Woven Structures, Compton, CA; Royce Beights, Custom Ag Service, Inc., Loraine, TX; Glenn Reynolds, Western Equipment & Supply, Inc., Loraine, Tx; Hasan Basri Karadayi, Birol Koleli and Erdogan Bayinder, Ziraat Yukset Muhendisi, Aydin, Nazilli, Turkey; and Jason Hung, Horng Haus Cotton Co., Ltd., Taipei, Taiwan.