

INTERNATIONAL
COTTON
CONFERENCE
BREMEN

2024



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PRESENTATION

Session:

Recycling

Title:

The use of recycled materials in short staple spinning

Speaker:

Anja Schleth, Uster Technologies AG (Switzerland)

Conference Organisation

Faserinstitut Bremen e.V., Bremen, Germany. E-Mail: conference@faserinstitut.de

Bremer Baumwollbörse, Bremen, Germany. E-Mail: info@baumwollboerse.de

USTER® STATISTICS 2023

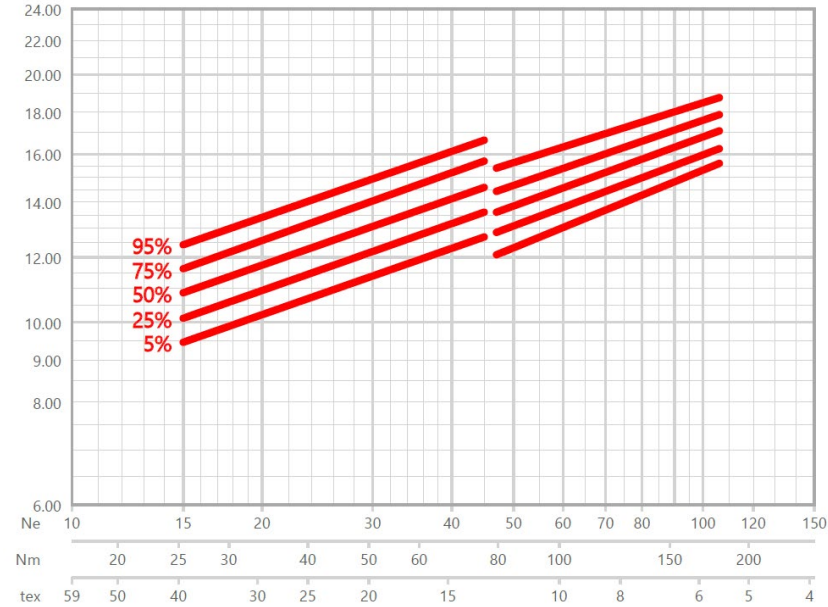
Yarn

Cotton/Recycled cotton, 70%/30%, Carded, Ring yarn, Package, Any application

Legend

Yarn count (15-40Ne) USP™ 5-95%

Characteristic	Value	Unit	USP™
Mass CS			25
CVm	15.47	[%]	25
CVm 1m	4.15	[%]	25
CVm 3m	3.51	[%]	25
CVm 10m	2.49	[%]	25
CVb CVm	1.8	[%]	25
CVb C	1	[%]	25
Imperfection CS			5
Thin -40%	134	[/km]	5
Thin -50%	16	[/km]	5
Thick +35%	376	[/km]	5
Thick +50%	85	[/km]	5
Neps +140%	421	[/km]	5
Neps +200%	91	[/km]	5
Hairiness OH / HL			
H	9.4	[]	79
CVb H	4.4	[%]	50
sH	1.9	[]	50



