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TEXTILE topics

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MATERIALS EVALUATION LAB SEES INCREASE IN SAMPLE TESTING

It has been a busy season for the Materials Evaluation Laboratory at the International Textile Center. From September, 2003 through mid-February 2004, the lab has classed approximately 41,300 samples using High Volume Instrument (HVI) testing.

Trays of cotton samples wait to be tested in the Materials Evaluation Laboratory

"Our machines run from the time we open and go non-stop until we close," said Pauline Williams, Lab Manager. "More and more samples arrive daily and we could be running like this well into March," she said.

The lab works closely with cotton breeders across the world, which accounts for the majority of samples tested each year. Employees in the lab take pride in providing a quick turnaround for clients, while maintaining excellent quality control.

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

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GRANT BRINGS NEW TESTING INSTRUMENT TO CENTER

The dyeing and finishing lab will soon have a new Accelerated Light Stability and Weathering Tester thanks to a generous grant from The CH Foundation. This new instrument will be able to test the reaction of textile products (garments, curtains, upholstery etc.) to light and humidity, thereby predicting the effects of sun or weather on the material. The instrument will also allow for "indoor" photo-stability testing by exposing textile products to fluorescent light, halogen, or other general lighting lamps found in retail outlets.

ITC TESTS NEW FIBER MEASUREMENT MACHINE

The International Textile Center is conducting tests on a new machine developed by Shaffner Technologies in Knoxville, Tennessee. The Isotester® is a stand-alone instrument designed to measure many aspects of cotton quality. The ITC is currently working only with the measurement of fiber length and length distribution.

Isotester®

ITC TRAVEL

- Eric Hequet, Mourad Krifa, Noureddine Abidi, Scott Irlbeck, and Dean Ethridge to San Antonio, TX to attend the 2004 Beltwide Cotton Conferences, January 5-9, 2004. Eight presentations were made during this year's meeting.

ANALYSIS OF STICKY COTTON YARN DEFECTS BY SCANNING ELECTRON MICROSCOPY

Noureddine Abidi and Eric Hequet

INTRODUCTION

Cotton contaminated with stickiness, caused by excess sugars on the lint, is a very serious problem and can affect the yarn quality and the textile mills productivity [1-3]. The poor yarn quality is mainly due to the unevenness in the flow of fibers being drawn, while the low productivity is the result of an increase in the cleaning schedule, necessary to clean off the residues accumulated on the textile equipment, and excessive ends-down. Stickiness contamination originates from physiological sugars coming from the plant itself and/or entomological sugars coming from phloem-feeding insects [4]. Insects have been documented as the most common source of contamination in some studies [5]. The analysis of honeydew from the cotton aphid and the cotton whitefly has shown that aphid honeydew contains ~38.3% melezitose plus ~1.1% trehalulose, whereas whitefly honeydew contains ~43.8% trehalulose plus ~16.8% melezitose under the conditions described by Hendrix [6].

During the fibers-to-yarn transformation, the flow of lint is subjected to different friction forces; consequently, the temperature of some mechanical elements may increase significantly and affect the thermal properties of the sugars involved in cotton stickiness contamination. After a sugar becomes sticky, the other sugars present on the lint, as well as other substances (silica, dusts, seed coat fragments etc.) will stick on it, causing unevenness in the flow of the lint being drawn. Problems may include lapping up on the rolls, nep-like structures, yarn breakage, and ends-down.
In this article, we present the results of a study of cotton yarn defects using Scanning Electron Microscopy (SEM). The usefulness of the SEM to analyze the origin of the yarn defects will be demonstrated.

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MATERIALS AND METHODS

Twelve sticky cotton mixes having a moderate level of stickiness were evaluated in both ring and rotor spinning. In the ring spinning trials, the yarns were spun to 30Ne (19.68 tex) and for the open-end spinning trials; the yarn produced was 22Ne (26.84tex). During the processing of these sticky cotton mixes, a large number of yarn defects were noticed. They were identified and collected and the Scanning Electron Microscopy was used to analyze the morphological aspect of the defects. The samples were mounted on the microscope stubs and coated with a layer of gold by means of thermal evaporation in a vacuum coating unit (Polaron SEM Coating Unit). The samples were then viewed using a Hitachi Scanning Electron Microscope Model S500 equipped with Polaroid camera model 55 P/N, using an accelerating voltage of 20 KV.

