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TEXTILE TOPICS

INTERNATIONAL TEXTILE CENTER • TEXAS TECH UNIVERSITY
LUBBOCK, TEXAS USA

Sharing current research information and trends in the cotton and textile industries.

EQUIPMENT TO ENHANCE RESEARCH CAPABILITIES

The ITC continues to improve research capability with the acquisition of new technology in image analysis and contamination testing. The wet processing area is also being upgraded with a new padder.

Image analysis is now available at the ITC for fiber, yarn, and fabric research. The system consists of a video camera with output to a computer with frame grabbing capability and special analysis software. A microscope can be linked to the system.

A Burlington Industries Laboratory Padder has been purchased for the ITC Chemical Processing Laboratory. The new padder has digital controls and has replaced a very old padder. It will be used for controlled application of dyes and chemicals to woven and knitted fabrics. The new padder will be used for dyeing and finishing application research, including work on covering neps, flame retardants, durable press, easy care, and wrinkle resistant finishes.

The ITC is a beta test site for a Lintronics Fiber Contamination Tester (FCT). Other units are at Cotton Incorporated, Raleigh, NC, and in Israel. The FCT will be used for accurate identification and evaluation of different types of contaminants in textile fibers including stickiness, neps, trash, and seed coat fragments. Dr. Uzi Mor, one of the developers, installed the system in January.

The system uses a small card to make a web and image analysis to detect contamination. Special software differentiates between neps, trash, and seed coat fragments. Stickiness is measured using signal processing techniques. ITC research on the problem of stickiness will be greatly enhanced with the addition of the FCT.

NEW DISPLAY TELLS ITC STORY

The ITC can now have a presence at trade shows and various events with a new high tech display unit. The first use of the new display was in the Cotton Foundation exhibit area at the Beltwide Cotton Conferences in Nashville, Tennessee, January 9 through 11. Response was very positive. The story of natural fiber research at the ITC is told with photos of the various ITC labs and activities, a logo, and key words. The modular pop-up exhibit collapses into a single case and can be checked as airline luggage.

Pam Alspaugh, Information Specialist, took the display to the New Mexico 1517 Association meeting and the New Mexico Seedsmen Association meeting in Las Cruces, NM on February 8-9. For both meetings she presented a slide tour of the ITC, explaining textile processing and research activities.

DOUBLE T FABRIC AVAILABLE

Every few years the ITC makes a special fabric for Texas Tech University departments and fans. We call it "Double T Fabric" and it is truly special. One side is red with black double T's and the other side is black with red double T's. The 100% cotton fabrics are woven simultaneously. Campus departments use the fabric for tablecloths and for displays. Vests are another popular end use for the reversible fabric. Fabric is available for $15 per yard from the ITC business office.

EVALUATING COMBING ROLL FIBER DAMAGE IN ROTOR SPINNING USING THE AFIS

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Introduction

Questions have been raised from time to time concerning how much cleaning of the fiber and at what cost to fiber properties occurs during the opening action of the combing roll. The Uster AFIS, with the ability to measure fiber length, quantify trash and neps, et cetera, has made this study easy to perform provided fiber could be collected without damage after passing through the opening process of the combing roll.

The purpose of this study was to quantify the influence on fiber properties and the cleaning effect of the rotor spinning combing roll as measured by the Uster AFIS machine. The objective was to test the effect of the processing rather than compare varieties.

The four cotton varieties selected for this study were from excess cottons from a former project.[1] These were chosen to give a range of staple lengths, micronaire, nep and trash counts. Each variety was tested from the bale on Spinlab 900B for HVI data and Uster AFIS.

This article uses the averages of the four varieties to show the overall trends of the influence on fiber properties by processing. The full report is in the 1994-95 Annual Report to the Texas Food and Fibers Commission, available from the ITC.

Procedure

Spinning Preparation
Mechanical processes are outlined in Exhibit 1.

Each variety was processed in the same manner. Maximum cleaning was used in blowroom and waste through carding quantified (Table 1). Carding was on a Rieter C-4 cotton card setup to process Texas Upland cottons. Two drawing processes were used: breaker drawing on a Platt Saco Lowell Versamatic draw frame and finisher drawing to 55 gn/yd on a Rieter RSB-851 draw frame.

