Objective handfeel assessment of knitted fabrics made of LENZING™ ECOVERO™ fiber, cotton and their blends

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Abstract

Handfeel of knitted fabrics made of LENZING™ ECOVERO™ viscose fiber (in the following text ECOVERO™) in comparison to cotton was assessed using Phabrometer (AATCC 202) and Tactile Sensation Analyzer (TSA). The results show the advantage of ECOVERO™ in comparison with cotton in terms of handfeel, and the improvements achieved by blending the fiber to cotton.

Materials

The Single Jerseys were knitted on a E28 circular knitting machine with Ne 30 yarns. The material composition (ECOVERO™/cotton ratio) of the fabrics are indicated in Table 1. The fabrics were fully plated with 6% 22dtex Elastane.

To obtain a comparison near to textile product reality, the fabrics were treated in a finishing process typical for light knits. Samples containing cotton were bleached in a mild peroxide treatment. The ECOVERO™ fabric was scoured (light alkali-wash). All samples went through a reactive dyeing process dyed on a Softflow machine and softened with a combination of polysiloxan and fatty acid condensation product on a padder.

In the following assessment, the fabrics were measured on the right fabric side.

Experimental

Tactile Sensation Analyzer (TSA) is a technology developed by Emtec GmbH (Germany) [1,2], where the surface properties of the fabric are assessed through the sonic waves (noise) of the vibrations induced by the friction of a rotating part on the fabric surface (Figure1, left). In the recorded sonic spectrum (Figure1, right), the signal peak at 750 Hz (stated as TS750) results from the vibration of the fabric under the rotating part and correlates according to the provider with the fabric's smoothness. The signal at 6500 Hz (stated as TS7) results from the vibration on the rotating blades above the fabric surface and is related to the "softness" of the surface fibers bending under the blade. The lower these values, the smoother resp. softer the fabric. An algorithm based on the correlation of these values, fabric mass per unit area, thickness, and the correlation with a human handfeel assessment [3] provides the Handfeel Value (HF). Phabrometer™ measurements were performed using a Nu Cybertek (Hong Kong) device according to AATCC 202-2012 [4]. In this method, the force-displacement curve is measured while pushing the fabric through an opening (Figure 2, left) and the resulting curves (Figure 2, right) analyzed to provide an internal algorithm based on a correlation with human sensation to provide values for softness, drape and smoothness. The relative handfeel value represents a ranking in comparison to the softest fabric [5,6,7].

Table 1: Material composition and fabric code

Fabric composition	Fabric Code		Mass per area (g/m²)	Fabric thickness (µm)
ECOVERO™	E33-22-0521-03	337	234	0.74
ECOVERO™/cotton 50:50	E33-22-0521-04	342	192	0.68
ECOVERO™/cotton 30:70	E33-22-0521-05	343	180	0.67
Cotton	E33-22-0521-08	347	162	0.59

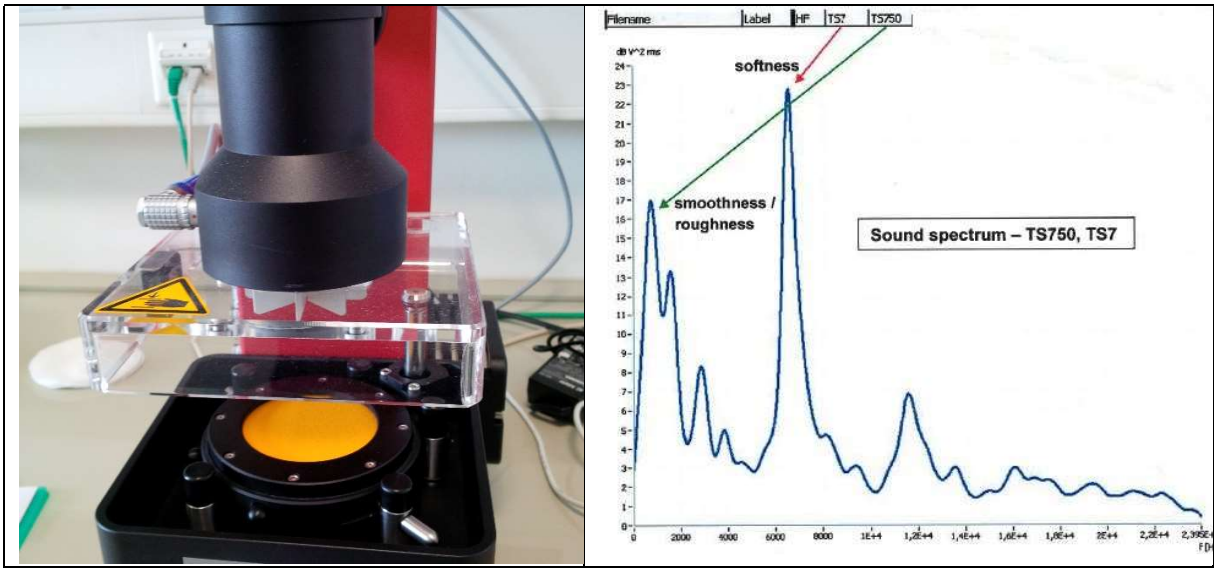

Figure 1: Tactile Sensation Analyzer (TSA) device (left) and an example of the sonic spectrum obtained

