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REPORT

D4.2 Demonstrators. Material performance of CelluNova fabrics or fabrics of other bio based fibers

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CONTENTS

1 Introduction

This report documents the different textile demonstrators from bio based materials which were developed and produced within Mistra Future Fashion, Project 4, *Moving towards eco-efficient textile materials and processes.* The aim of the demonstrators is to show the difference between materials both in appearance, comfort and technical aspects. The processing conditions used in the production of the demonstrators are described in report D4.3 *Report describing processing windows for production processes of fabrics made of sustainable fibers (e.g. CelluNova fibers),* together with results from studies performed to benchmark the technical performance of the new materials to each other and to commercial commodity textile materials.

2 Materials and methods

2.1 CelluNova fibers

CelluNova fibers that are used are produced at IBWCH in Lodz, Poland August 2011, see Image 1. The owner of these fibers is the For Tex project. However, Mistra Future Fashion has got permission to use some of the batches to manufacture fibers into textile samples and demonstrators and to disseminate the results.

Image 1: CelluNova fibers produced at Lodz in Poland.

2.1.1 Nonwoven samples

Cut staple fibers, 38 mm, carded two times and then needled one time from each side:

100% CelluNova
50% CelluNova, 50% Polyester
50% CelluNova, 50% Modacrylic
100% Lyocell
100% Bamboo viscose
100% Bamboo modal.

Image 2 To the left nonwoven 100% CelluNova. To the right 50% CelluNova 50% Polyester. CelluNova works well as blend in fiber but also as single fiber in nonwoven structures.

2.1.2 Twisted threads

Image 3 shows threads twisted at Swerea IVF in DirectTwist® 2D6 from Agteks Ltd., displaying cotton, Lyocell, Viscose, Wool, CelluNova, Cellunova+Lyocell, CelluNova+Polyester.

Image 3: Threads in different materials with various numbers of twists per meter.

2.1.3 Yarn twisting techniques

Image 4 shows different ways to twist yarn in Agteks DirectTwist® 2D6.

Single yarn covering

Multi yarn covering

Multi color twisting

Double yarn twisting

Cross yarn covering

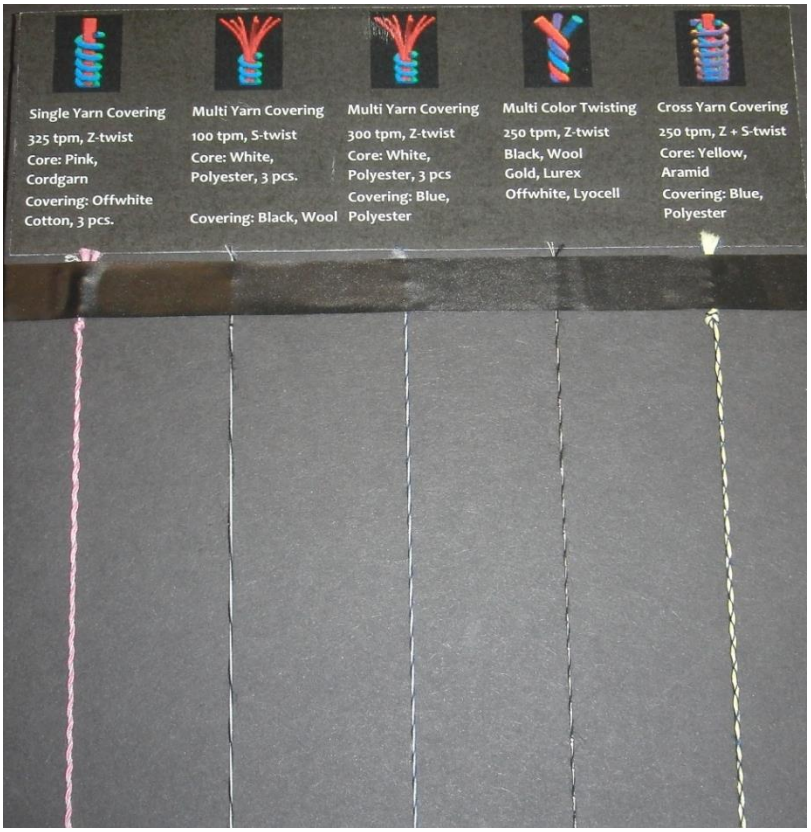

Image 4: Five threads twisted with different techniques from left to right.