Finisher drawing sliver from each variety was collected and a knot was placed in the trailing end to ensure the correct direction of running through the AFIS. These samples provided the reference data from AFIS prior to the combing roll action.

A Schlafhorst Autocoro SE-8 rotor spinning machine was chosen for this project. A fixed draft of 114.4 was used throughout the study. This draft gave an intake speed for the sliver of 1.18 meters per minute and a yarn delivery rate of 135 meters per minute.

Two different Schlafhorst combing rolls designed for cotton processing were used. The OB20F has been the standard for 100% cotton processing, and the B174DN is a Schlafhorst product with a different design. Although the geometry of the teeth area is similar, the OB20F is wire wound, whereas the B174DN is machined from one piece of metal. Some advantage has been demonstrated in other studies[2] in terms of yarn quality with the B174DN having advantage over the OB20F.

In addition to the two different types of combing rolls, a range of speeds were used. Samples were run and collected from each rpm starting with 6,500 and increasing each time by 500 rpm up to 9,000.

A large rotor with its appropriate feed channel was used to maximize the amount of fiber that could be passed through opening at one time. Lengths approximately 6" long of 55 gn/yd sliver were passed through with no stoppages to eliminate fiber damage due to the combing roll running through a stationary sliver beard.

Fiber Testing

Refer to Table 2. Fifty-two separate fiber samples were collected to be tested on the Uster AFIS. This number included four sliver samples from each of the four varieties, and forty-eight opening roll samples from four varieties, two combing roll types and six combing roll rpms. Three replications were run on each sample on AFIS for complete analysis—that is fiber parameters, trash, and neps.

Results and Analysis

Uster AFIS: Raw Stock vs Finisher Drawing Data
Refer to Figures 1, 2, and 3. AFIS data from raw stock and finisher drawing slivers were as expected in good processing. Comparing the finisher drawing sliver with the raw stock samples, the following observations can be made:

1. The upper quartile length increased by an average of 0.08 inches.
2. Mean length increased by an average of 0.07 inches.
3. Percent short fibers decreased by an average of 2.0%.
4. Nep count (no./g) decreased by an average of 64.
5. Total trash (no./g) decreased by an average of 411.

Uster AFIS: Finisher Drawing vs Combing Roll Fiber

This comparison measured the before and after action of the combing roll. Disregarding combing roll types and rpms, the following observations can be drawn:
1. Upper quartile length decreased by 0.05 to 0.09 inches.
2. Mean length decreased by 0.03 to 0.09 inches.
3. Percent short fiber increased from 0.4% to 2.5%.
4. Nep count (no./g) decreased from a low of 1.6% to a high of 35.7%.
5. Total trash (no./g) decreased 5.2% to 69.1%.

Conclusions

There are many effects that the combing roll action has on the fiber from finisher sliver to rotor groove. Some of the most obvious from this study are:
1. The combing roll is an effective cleaning device removing a significant amount of trash from the sliver.
2. The cleaning was at a cost to fiber damage in terms of increased short fiber content, shorter mean length and shorter upper quartile length.
3. The combing roll action reduces the nep count significantly.
4. Percent short fiber increases as combing roll rpm goes up.
5. Cleaning efficiency goes up with rpm after 7,500.
6. Nep count goes down as rpm increases.
7. Advantages of one combing roll type over the other is a "mixed bag" and would best be determined by spinning efficiency and yarn quality studies.

The above statements as general truths are supported by this study, however, exceptions can be found and are likely to happen in actual experience.

References

1. Unpublished work, ITC Project 1731.
2. Boone, Harriet, ed. "Effects of Schlafhorst Autocoro Opening Roller Speed on Yarn Quality: Results Using California Acala Cotton", ITC Textile Topics, Volume 22, No. 3, Spring 1994.