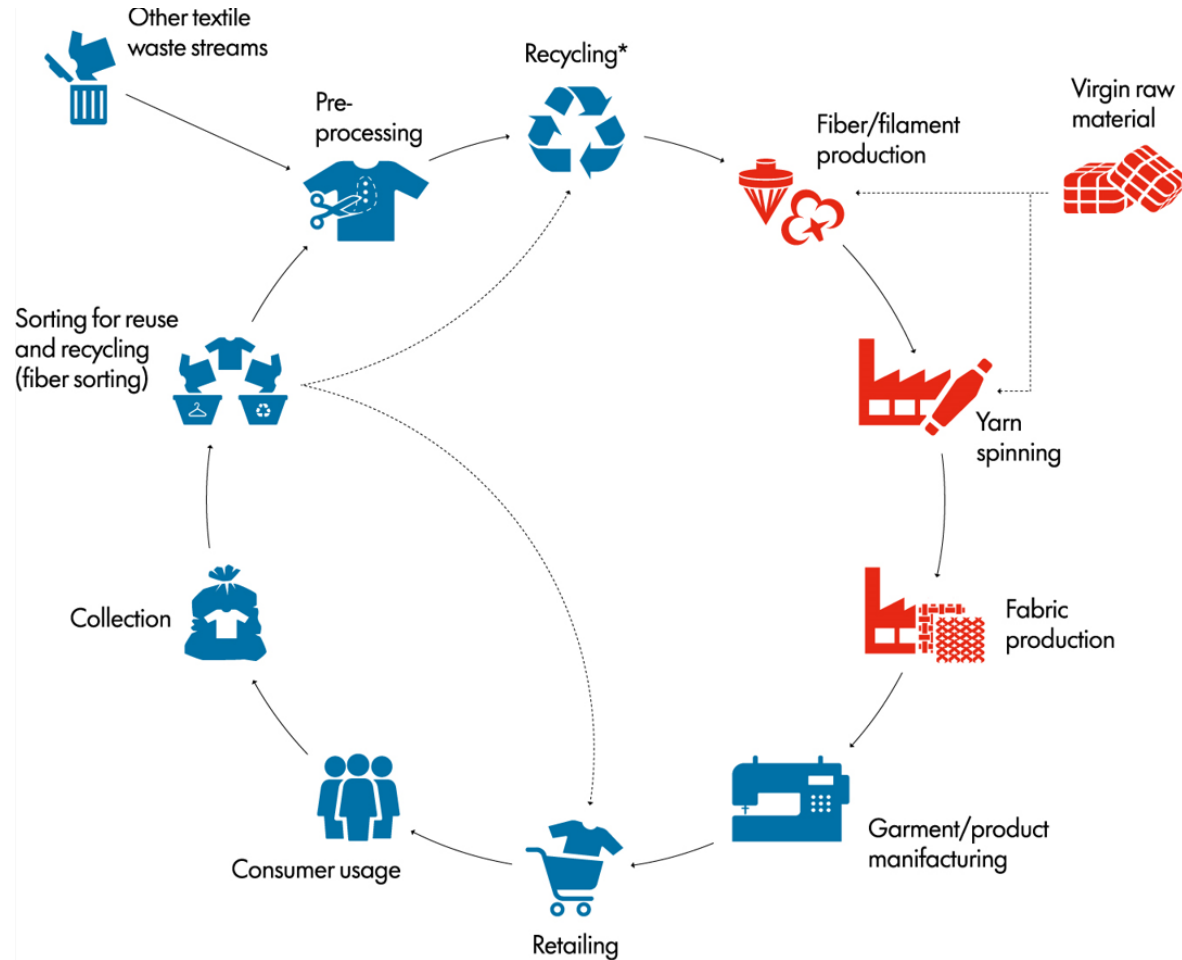
Uster Technologies AG

The use of recycled materials in short staple spinning

Why textile recycling?



The textile value chain today



- The textile value chain today is changing rapidly
- Trying to adapt to the increasing demand for a circular approach in textile production and consumption
- Uster's traditional areas of expertise are highlighted in **red**
- **Blue** are those areas outside Uster's traditional business environment but that are, rapidly, becoming increasingly important

Definition

Waste types

Industrial Waste



'Hard' waste from the winder, for example

Pre-Consumer Waste



Unsold T-shirts in a shop

Post-Consumer Waste



Typical collection of discarded clothing

Definition

Recycling methods

The three major recycling methods are:

Mechanical



Used in short-staple spinning

Thermo-mechanical



Used in Filament & short-staple spinning

Chemical



Used in Filament & short-staple spinning

Challenges in yarn production

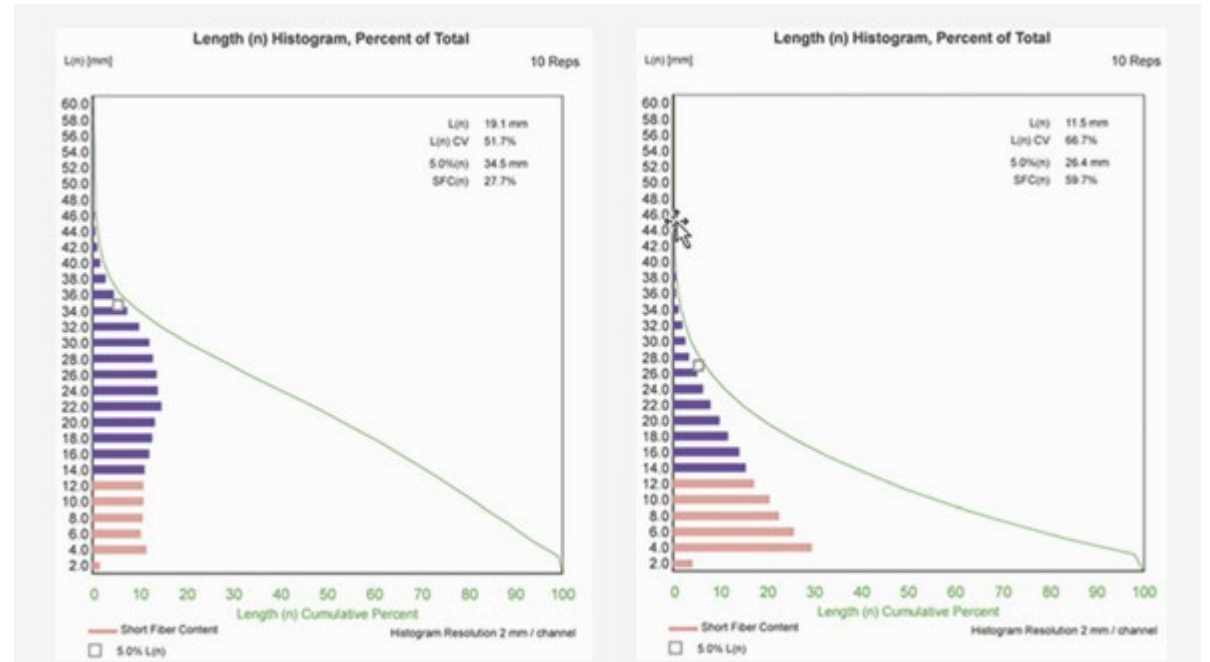
Fiber: Influence on length and short fiber content

Comparison between a 100% virgin cotton (left) with a 100% recycled cotton from industrial waste (right):

- All average fiber length parameters are a lot shorter for the recycled cotton.
- Short fiber content is high, and the fiber length variation is accordingly larger.

→ 'Uneven' fiber length distributions are not ideal for blending, leading to challenges in the spinning process, especially in drawing.

Bale	L(n)	L(n) CV%	SFC (n)	5% L(n)
100% CO	19.1	51.7	27.7	34.5
100% CO-R	11.5	66.7	59.7	25.4



Challenges in yarn production

Yarn: Influence on short mass-variations 1m, 3m, 10m

In yarns with recycled fiber content, it is noticeable that:

- Even if the CVm is still reasonably good, as indicated in the lower USP values
- There are difficulties with the cut length results CVm 1m, 3m and 10m that are all showing higher USP values

→ Increased short mass-variations can result in an uneven fabric appearance.

Ne 10, rotor yarn, carded, 52% PES / 48% CO-R

No.	CVm %	CVm 1m %	CVm 3m %	CVm 10m %
1 / 1	14.09	5.15	3.76	2.24
2 / 1	13.59	5.26	4.10	2.56
3 / 1	13.92	5.27	3.87	2.41
4 / 1	13.51	5.01	3.60	2.06
5 / 1	13.18	4.89	3.61	2.13
6 / 1	13.71	5.12	3.94	2.40
7 / 1	13.43	5.13	3.95	2.29
8 / 1	13.65	5.95	4.68	3.14
9 / 1	14.04	6.02	4.86	3.44
10 / 1	13.30	5.04	3.89	2.29
Mean	13.64	5.28	4.03	2.49
CV	2.2	7.3	10.4	18.0
s	0.30	0.39	0.42	0.45
Q95	0.22	0.28	0.30	0.32
USP™ 2018	38	>95	>95	67

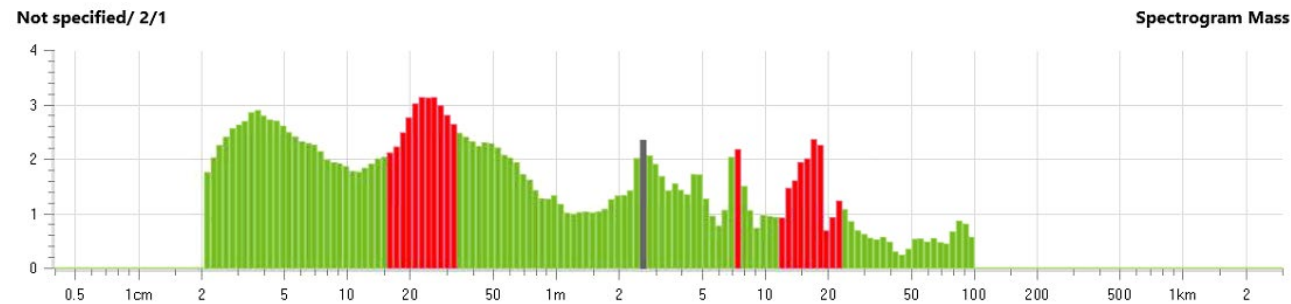
Ne 30, rotor yarn, carded, 65% CO-R / 35% PES