2.1.4 Flat knitting samples

Flat knitted at Swerea IVF in a machine with gauge 6 (see Image 5):

Cotton

CelluNova

CelluNova+Lyocell

CelluNova+Polyester

Image 5: Small flat knitting samples, gauge 6.

2.1.5 Ring spinning, staple yarn of CelluNova

One batch of CelluNova multifilament was crimped at Swerea IVF, Image 6. Staple fibers were cut and a ring spinning process was carried out at the Swedish school of Textiles in Borås.

Image 6: CelluNova multifilament before (left) and after (right) crimping.

2.1.6 Fiber to fabric

8 steps that are needed to produce a ring spun yarn and finally a fabric (see Image 7).

Multifilament from wet spinning process (Viscose, CelluNova)

Crimped multifilament

Cut into staple fibers

Carded into a fiber web

Drawing process

Ring spinning to yarn

Knitting

(Dyeing)

Image 7: Eight steps describing the way from fiber to knitted fabric.

2.1.7 Circular knitting of CelluNova

Circular knitting was done at the Swedish School of Textiles in Borås. A single jersey fabric with gauge 18 is produced (see Image 8). The stripeiness in the fabric is due to uneven CelluNova thread manufactured in ring spinning equipment. This is done in lab scale and with limited amount of material, which is why the quality of the thread is not production like.

100% Viscose

100% CelluNova

100% Cotton

Image 8: Single jersey, undyed and dyed. At the top, viscose, in the middle, CelluNova and lowest cotton. Viscose and cotton works as reference materials.

2.2 Dyeing of CelluNova

Two different trials were performed with red and turquoise color (see Image 9 and Image 10). The fabrics were dyed with reactive colors at Swerea IVF.

The test included CelluNova as well as viscose, bamboo viscose, lyocell and cotton. These other cellulose based materials were chosen for comparison to CelluNova, see Image 10.

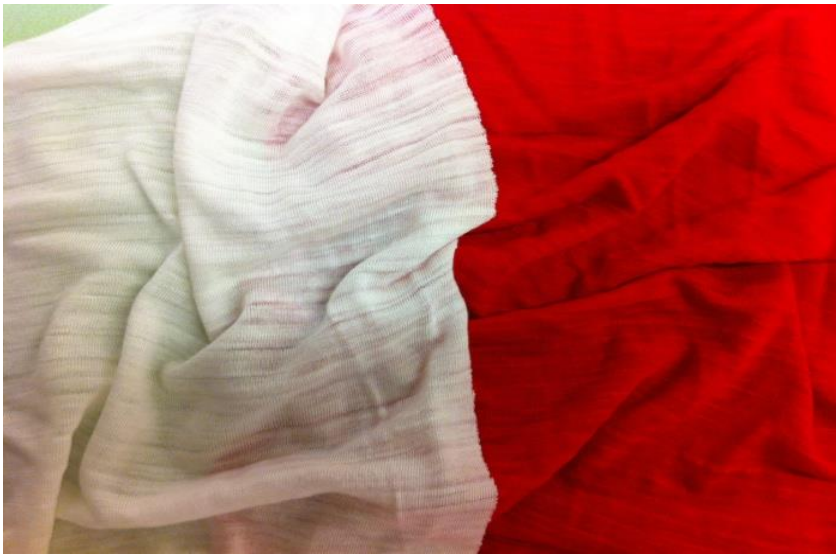

Image 9: CelluNova undyed and dyed in a red color.