EXHIBIT 1: Outline of Mechanical Processes

Hunter Weight Pan Hopper Feeder		
Monocylinder B4/1	Roll Speed	= 750 rpm
Dust Remover		
ERM B5/5 Condensor	R20/10 Beater Speed	= 850 rpm
ERM B5/5	R10/10 Beater Speed	= 950 rpm
AMH Blender		
Rieter Aerofeed U Chute		
Rieter C-4 Card Trashmaster	Production Rate Sliver Weight	= 100 lb/hr = 60 gr/yd
Platt Saco Lowell DE-7C Draw Frame	Delivery Speed Sliver Weight	= 570 ft/min = 55 gr/yd
Rieter RSB 851 Draw Frame	Delivery Speed Sliver Weight	= 1320 ft/min = 55 gr/yd
Schlafhorst Autocoro SE-9 Rotor Spinning Machine	Draft Intake Speed Delivery Speed	= 114.4 = 1.18 m/min = 135 m/min

Figure 1. Average AFIS Short Fibers for All Bales Using Different Combing Rolls at Various Speeds

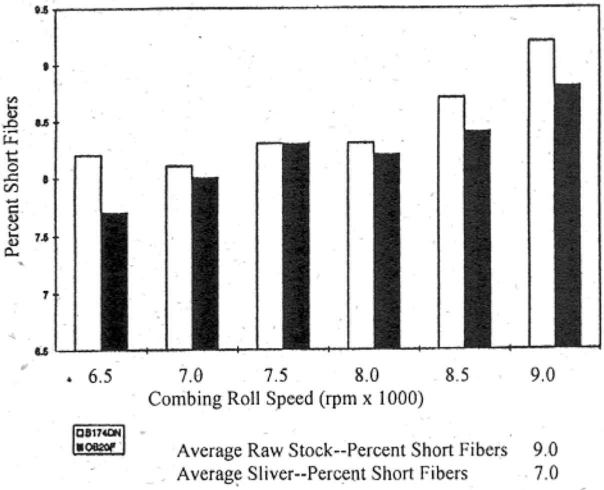
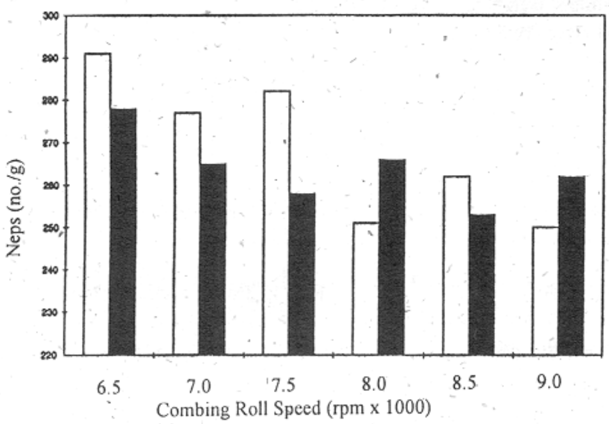
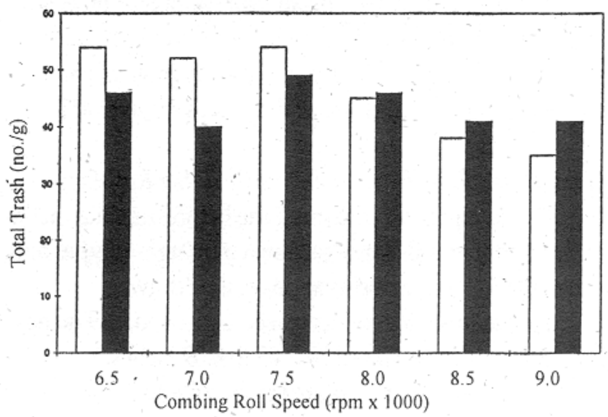


Figure 2. Average AFIS Neps for All Bales Using Different Combing Rolls at Various Speeds



Average Raw Stock--Neps (no./g)	382
Average Sliver--Neps (no./g)	318

Figure 3. Average AFIS Total Trash for All Bales Using Different Combing Rolls at Various Speeds



Average Raw Stock--Total Trash (no./g)	496
Average Sliver--Total Trash (no./g)	85