No.	CVm %	CVm 1m %	CVm 3m %	CVm 10m %
1 / 1	16.04	5.79	4.69	2.93
2 / 1	15.44	7.00	6.09	3.95
3 / 1	15.72	7.04	6.01	4.29
4 / 1	15.37	6.21	5.29	3.64
5 / 1	15.88	6.93	6.03	4.32
6 / 1	15.30	6.13	5.92	4.18
7 / 1	14.95	5.71	4.73	3.32
8 / 1	15.46	6.00	4.87	3.31
9 / 1	15.41	6.23	5.16	3.14
10 / 1	14.16	5.46	4.68	3.33
Mean	15.37	6.32	5.35	3.64
CV	3.4	9.3	11.3	14.0
s	0.53	0.58	0.61	0.51
Q95	0.38	0.42	0.43	0.37
USP™ 2018	15	>95	>95	>95

Challenges in yarn production

Yarn: Influence on spectrograms/ periodic faults

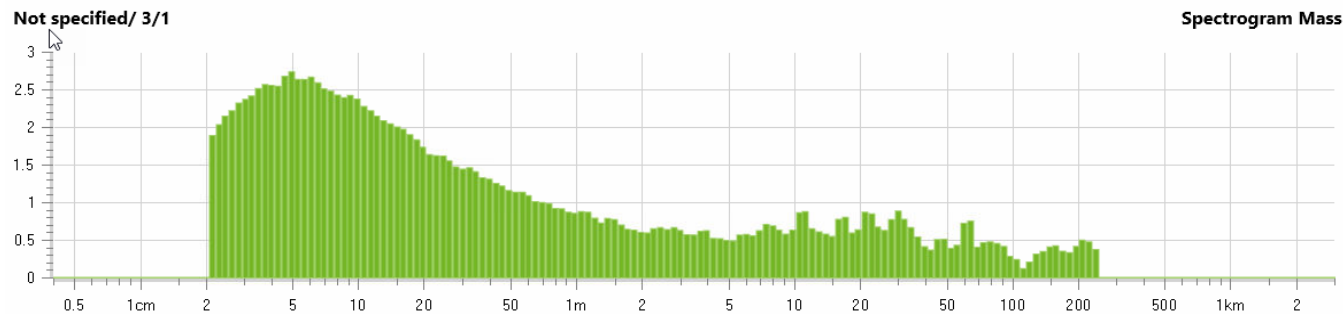
Ne 7, ring yarn, carded, 70% CO / 30% CO-R



Comparison to a yarn made from 100% virgin cotton (bottom):

- The ring yarn (top) with a 30% recycled cotton content shows periodic faults, typically resulting from problems in the drafting zone.