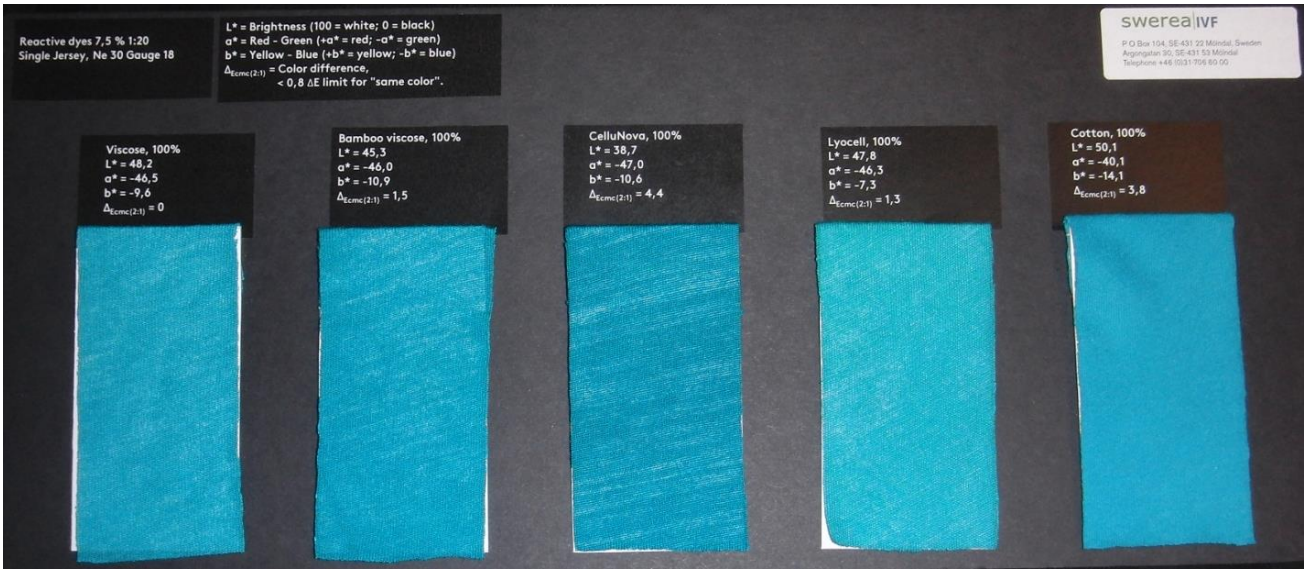

Image 10: Different cellulose based materials dyed under the same conditions.

2.2.1 First CelluNova dress

A dress to a doll in turquoise. The amount of CelluNova material is limited so that is why a dress to a doll was chosen for the first garment in CelluNova (Image 11).

Image 11: The first CelluNova dress.

2.3 Milk protein fiber yarn

Yarn produced in China. Raw white Ne30 and a thicker purple yarn for hand knitting.

Image 12: Milk yarn in two different performances on top to the left XX and on top to the right yarn for knitting, both from 100% milk fiber. At the bottom, a view of the knitting machine.

2.3.1 Cardigan, milk fiber

Purple cardigan knitted at Swerea IVF on a flat knitting machine with gauge 6 (see Image 13).

Image 13: Cardigan made of 100 % milk protein fiber yarn.

2.3.2 Knitted milk fiber fabric

Single jersey knitted at the Swedish School of Textiles, in Borås. Gauge 18, raw white (Image 14).

Image 14: 100% Milk protein fiber in a single jersey fabric.

2.3.3 Cow illustration

Cow illustration by Emma Cowlam (Image 15)

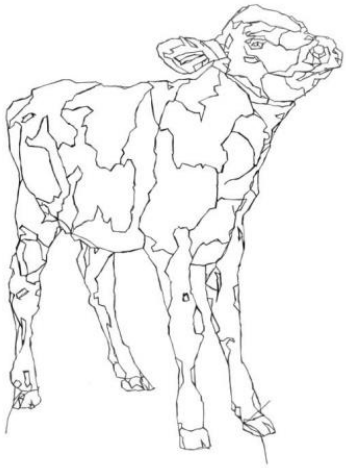

Image 15: Illustration done by Emma Cowlam.

