THE SDL-CIRAD HIGH SPEED STICKINESS DETECTOR: IMPROVEMENTS INCORPORATED IN THE PRODUCTION VERSION

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Abstract

The stickiness of cottons during the spinning process has now become a selection criterion in the spinning industry. It would therefore be advantageous at the production stage to evaluate the stickiness of each bale. The analytical rate of the H2SD detector is compatible with that of HVI measurement lines and the results it gives correlate well with those obtained on the SCT thermodetector. The H2SD is therefore very promising for a bale-by-bale evaluation. In comparison with the prototype, the production machine has been improved for intensive use in an industrial environment and modified to provide easy maintenance.

Introduction

An analysis of the 1996-1997 season shows that cotton is cropped in more than 70 countries, with world-wide production estimated at approximately 20 million tonnes. Certain cottons disrupt the spinning process by depositing sticky substances onto machine parts that exert pressure, e.g. the card, drawing frame and rotor turbines. These cottons are primarily contaminated with honeydew produced by aphids and white fly. The resulting increase in neppiness and irregularities decreases the quality of the yarn produced.

For spinners, the stickiness of a given cotton has therefore become a selection criterion. Thus, cotton producers are sometimes obliged to sell their cotton at a discount. Under these conditions, a country that has acquired a reputation for supplying sticky cottons may see its entire production down-graded, whereas in fact, a preliminary study has shown that a significant proportion of the cotton produced in that country is uncontaminated. The capacity to characterize each individual bale for its stickiness at the production stage can therefore be a considerable advantage, separating the uncontaminated cotton so that it can be more profitably utilized. Spinners could thus reduce the effects caused by contaminated cotton using appropriate means, such as mixing cottons for which the degree of stickiness has previously been determined, decreasing relative humidity (Gutknecht *et al*., 1988; Frydrych, 1996), or using various treatments, such as additives (Perkins, 1992), washing (ICAC, 1994).

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Testing the stickiness of each bale requires a machine that is able to detect stickiness as rapidly as the analyses performed by HVI lines for other characteristics. To meet this challenge, CIRAD has developed a detection machine that functions more rapidly than the SCT thermodetector (Perkins, 1993). The machine is called the H2SD (high speed stickiness detector). Here, we present the improvements made to the detection system and describe the performance of this machine which is manufactured in partnership with SDL (Stockport, UK) and should be available on the market in 1998.

H2SD Detection and Measurement of Stickiness

Improvements Made

The H2SD (Frydrych *et al*., 1994) is made up of five work stations (fig. 1): rotor opening of the cotton sample (1), hot pressure (2), pressure at ambient temperature (3), cleaning of the aluminium mounting and removal of non-sticky fibers (4), counter of sticky points or honeydew deposits on the mounting (5). The sample is carried successively and automatically from one station to the next. As these stations are independent, several samples can be processed simultaneously. Thus, the machine is able to analyze a sample in 30 seconds (table 1). This 30-second window in fact corresponds to the time required for the technician to feed samples into the machine and note the reference name by typing on the keyboard. It could therefore be reduced still further when automatic feeding (that is currently under study) is operational and when sample references are entered using bar codes.

As the H2SD can analyze approximately 100 samples/hour, work was conducted to optimize the functioning of each station in order to render the machine compatible with intensive use in an industrial environment. In addition, access to the various parts of the machine has been improved for easy and rapid maintenance. This applies to both the mechanical and the electronic sections of the machine.

The rotor (1) opens a cotton sample weighting approximately 3.5 g in 15 seconds. This rotor has been designed to provide maximum opening of the cotton while producing as little dust and as few loose fibers as possible; the rotor generates very little noise as it relies on direct transmission. The rotor is housed underneath a rigid cover that is compatible with the processing of all types of cotton (saw-ginned or roller-ginned) and provides an excellent interface between the base and the aluminium mounting.

A single housing contains the hot-pressure plate (2) and the ambient-temperature pressure plate (3). The plates are cleaned after each test to remove any sticky residues.

The cleaning (4) consists of sucking up the mass of unstuck fibers and discarding these into a hopper outside the machine. A rotating cylinder coated with a soft material then removes any further fibers not stuck to honeydew deposits. Before counting the sticky points, any residual dust is sucked out of the housing where the image of the sticky points is taken.

The sticky-point counting system consists of a camera and image-processing software (5). Information displayed on the screen (fig. 2) includes a digital image of the sticky points (1), a histogram of sticky-point size (2), the results (3) along with the sample reference name, the total number of sticky points and distribution in three size classes (small, medium and large). It has been shown (Hequet *et al*., 1997) that this size distribution is very variable from one cotton to the next. Disruption caused in the spinning process probably also depends on the size of the sticky points, and weighting of the total sticky-point count with respect to size should also be considered.