Table 1. Waste Data Percentages

Bale Number	2697	2698	2699	2700
Blowroom				
Monocylinder	1.12	0.98	1.33	0.93
ERM 1	0.67	0.70	0.99	0.80
ERM 2	0.45	0.53	0.75	0.59
Total Blowroom	2.24	2.21	3.07	2.32
Card				
Undercard	0.68	0.74	0.80	0.74
Filter	2.65	1.98	2.28	2.09
Total Card	3.33	2.72	3.08	2.83
Total Waste	5.57	4.93	6.15	5.15

Table 2. HVI and AFIS Data

Bale Number	2697	2698	2699	2700
1/8"Gauge Strength (g/tex)	35.9	31.4	36.7	29.6
Elongation (%)	6.2	5.8	5.9	6.5
Length (in)	1.20	1.09	1.23	1.02
Uniformity Index	84.0	82.4	84.6	81.3
Micronaire Index	3.9	4.5	3.3	4.7
Reflectance (Rd)	68.3	68.4	68.1	68.9
Yellowness (+b)	11.7	11.9	11.5	11.9
Color Index	33	33	33	33
Leaf Grade	1	1	1	1
Uster AFIS-Raw Stock Data				
Upper Quartile Length (w) (in)	1.24	1.11	1.29	1.03
Mean Length (in)	1.01	0.91	1.04	0.86
Percent Short Fibers	8.2	9.7	8.0	9.9
Diameter ((m)	11.9	13.9	11.2	15.0
Neps (no./g)	435	294	493	307
Total Trash (no./g)	492	237	954	301

THE COVERING OF NEPS AND IMMATURE COTTON ON KNIT AND WOVEN FABRICS BY SIMPLE CHEMICAL PRETREATMENT

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Shridhar Chikkodi, Research Associate
Chemical Wet Processing

Introduction

Neps are hopelessly entangled fibers. Generally, cottons that are classed as immature are more susceptible than mature fibers to the formation of neps during fiber preparation and yarn processing. Neps in cotton yarn and fabric have always posed problems to the textile dyer. Immature cotton fiber has poor cell wall development and when that fiber gets tangled, it forms a nep. The neps in dyed fabric absorb less dye and appear much lighter in shade compared to the rest of the fibers in the fabric. Hence, they appear as "white" specks on the surface of the fabric. While they exist even when fabrics are dyed with lighter colors, they are particularly noticeable on fabrics dyed with dark colors such as black, navy, brown and green.

In the past, better fiber selection methods and modifications of machine settings during textile processing were practiced to avoid the formation of neps. Mercerization of yarn, a caustic soda chemical treatment, was found to be partially effective in covering neps. Some dyes have also been developed to cover neps, however they are available in only a limited range of colors. A study conducted by Mehta (1) reported a chitosan pretreatment method to successfully cover fabric neps prior to dyeing with direct dyes. (Chitosan is a natural cationic product made from the exoskeletons of crustaceans, a by-product of the shellfish industry). However, when the chitosan-treated fabrics were dyed with direct dyes, the wash fastness properties of these fabrics were found to be poor. It is a well established fact that the washfastness property of fabrics dyed with reactive dyes is superior to that of fabrics dyed with direct dyes. Therefore, this study evaluates the washfastness property of reactive dyed fabrics under a somewhat modified chitosan application process.

Chitosan Application Procedures

For this study, both woven and knitted cotton fabrics were used. Fabrics used were of 100% cotton and were scoured and bleached before being treated with the chitosan. The chitosan treatment was done before the reactive dyeing procedure. Two distinct methods were used to apply the chitosan.

1. *Pad-Batch Method:* The bath was set with 0.5 grams/liter of non-ionic wetting agent and 15 grams/liter of chitosan. The amount of chitosan used was determined after several laboratory trials. The fabric was padded at 90% pickup, rolled and batched for four hours. After batching, the fabric was padded in a bath with 10 grams/liter of soda ash and dried. Then the chitosan-treated fabric was dyed with reactive dyes.

2. *Exhaust Method:* The bath was set with a goods-to-liquor ratio of 1:25, to which 0.5% of non-ionic wetting agent and 0.8% of low viscosity chitosan on the weight of the fabric were added. The temperature of the bath was raised to 60° C and 10% of sodium sulfate was added. The fabric was treated for 30 minutes and the treatment bath was drained. A fresh bath was set with 0.5% soda ash, and the fabric was treated in cold bath for 20 minutes while maintaining the pH at 6.5. After the chitosan treatment, the fabric was dyed directly with reactive dyes without rinsing.