RESULTS

Figure 1 shows an example of the SEM micrograph of a yarn defect attributed to stickiness. At higher magnification (180x), it reveals that the cotton fibers within the defect are embedded in a matrix of amorphous substance acting like glue, thus interfering with the drawing process during the yarn production (Fig 2-a). For comparison purposes, the micrograph of a yarn made from non-sticky cotton is presented in figure 2-b. Furthermore, at higher magnification, contaminated cotton fibers appear completely coated with the glue-like substance (Fig 3). Accumulation of other materials- silica, dusts, and other crystalline sugars- on this sticky substance is shown in Fig 4.
Prior to spinning the yarn and after machine warming, the textile equipment temperatures were recorded. All were above 25°C [1]. The highest temperature range was recorded on the drawing frame (from 38°C to 53°C). Thus, sugars with low

melting point could be at the origin of the amorphous structure observed in yarn defects.
In order to identify the sugar that is more sensitive to temperature increase, we studied thermal and hygroscopic properties of sugars involved in cotton contamination [1]. First, using Differential Scanning Calorimetry (DSC) we have shown that dehydrated trehalulose, which is present only in insect secretion has, by far, the lowest melting point (48°C). In addition, the DSC profiles showed that this sugar starts melting as soon as the temperature starts rising around 25°C. Second, studying the hygroscopic properties of the sugars, we demonstrated that trehalulose is highly hygroscopic and absorbs ~17.5% of water at 65%±2% relative humidity and 21°C ±1°C [1]. Thus, trehalulose may be at the origin of the glue-like substance observed in the yarn. To confirm this, residues collected on spinning frames after processing of sticky cotton were analyzed using High Performance Liquid Chromatography. The results clearly showed that trehalulose is the sugar that accumulates on the frames.

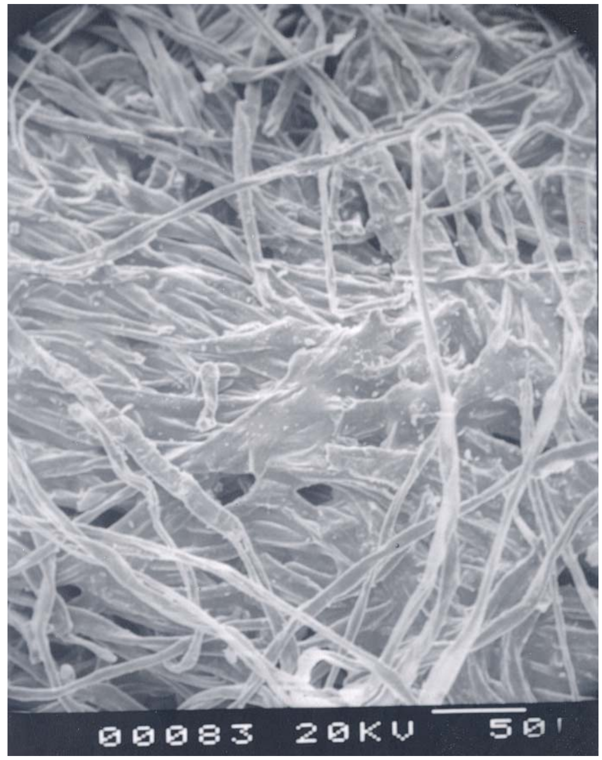

Figure 2(a): SEM micrograph of a yarn defect. Scale bar = 50 microns.

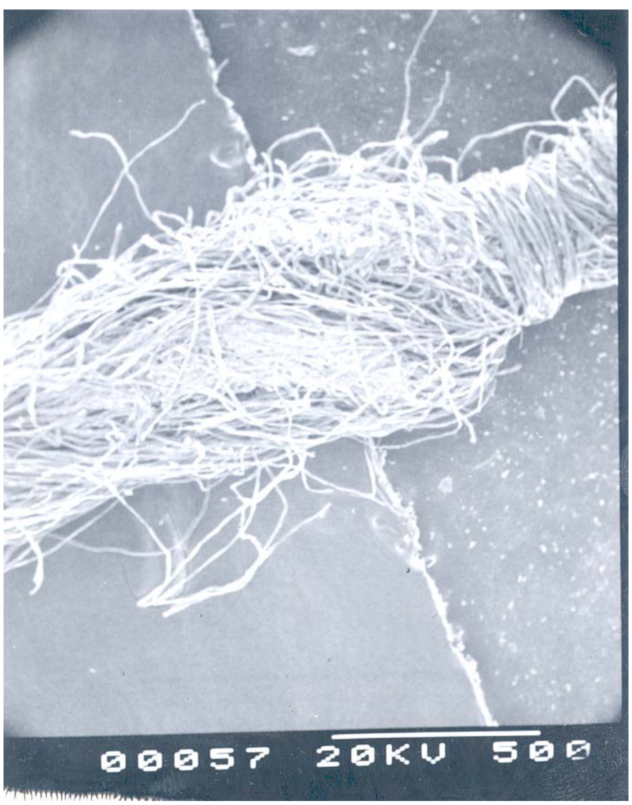

Figure 1: SEM micrograph of a yarn defect attributed to stickiness. Scale bar = 500 microns.