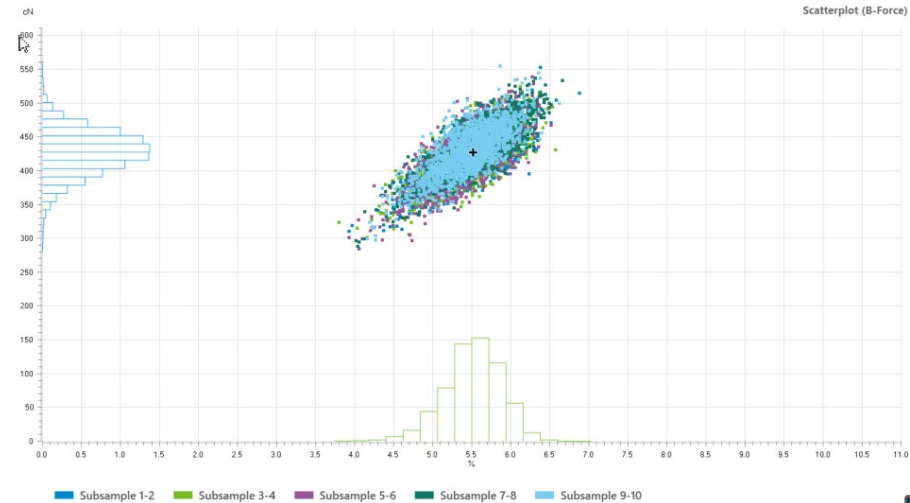
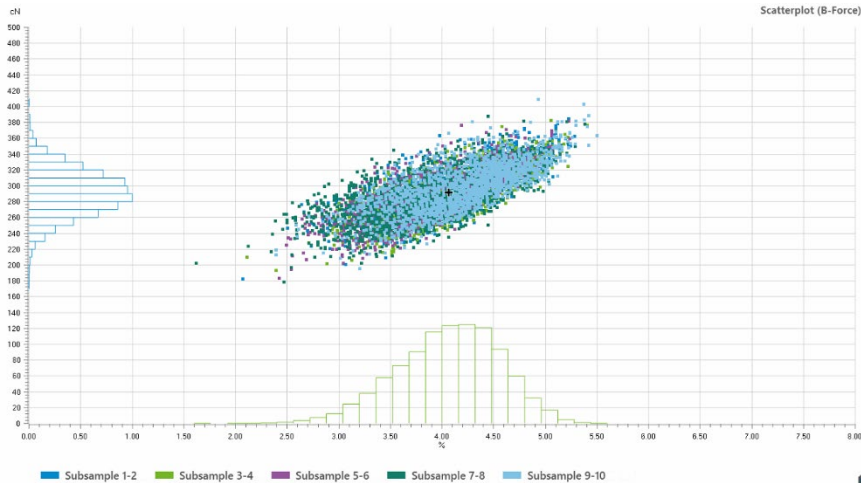
→ Periodic faults can result in an uneven fabric appearance and affect yarn strength and elongation as well.



Challenges in yarn production

Yarn: Influence on tensile properties (strength and elongation)

Ne 40, ring yarn, carded, 80% CO / 20% CO-R



Comparison to a yarn made from 100% virgin cotton (right):

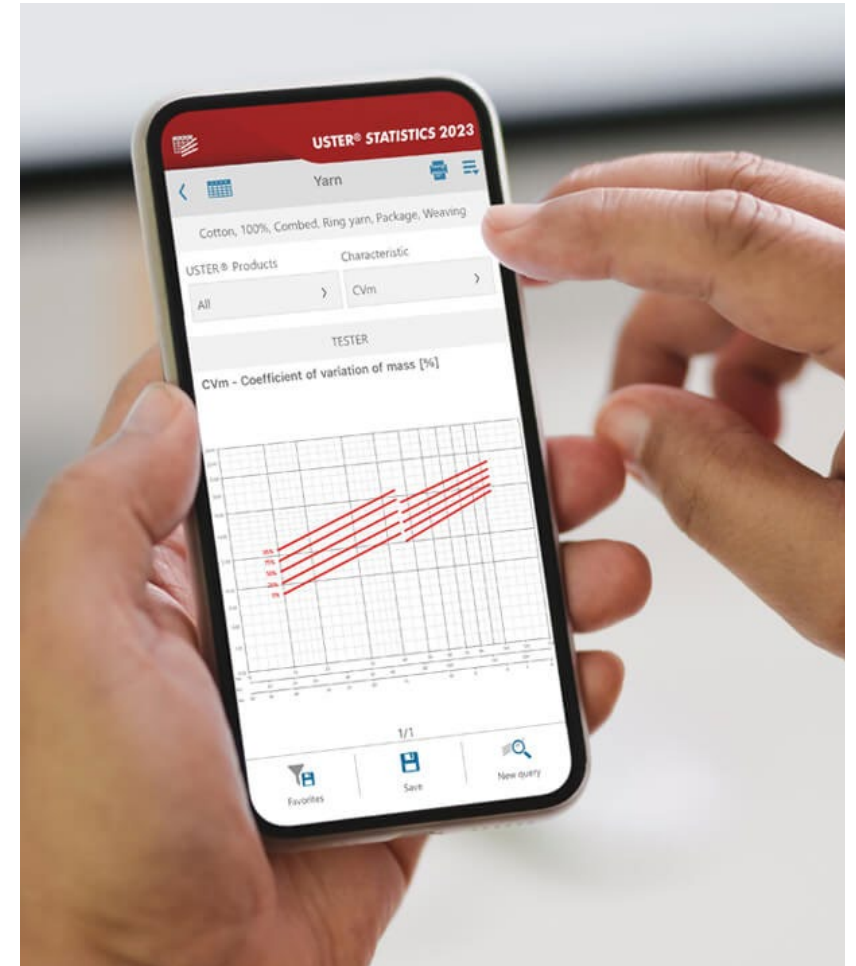
- The ring yarn (left) with a 20% recycled cotton content shows a much broader scatterplot, with a lower average yarn strength/ tenacity and elongation.
 - The coefficient of variation is high with 9.6% in strength/ tenacity and 12.2% in elongation.
- The high variation in yarn strength and elongation, combined with the lower averages, can lead to downtime in subsequent processing, such as weaving.