Reactive Dyeing Procedures

For both woven and knitted fabrics four reactive dyes were used: Reactive Yellow 168 (RY168), Reactive Red 235 (RR235), Reactive Blue 235 (RB235), and Reactive Black 5 (RBL5). The chitosan treated fabrics as well as control fabrics were dyed using the following methods:

1. *Pad-Batch Dyeing Method:* The pad bath was prepared with 0.5 grams/liter of non-ionic wetting agent, 20 grams/liter of soda ash, and 20 grams/liter of the reactive dye. Both chitosan-treated and untreated fabrics were padded at 90% pickup, and batched for 24 hours. Then the fabrics were rinsed and boiled off at 85° C for 10 minutes, rinsed again, and dried.

2. *Exhaust Dyeing Method:* The dyebath was prepared with 0.5% of non-ionic wetting agent, 60 grams/liter of sodium sulfate, and 2% of the reactive dye. Both chitosan-treated and untreated fabrics were treated at 60° C for 30 minutes, and 8 grams/liter of soda ash was added. The

treatment was continued for 60 more minutes. Then the fabrics were rinsed and boiled off at 85° C for 10 minutes, rinsed again, and dried.

Tests

Tests performed included the following:

- CIE (Commission International de l'Eclairage) Lab color difference at equal apparent strength of the dyed fabrics - determined by using Illuminant D 65 and a viewing angle of 10° with a Macbeth Color-Eye 3000 Spectrophotometer.
- Colorfastness to washing - evaluated by AATCC Test Method 61-1993; Wash Method 2A was used for reactive dyes.
- Colorfastness to dry and wet crocking - measured with a rotary crockmeter using AATCC 116-1989 test method.
- Lightfastness - measured at 20 and 40 hours of exposure according to AATCC Test Method 61-1989 using an Atlas Sunchex air-cooled Xenon-Arc Lamp; for calibration, used blue wool lightfastness standard L-4 for 20 AATCC fading unit equivalents.

Results

Results of the color difference values obtained on the chitosan pretreated and reactive dyed fabrics for the above tests is summarized in tables 1 and 2 . Reactive dyed fabrics without the chitosan pretreatment were used as control fabrics. Table 1 shows the color difference results of fabrics dyed with Pad-Bath Method and Table 2 shows the color difference results of fabrics dyed using Exhaust Method. From these tables, the ΔE (Delta E) value, the total color difference, indicates that in all cases the chitosan treatment increased the shade of the dyed fabric. The Macbeth Spectrophotometer ratings also supported the (E values, which indicated about 4 to 69% increase in the strength.

The colorfastness properties to washing, crocking and light are shown in Tables 3 and 4. Table 3 shows the results of fabrics dyed with the Pad-Batch Method and Table 4 shows the results of fabrics dyed using Exhaust Method. From these results, it is evident that the chitosan pretreated fabrics demonstrated excellent colorfastness properties to washing, crocking, and light.

Conclusions

It has been demonstrated that, for the dyes used in this study, the chitosan pretreatment had:

1. Significant and desirable effects on the color properties.
2. Noticeable change in nep coverage.
3. Improved fabric appearance.

It is evident from these results that a full range of medium to dark shades may be produced on cotton fabrics containing neps. Thus, it is possible to simultaneously improve the colorfastness properties, as well as cover the neps.

Reference

(1) Mehta, R.D., "An Improved Process for Nep Coverage in Dyeing Cotton". American Dyestuff Reporter, Sept., 1991.