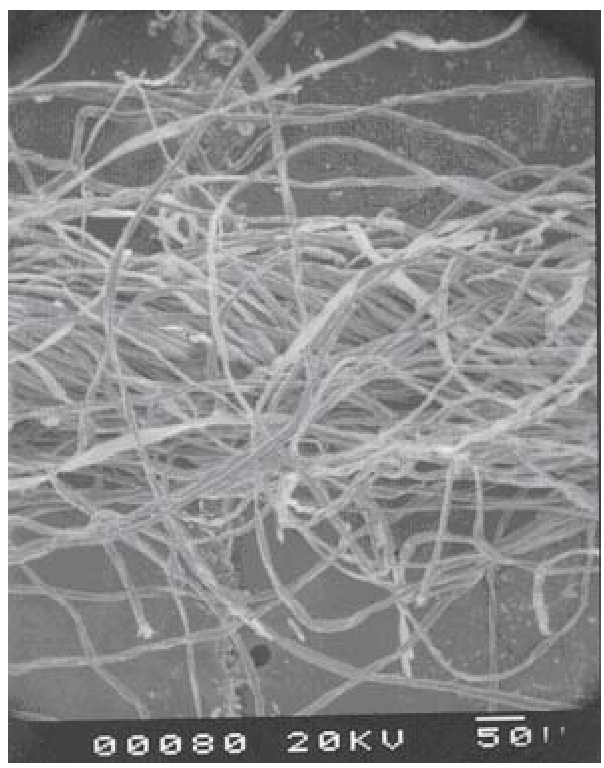

Figure 2(b): SEM micrograph of a yarn without defect. Scale bar = 50 microns

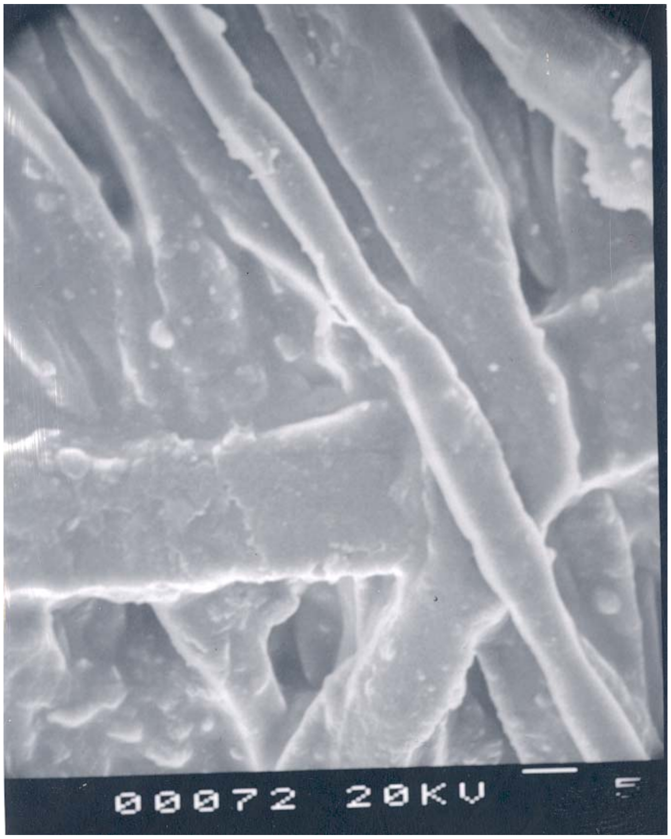

Figure 3: SEM micrograph of a yarn defect showing the glue-like substance. Scale bar = 5 microns.

Figure 4: SEM micrograph of a yarn defect showing accumulation of other materials. Scale bar = 5 microns

CONCLUSIONS

This article demonstrated the usefulness of the SEM to investigate the origin of yarn defects noticed during the processing of cotton contaminated with insect sugars. The morphological examination of the yarn defect was very important to understand the effect of the temperature increase on the sugar properties and to discriminate between type of cotton contamination.

ACKNOWLEDGEMENT

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