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FIRST EXPERIENCE OF THE AUTOMATED STICKINESS TESTING WITH LOEPFE FIBERMAP AND MESDAN CONTEST

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• ABSTRACT

The Loepfe LabMaster® FIBERMAP together with Mesdan CONTEST® set a new standard for laboratory measurement of cotton. The testing devices, which are developed on the same platform, integrate the most important measurement functions into one system in order to complete the fiber profile throughout the whole preparation process of the spinning mill, from bale to finisher sliver. Apart from delivering the standard data known from cotton classification, detailed analysis of process relevant fragments such as neps, seed coat neps, trash and stickiness are integrated.

One of the unique features of the instruments is the automated measurement of stickiness. Over the past two years, we have carried out various investigations and analyses on the measurement of this parameter, collected the experience of several customers and analyzed round trial results. The result of these efforts are shown in this presentation.

We were able to prove that our instruments provide a reliable solution for both cotton traders and spinners.

• INTRODUCTION

Loepfe LabMaster FIBERMAP® and Mesdan CONTEST®

Mesdan and Loepfe developed two instruments that are able to measure parameters, which are important to evaluate the raw material and to control the preparation process.
The instrument sold by Mesdan is the so-called CONTEST®. The instrument sold by Loepfe is called LabMaster FIBERMAP®. Both instruments use the same platform and technologies to measure neps, seed coat neps, trash, stickiness and Micronaire, maturity, and fineness.
In addition to these properties relevant for processing, Loepfe LabMaster® FIBERMAP measures all the parameters that are required for cotton classification. These are length, strength, elongation, color and trash.

Fig. 1: Mesdan CONTEST®

Fig. 2: Loepfe LabMaster® FIBERMAP

In this presentation, I am going to look in more detail into the stickiness measurement of both instruments. The evaluation of the stickiness is a very critical matter for the whole cotton supply and processing chain. A spinning mill needs to know if there is any risk of stickiness as it can cause severe problems from deterioration of quality, increased maintenance for cleaning, clogging of machinery up to production loss or even complete shutdown of the whole spinning mill.

Overview of topics

In this presentation, the focus is going to be on

- The investigation on various factors influencing stickiness results
- The results of the stickiness round trial
- First customer experience with the instrument

Measuring principle of the Stickiness Module

A 3.5 gram specimen made of cotton (hand shaped in sliver form) is automatically transformed into a 10 meters thin homogenous web by a number of carding elements. After the web has gone through the contamination measuring unit, the web is passed through two heated (35°C) drums, which press against each other at a constant pressure. Sticky particles adhere on the rollers whereas the web is sucked away and delivered to the next test. The sticky deposits are optically counted and classified according to size. At the end of the test, the drums are cleaned by brushes and knives to prevent repeated counting of sticky deposits. The measured stickiness is graded by a special algorithm that gives higher importance to large deposits.

Advantages of the Stickiness Module

One of the biggest advantages of this module is that it enables accurate and rapid measuring of stickiness thus making it suitable for mass testing of large numbers of samples. The stickiness is measured in less than 60 seconds. The instrument gives the spinner an operator-independent tool that is able to classify the cotton bales according to Stickiness Grade (from non-sticky to low, moderate and sticky bales) - the same as for other known classing parameters - and to take relevant processing decisions.
But overall, the most important advantage is the ability to provide practical information on cotton stickiness simulating the passage of the cotton through rollers and drums in various stages of spinning preparation: it detects all sticky deposits coming from different sources (insects' honeydew, concentration of plant sugars, crush seeds, oil, etc.) that can contaminate the spinning machinery.

Overview of factors influencing stickiness results

The following factors were analyzed with regard to their influence on the test results:

- Sample size
- Degree of opening / homogeneity
- Sample conditioning / humidity
- Drum temperature

Seven different type of cottons were used for these trials:

- Sudan: Barakat
- Sudan: Acala
- India: Shankar 6
- US: Ultima
- Ivory Coast
- US Pima
- Egypt Giza 86

With this selection, it was the intention on one side to cover different levels of stickiness, but also to cover other factors, such as different trash grades or fiber lengths.

Influence of sample size

The standard sample size is 3.5 grams. The size varied between 3.4 to 4.3 grams for the trial.