Uster Statistics

Industry benchmarks as the universal quality language for textiles

How can Uster support the industry dealing with these challenges?

- Uster Statistics provides unique value to the industry:
 - Industry standards: A compendium of all important fiber and yarn quality characteristics – the **universal quality language** for the textile manufacturing industry
 - Currency of the market: Producers and trading partners can compare product quality on world market levels – the acknowledged **industry benchmarks** in textile manufacturing
- Uster systems ensure compatibility with Uster Statistics – correlated with historical data over the past 60+ years.

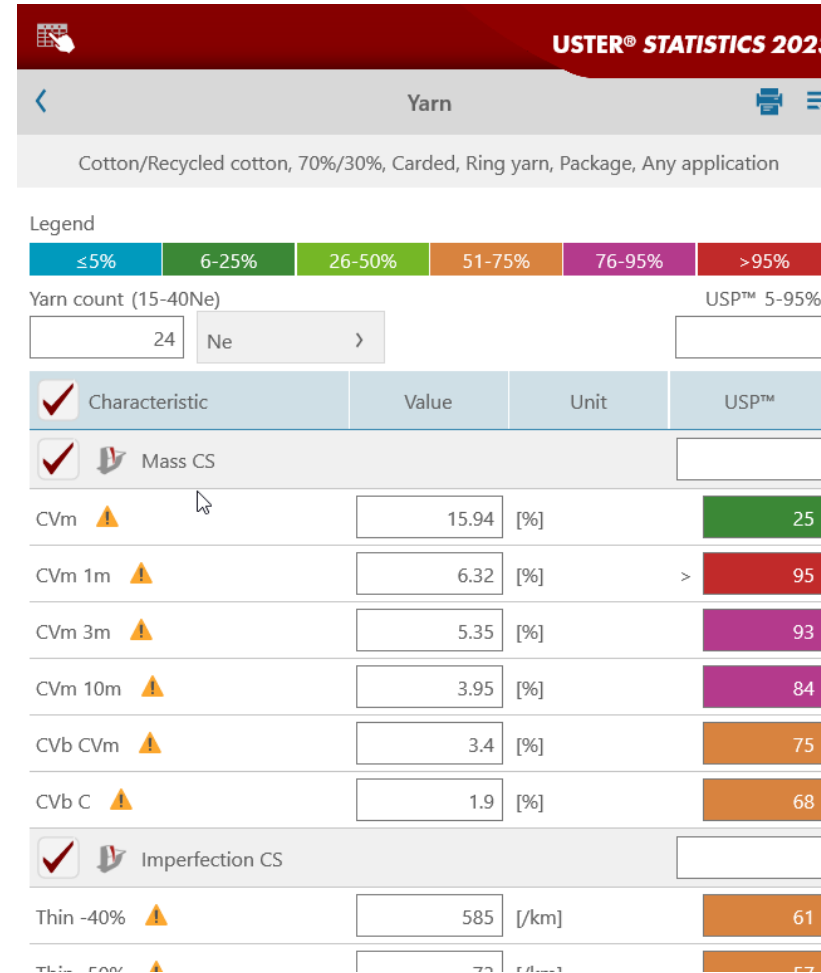


Uster Statistics

Introducing for the first time a section on recycled yarns

New chapters:

- 70% CO / 30% CO-R
 - ring yarn, carded
 - compact yarn, carded
- 40% PES-R / 30% CO / 30% CO-R
 - ring yarn, carded
 - compact yarn, carded
 - twin spun yarn, carded