Table 1: Color Difference Values and Color Strength

	ΔL	Δa	Δb	ΔE	Strength
RY168	-1.79	3.53	0.10	3.96	13.5%
RR235	-6.15	0.56	4.84	7.85	69.0%
RB235	-3.26	1.77	1.60	4.04	20.0%
RBL5	-2.05	2.47	2.49	4.06	11.0%

Table 2: Color Difference Values and Color Strength

	ΔL	Δa	Δb	ΔE	Strength
RY168	-2.24	3.29	-1.33	4.20	11.0%
RR235	-5.60	1.68	3.04	6.59	64.0%
RB235	-1.19	1.14	1.20	2.04	04.0%
RBL5	-3.17	2.86	2.48	494	20.0%

Table 3: Dye Performance of Fabrics

	Washfastness Alteration	Crocking Dry	Wet	Lightfastness 20 Hours
RY168 Untreated	5	5	4.5	4.5
RY168 Treated	5	4.5	4	4.5
RR235 Untreated	4	4	3.5	4
RR235 Treated	5	5	3	4.5
RB235 Untreated	4.5	3.5	3.5	5
RB235 Treated	5	4	3	5
RBL5 Untreated	5	5	4	4
RBL5 Treated	5	4	2.5	3

Table 4: Dye Performance of Fabrics

	Washfastness Alteration	Crocking Dry	Wet	Lightfastness 20 Hours
RY168 Untreated	5	4	4	5
RY168 Treated	5	3.5	3.5	5
RR235 Untreated	5	4	3.5	4.5
RR235 Treated	5	3	3	4
RB235 Untreated	5	3.5	3.5	5
RB235 Treated	5	3	3	5
RBL5 Untreated	5	3.5	4	4.5
RBL5 Treated	5	5	3	3.5

FIBER PROPERTIES SEMINAR FOR COTTON BREEDERS

Sixteen public and private cotton breeders attended the second Seminar on the Testing and Measurement of Cotton Fiber Properties February 27 and 28 at the ITC. The curriculum included sessions on fiber properties, history of testing, utilizing fiber measurements in screening, advanced screening and SPY tests, fiber issues in textile processing, bale selection, and a demonstration of fiber processing. Attending were: Mark Barfield, Stoneville Pedigreed Seed Co.; Dick Bassett, UC Shafter; Judith Bradow and Gayle Davidonis, USDA, SRRC, New Orleans; Steve Calhoun, MSU Delta Research Center; Charles Cook, USDA, ARS, Weslaco, TX; Mike Nelson and Mike Johnson, All-Tex Seed; Norma Trolinder and Linda Koonce, BioTex; Gene Lorance, Buttonwillow Research, CA; Mark Mayo and Rodney Smith, Paymaster Cotton Seed; Carl Roberts, NMSU, Las Cruces; and Tommy Valco, Cotton Incorporated, Ag Research.

ATP PROJECT GETS UNDERWAY

In November, the ITC and the Department of Electrical Engineering, Texas Tech University College of Engineering, jointly received a grant for the objective selection and control of cotton for efficient textile manufacturing. The project is funded by the Texas Board of Higher Education Advanced Technology Program (ATP) for basic research benefiting the State of Texas.

Fiber properties of cotton varieties from around the world will be analyzed and entered into a database that will eventually be used for improved bale selection technology. Dean Ethridge of the ITC is the investigator for the project. The data will be analyzed with neural network algorithms with assistance from Don Wunsch, PhD, Assistant Professor, Electrical Engineering, Texas Tech University, co-principal investigator for the project.

Fifty pound samples of lint are being sent in by cotton breeders for fiber testing and spinning trials. The test data will be entered anonymously into the global database.

The two year project will involve most labs and personnel of the ITC. Reiyao Zhu PhD, Head of Fiber Research, Bill Cole, Manager of Short Staple Spinning, Shridhar Chikkodi, Research Associate, and Pauline Williams, Materials Evaluation Manager, are starting test procedures.

Schlafhorst and Zwelleger Uster are industry cooperators on the project.

COTTON ARRIVES FOR ADVANCED TECHNOLOGY PROGRAM PROJECT

(left to right) Reiyao Zhu, PhD, head of Fibers Research, ITC, Dean Ethridge, PhD, Director of the ITC, Jorge Auñón, PhD, Dean of the College of Engineering, Texas Tech University, and Don Wunsch, PhD, Assistant Professor, TTU Electrical Engineering Department look over 100 samples in the ITC warehouse that have arrived from Israel, India, Brazil, Egypt, Turkey, and the U.S.