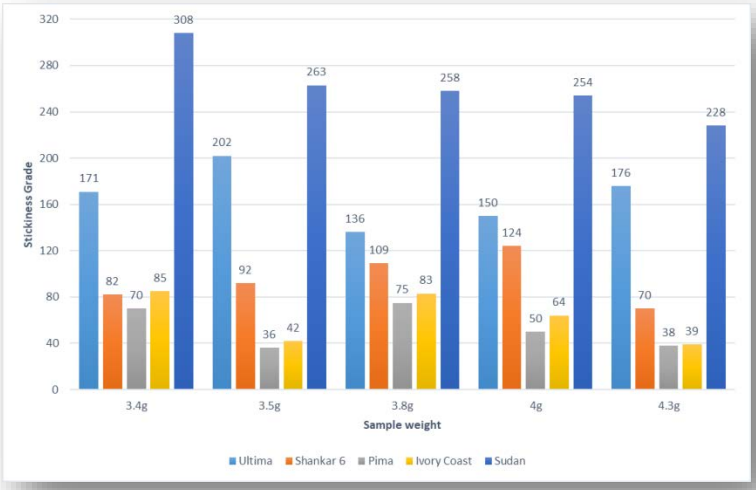

Fig. 3: Influence of the sample size

The conclusion of this trial was that the sample size has no influence on the number of sticky points / stickiness grade. The number of sticky points is calculated per gram independent of the initial weight and the recovery weight (weight of the ejected sample after all tests have been carried out).

However, probably more interesting for a spinner, is the number of recommended subsamples within a bale to get a reliable indication of the stickiness level. Our recommendation is to test 7 – 10 subsamples per bale for the best precision – assuming that the stickiness is distributed homogeneously within the bale. A first indication can be reached already with just 3 subsamples per bale. For the evaluation of a whole cotton lot, our initial recommendation is 25% of the bales, which should be tested. However, depending on the variation, a statistical approach is recommended.

Influence of degree of opening / homogeneity

In order to investigate the influence of a sample homogeneity, we prepared the samples with the so-called Raw Cotton Selector from Mesdan before the test with FIBERMAP. The Raw Cotton Selector is a mini-card which works without flats. The sample needs to be removed by a long needle from the wires in order to obtain a more homogenous web. This sample was then used to feed the FIBERMAP. All samples were inserted in the direction of the card.

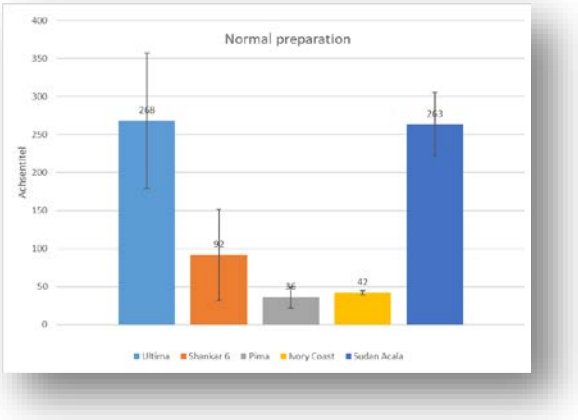

Fig. 4: Normal sample preparation

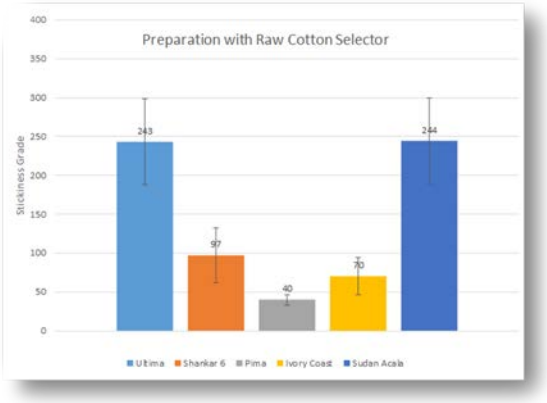

Fig. 5: Sample prepared with the RCS

Our conclusion is that there is no statistical significance on the stickiness grade – also independent of the stickiness grade of the reference samples. However, the standard deviation of the stickiness grade decreased slightly when the sample was prepared with the RCS. This means that the preparation improved the homogeneity of the stickiness within the sample. We can conclude that the preparation of the sample with FIBERMAP is absolutely appropriate and good enough for a reproducible measurement.

Influence of conditioning / humidity

This trial shows the influence of the conditioning at a range of nine different temperatures and relative humidities. The samples were conditioned in a conditioning oven for at least 24 hours and tested immediately.