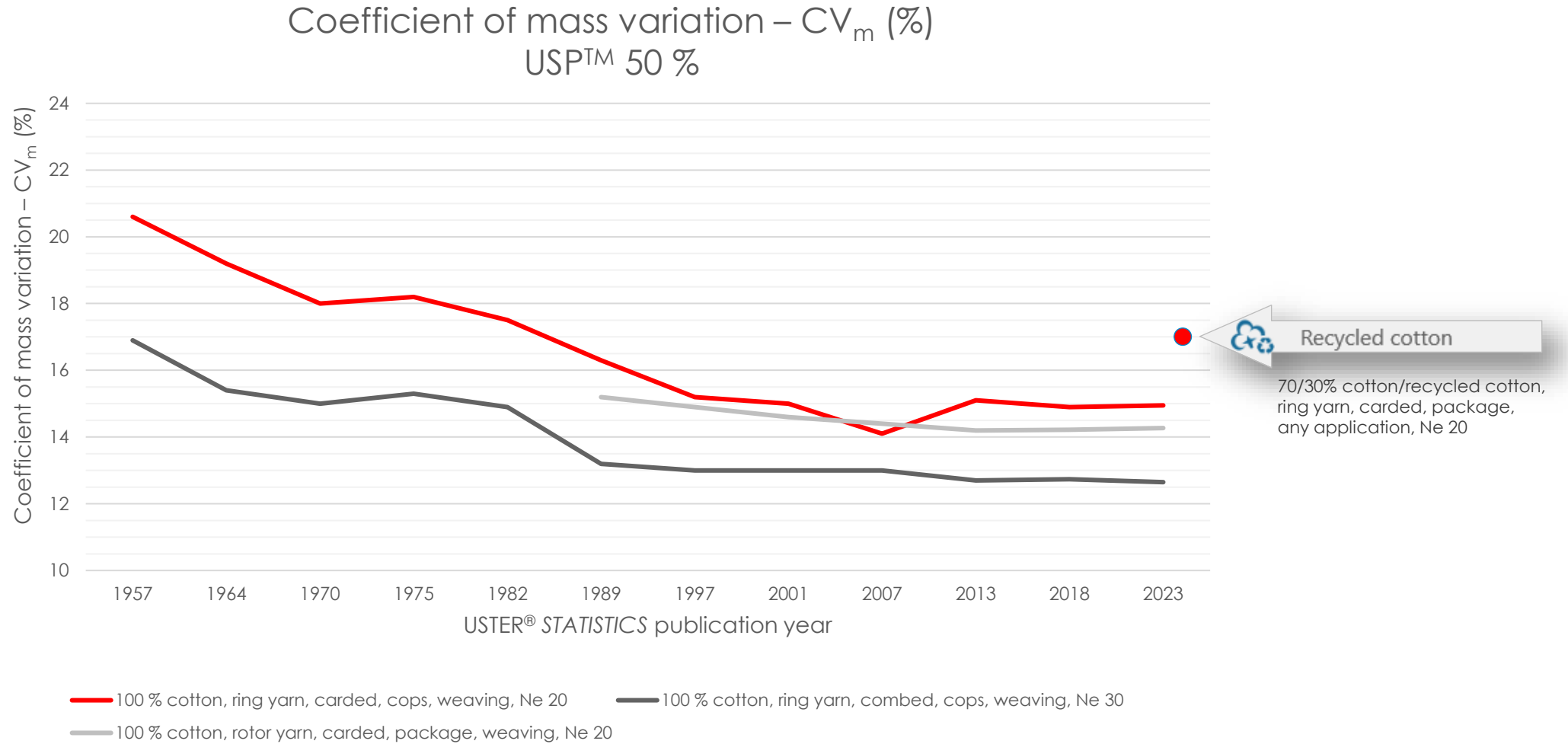


The screenshot displays the Uster Statistics 2023 interface for a 'Yarn' category. The specific yarn is identified as 'Cotton/Recycled cotton, 70%/30%, Carded, Ring yarn, Package, Any application'. A legend at the top indicates quality ranges: ≤5% (blue), 6-25% (green), 26-50% (light green), 51-75% (orange), 76-95% (purple), and >95% (red). The table below lists various characteristics with their values, units, and corresponding USP™ quality scores.