The rotor, pressure unit, cleaning system and image analyzer are independent modules that can be replaced with ease. The assembly made up of the conveyor mechanism and the modules is mounted on a slide system that can be withdrawn from the machine.

The machine's control system has been concentrated in a rack. General system function is checked before powering-up the machine and some of the automatic processes are controlled by a microcomputer.

Results Obtained with the H2SD

Fifty cottons samples, with three replications, originating in different countries were tested on the H2SD and the thermodetector SCT.

A very good relationship was obtained between the results on the thermodetector and on the H2SD as a correlation coefficient of 0.92 was observed. The data were converted into square root values in order to meet the conditions required for linear regression.

Conclusion

As many cottons now show stickiness caused by insect honeydew, the development of a rapid method for the detection of stickiness is more important than ever. This will allow countries with a reputation for producing sticky cottons to make better use of their non-sticky cotton, and provide the spinning industry with a tool for managing cotton purchasing and storage. The high-speed H2SD sticky cotton detector is very promising in this field. The improvements made to the production version optimize the machine's operations for intensive use in an industrial environment and provide easy access to the different stations for rapid maintenance. These changes increase the machine's reliability while conserving an analysis rate compatible with HVI measuring lines (20 to 30 seconds). The results obtained with the H2SD correlate well with those given by the apparatus currently recommended by the ITMF, i.e. the SCT thermodetector. A bale-by-bale classification of stickiness for entire production batches can therefore be envisaged. The machine developed by CIRAD will be manufactured and marketed in 1998 by SDL (Stockport, UK). The inclusion within this machine of a new module to measure neppiness is currently under study.

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Table 1. Sample sequence for each station in automatic mode

Time in seconds	Opener	Hot pressure	Pressure at ambient T°	Image analysis
30	sample 1			
60	sample 2	sample 1		
90	sample 3	sample 2	sample 1	
120	sample 4	sample 3	sample 2	sample 1

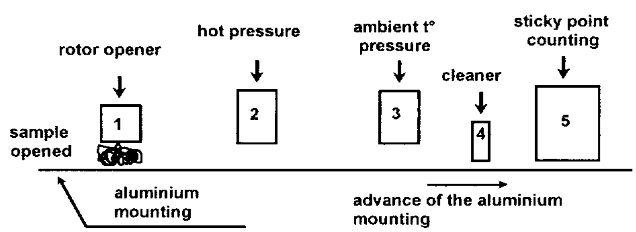

Figure 1. H2SD principle: five work stations

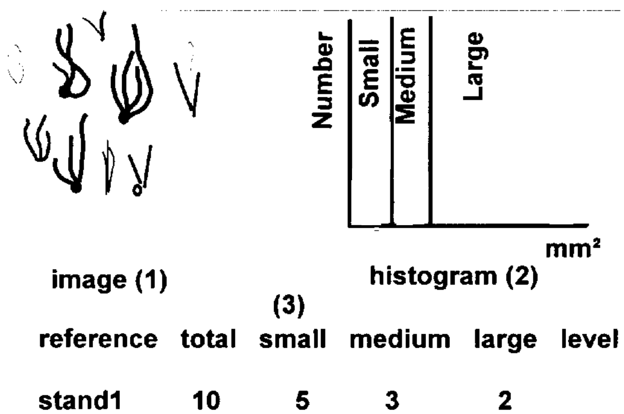

Figure 2. Results on the screen

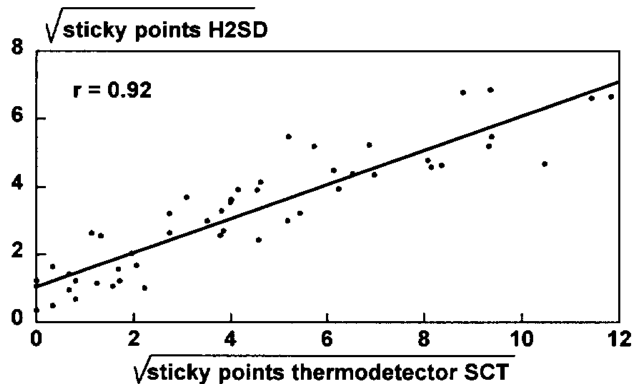

Figure 3. Thermodetector SCT vs H2SD on 50 samples from different countries (mean of 3 replications)