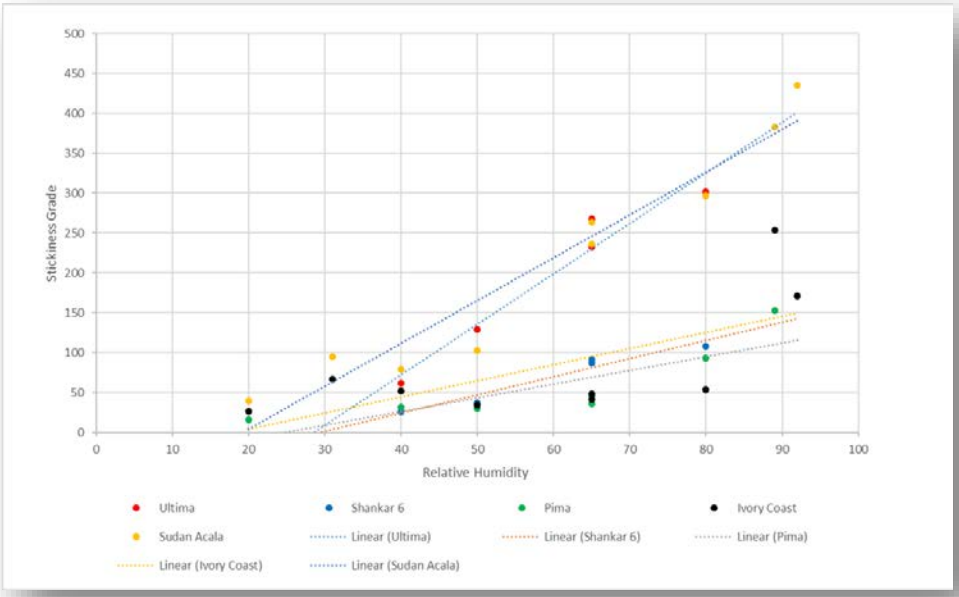

Fig. 6: Results of conditioning tests

The results of this test are very interesting. We can see that the stickiness grade is increasing when the samples were conditioned at a higher relative humidity. However, this trend can only be observed for cotton samples that can be considered as sticky. Non-sticky cotton is not becoming a sticky cotton with higher relative humidity. Therefore, we can say that the proper conditioning of the cotton is as important for the measurement of stickiness as with the measurement of other cotton parameters such as length, strength and neps.
The standard as well as the complementary laboratory atmospheres are marked in the graph. You can see that the difference of 15% of relative humidity already makes a big difference for cottons which have a tendency to stickiness. Non-sticky cottons are not affected by these changes.

Influence of the drum temperature

It is well known that the reasons for stickiness can be numerous. However, the most common reason are whiteflies and aphids. Their secretions (trehalulose) melt at lower temperatures than other kind of sugars such as glucose. The FIBERMAP contributes to this fact and measures the stickiness at a temperature of 35°C.
In this trial, the temperature was varied between 30°C and 40°C. The selection of samples included a range from non-sticky cottons to very sticky cottons.

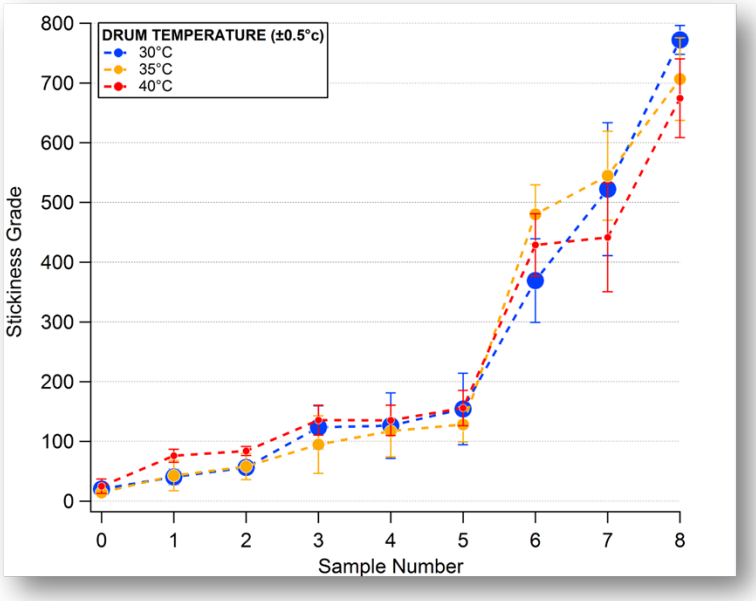

Fig. 7: Influence of drum temperature

With this trial, we could prove that there is no significant difference between the stickiness results within the described temperature range. There is no trend towards higher stickiness results within this temperature range. However, the drum temperature is kept at a constant temperature of 35°C +/- 2°C. From the instrument side, no measurements are possible outside this range.