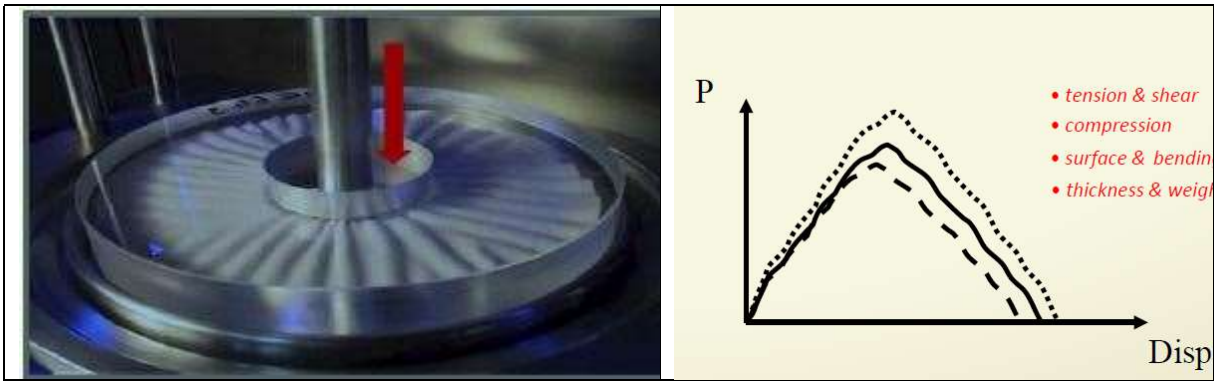

Figure 2: Device action (left) and an example the resulting force/displacement curve of the Phabrometer (source: nu Cybertek, briefing presentation for Lenzing)

Table 2: Tactile Sensation Analyzer (TSA) results

	TS7 (dB V^2 rms)[1]		TS750 (dB V^2 rms)[1]		Handfeel (HF)[2]
	Value	CV%	Value	CV%	
ECOVERO™	2.2	8.8	10.9	13.3	23.7
ECOVERO™ /Cotton 50:50	3.1	3.0	17.8	4.6	11.4
ECOVERO™ /Cotton 30:70	3.2	1.3	18.4	3.1	7.7
Cotton	5.0	6.9	15.8	5.3	7.0

[1]: the lower the TS7 value, the lower the noise, resp. smoother the fabric.
[2]: The higher the HF value, the softer the fabric

Wrinkle recovery results from the difference between the force-displacement curves of the sample and the repetition measurement of the same specimen. It expresses the recovery of the fabric from the compression and deformations caused by the first test run.

Results and discussion

The results of TSA measurements are shown in table 2. The handfeel value (HF) shows a clear trend of the relation between the fabric softness and the ECOVERO™ content in the fabric.

Figure 3 illustrates the effect of ECOVERO™ content on the fabric handfeel.

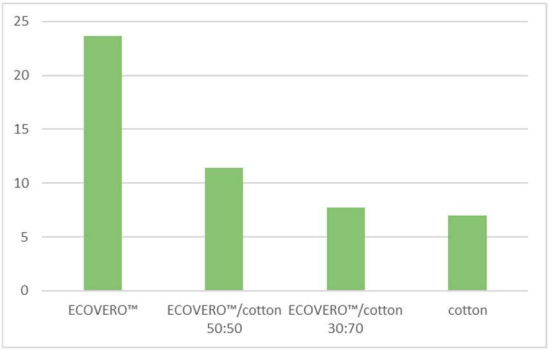

Figure 3: TSA handfeel values (HF) of the blend gradient ECOVERO™ - cotton

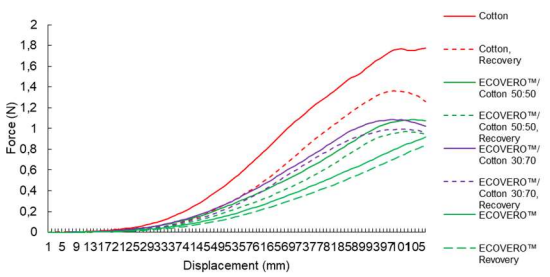

Figure 4: Force/displacement curves of the ECOVERO™/cotton blend gradient measured by PhabrometerTM

Similar trends were observed in the Phabrometer™ results. Figure 4 shows the force-displacement curves of the fabrics in the original measurement and the repetition to assess the wrinkle recovery. The results show that more force was required to push the cotton fabric through the opening, and that the necessary force decrease with the ECOVERO™ fiber content in the fabrics, meaning that the fabric becomes more flexible and show increased drape.

The detailed analysis of these characteristics is given in the Table 3.

Table 3: PhabrometerTM fabric descriptors as derived from the fore/displacement curves

Fabric	Drape[1]	Resilience (stiffness) Score[2]	Softness Score[2]	Smoothness Score[2]	Wrinkle Recovery Rate (%)[2]	*RHV[3]
ECOVERO™	1.48	32.00	**78.61**	53.74	74.16	0.00
ECOVERO™ /Cotton 50:50	3.33	34.58	77.23	54.11	73.45	1.86
ECOVERO™ /Cotton 30:70	4.12	35.69	76.65	54.30	81.63	2.66
Cotton	8.29	41.49	73.63	55.11	52.03	6.83

1: The smaller value, the higher the property
2: The larger the value, higher the property
3: Relative Hand Value (RHV) shows the difference of each sample relative to the softest fabric.

In this assessment, ECOVERO™ fabrics also show improved wrinkle recovery in comparison to cotton. The results show that adding ECOVERO™ even in minority blends leads to a significant improvement in wrinkle recovery.

Conclusion

Handfeel-relevant characteristics of knits made of ECOVERO™ and its blends with cotton were assessed by two objective methods. The results show the advantage of ECOVERO™ in terms of handfeel in comparison with cotton, and the possibility to improve handfeel and wrinkle recovery of cotton fabrics by blending ECOVERO™.

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