2.3.4 Jacquard knitted milk fiber fabric

Three color jacquard knitted fabric with the illustrated cow (Image 16). Milk fiber knits at the front side color off-white. The cow pattern line, the black thread, is in viscose. White viscose is knitting on the back side to fill up the third color.

Image 16: Three color jacquard in milk and viscose material.

2.3.5 Children's' hoodie

Some different fabric was done with various cow patterns, all with three color jacquard. One big cow is shown above. Smaller cows were also produced and from this fabric a hoodie was manufactured (Image 17).

Image 17: A children's hoodie with the cow pattern.

2.3.6 Woven milk fiber fabric

A trial was done with weaving a milk fabric. Two milk threads were twisted together to one yarn and this yarn was used in the insert. A weaving machine with a black cotton warp was chosen for the trial. Weft dominated twill gives a lighter upside due to the off-white insert and a black reverse because of black warp (Image 18).

Image 18: Woven fabric with milk fiber in the insert and black cotton in the warp. Fabric shows back side to the left and face side to the right.

2.3.7 Weaving single yarn insert in cotton warp

Single milk yarn was used as insert in a white cotton warp. The thread was too week as a single thread to work well in the machine. A little bit fabric is shown in image 19.

A 100% soybean thread was also used as insert in the same cotton warp. This material is more yellow than milk, see Image 19.

Image 19: To the left single milk thread in the insert. To the right soybean in the insert and for both cotton in the warp direction.

2.3.8 Dyeing of protein based materials

A trial with dyeing fabric with acid color, Brilliant orange GR, from Zenit AB was done at the Swedish School of Textiles in Borås. CelluNova fabric was also added in this trial for comparison. An orange color was chosen and the dyed materials were;

100% milk protein, knitted single jersey
40% milk, 60% cotton (warp direction, not protein based), woven fabric
100% silk, woven fabric
100% Wool, woven fabric
100% CelluNova

The CelluNova material is not protein based and therefore it did not take up much color in this dyeing test. CelluNova is cellulose based and dyes preferable best with reactive colors as shown in test above.

Image 20: Acid colors for protein based materials. To the left CelluNova that is cellulose based and did not take up these pigments well. At the top, knitted milk fiber, at the right woven milk fiber and cotton.
Down in the middle, silk and down to the right wool.

2.4 Fibers from seaweed

Fiber from the sea is a possible upcoming sustainable material. This bobbin Seaweed is produced in China. It is called 100% seaweed but according to the supplier it contains only 15% seaweed substance and the rest is conventional viscose.

Image 21: Seaweed fiber. It seems very similar to viscose.

3. Conclusion

Several textile demonstrators have been produced from a wide variety of bio based materials. Both materials blends and single material demonstrators were obtained. The demonstrators range from yarns and non wovens through knitted and woven textiles to miniature garments and fully functional fashion garments. As mentioned in the introduction, Processing parameters and technical benchmarking of the demonstrators are accounted for in deliverable D4.3 *Report describing processing windows for production processes of fabrics made of sustainable fibers (e.g. CelluNova fibers).*

About Mistra Future Fashion

The purpose of the Mistra Future Fashion Program is to deliver knowledge and solutions that the Swedish fashion industry and its stakeholders can use to improve the fashion sector's environmental performance and strengthen its global competitiveness. The program is structured so that it leverages the expertise and networks of leading Swedish and international research institutes and universities. Stakeholders engaged in the program include governmental agencies, voluntary organisations, and companies within the entire textile value chain: forestry, pulping, textile manufacturing and recycling. To find out more please visit www.mistrafuturefashion.com.