Results of the stickiness round trial 2017

In 2017, the first stickiness round trial organized by the Stickiness Task Force of the ITMF-ICCTM took place. Three different cottons were distributed among the participating laboratories. Samples A and B were the same cotton, however homogenized with two different methods.
Mesdan and Loepfe were highly satisfied with the results of this round trial. The inter-laboratory variation between our 5 participating instruments was mostly between 10 – 16%, which is very high considering the natural variation within one sample which is in the same range. The inter-laboratory variation for other testing devices with a certain population was approximately between 15 – 30%.

INSTRUMENT	COTTON A			COTTON B			COTTON C		
	AVG	SD	CV	AVG	SD	CV	AVG	SD	CV
CONTEST 103	359	125	35%	388	64	16%	448	19	4%
CONTEST 106	348	46	13%	339	43	13%	523	34	7%

FM 105	469	37	8%	329	43	13%	684	38	6%
FM 104				304	53	18%	509	49	10%
CONTEST 101	348	77	22%	311	60	19%	560	84	15%
Average	381	71	20%	334	53	16%	545	45	8%
SD	59			33			88		
CV	16%			10%			16%		

Fig. 8: Stickiness round trial results 2017

First customer experience

At the end of my presentation, I would like to show you the first customer experience for the stickiness measurement. The results shown come from a spinning mill in Turkey using mainly cotton from the Mediterranean region, which is known to be non-sticky.

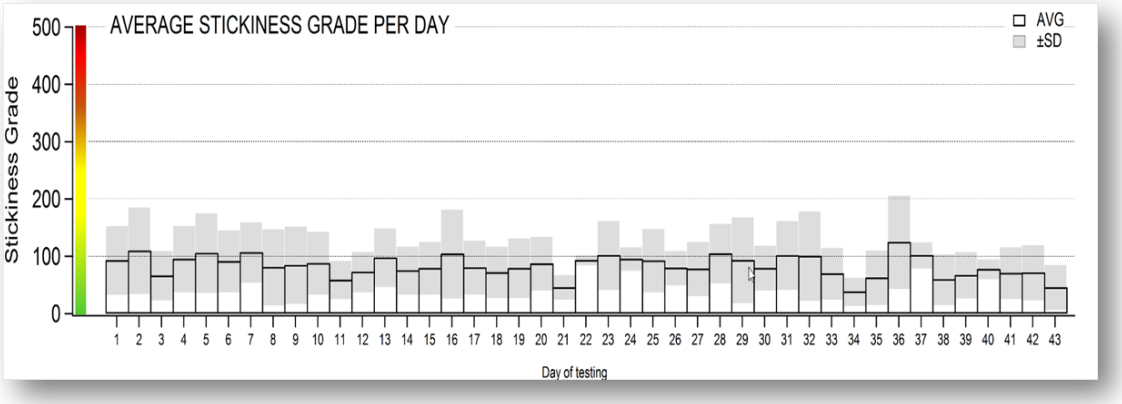

Fig. 9: Customer experience

The results confirm the high stability and reliability of the instrument. All results are within a stickiness grade level which is considered as none to low sticky. Even when the standard deviation of the measurements is taken into account, the results are stable. The customer relies on the instrument for the selection of cottons before the purchase as well as for the daily lay-down mix.

Conclusion

Summarizing the findings and experience from the last two years, we can say that the Loepfe FIBERMAP / Mesdan CONTEST are reliable instruments for the measurement of stickiness. As

the instrument-to-instrument variation lies within the natural variation of the stickiness, it can be used to exchange stickiness results between laboratories and for the trade. A spinning mill can rely on the stickiness results for the selection of their daily lay-down in order to avoid surprises in the performance of the spinning mill.

Our recommendation for testing cotton regarding stickiness is:

- Testing 3 – 7 subsamples per bale
- For the definition of tests of a whole cotton lot, a statistical approach is needed. Our initial recommendation is to test 25% of the bales.
- Conditioning the bales at standard conditions is important
- Sample size, preparation / homogeneity of the sample and the drum temperature are controlled within the instrument and need no special attention from the operator

Together, Loepfe and Mesdan are offering a reliable solution for one of the big challenges in trading and spinning cotton. We will continue our efforts to deliver an instrument that meets market requirements for stickiness as well as other central parameters in cotton testing.

Thank you very much for your attention! Sandra Meier