Characteristic	Value	Unit	USP™
Yarn count (15-40Ne)	24	Ne	USP™ 5-95%
Mass CS			
CVm	15.94	[%]	25
CVm 1m	6.32	[%]	> 95
CVm 3m	5.35	[%]	93
CVm 10m	3.95	[%]	84
CVb CVm	3.4	[%]	75
CVb C	1.9	[%]	68
Imperfection CS			
Thin -40%	585	[/km]	61
Thin -50%	72	[/km]	57

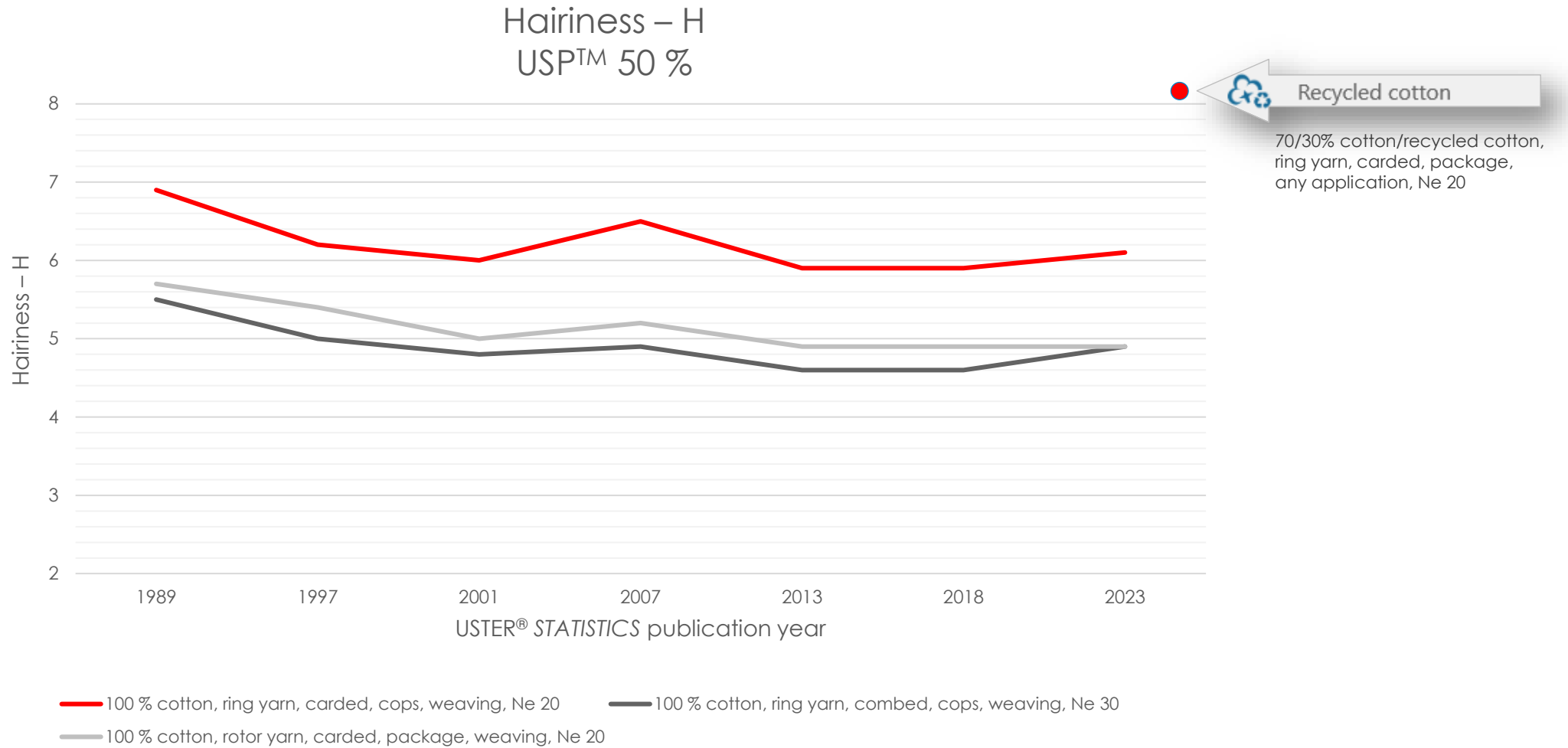
Uster Statistics

Trends in the textile market



Uster Statistics

Trends in the textile market



Sustainability

Recycled fibers and yarns

Application Report

USTER® – Sustainability Bulletin Nr. 1

Definitions, standards, and
textile knowledge for recycling material



Summary and outlook



- The challenges of spinning yarns with recycled materials must be acknowledged
- The new reality requires closer communication and cooperation between all industry partners from fiber to fabric, and into retail
- Uster already provides laboratory instruments and inline quality quality-monitoring systems to optimize quality and productivity when processing recycled materials
- Uster Statistics bridges the gap between yarn producers and yarn users, enabling them to talk about quality in a way that is understood by all
- This is a starting point, as there are numerous issues still open in this industry transformation – but Uster is ready to take the lead!



USTER®

Think quality