Homegrown: Investigating Design Potential of Bacterial Cellulose

Jennifer Harmon, University of Wyoming, USA

Keywords: Bacterial Cellulose, Drape

Contextual Review. Cellulose is one of the most popular natural fibers in the textile and apparel industries. Cotton, for example, has the second largest market share of all globally traded textiles (Carmichael, 2015). The cultivation of cotton can have negative impacts on the environment. For example, over 20,000 liters of water is needed to produce enough cotton for a single pair of jeans and a T-Shirt (World Wildlife Fund, 2016). Bacterial cellulose is a promising material that has experienced limited application in textiles.

Design Concept. The purpose of this piece was to explore different growing containers, drying methods and post growth treatments to improve the tactile properties of bacterial cellulose and explore the apparel potential of this material. Previous creative scholarship in this area has utilized minimalist construction (Lee & Ghalachyan, 2015; Hong, 2016). A final constraint is the size of the growing container, which has previously limited the apparel uses of the material (Lee & Ghalachyan, 2015; Hong, 2016). This piece addressed previous limitations while exploring new uses and methods of shaping the material.

Material Development. The potential for the growth of large pellicles was investigated by using three, 3 by 4 foot incubation containers. Combining a live scoby, sugar, water and cider vinegar, the bacteria was incubated at 70 degrees Fahrenheit until the pellicle was ¾ of an inch thick. This process took approximately 2 months per pellicle and required periodic additions of sugar and water. Once the pellicles were grown, the liquid media was drained, pellicles were twice rinsed and then soaked in a 1% sodium hydroxide solution. A final rinse removed the solution from the pellicle. This material was then transferred to a domestic freezer to dry. The drained media and scobys were transferred to containers measuring 1 ½ by 2 feet and incubation continued at 70 degrees Fahrenheit. These finished pellicles were treated in the same method outlined above. The smaller pellicles were dyed with a beet powder mixture and vinegar mixture. Finally, this material was air-dried at room temperature.

Aesthetic Properties. The hand of the fabric varies considerably between the two types of fabric. The bodice components were air dried and dyed with a water, glycerin, vinegar and beet powder solution. This material feels like vegetable leather to the touch. The skirt and waistband pieces remained undyed and were freeze dried. The waist and petal piece were also treated with bleach prior to freeze drying. As a result, these skirt pieces are softer to the touch than the vegetable leather. Mostly straight and diagonal lines were used in the bodice to convey the rigidity of this material. Curved lines were used in the waistband, petals and skirt panels. The different material textures were isolated to the bodice and the skirt with symmetrical balance.

Process, Technique, and Execution. This design was constructed through a combination of draping and flat pattern. A draft of the complete design was constructed with muslin and adjusted to a size 6 dress form. The bacterial cellulose pieces were then lined before construction with fusible interfacing and cotton fabric to provide reinforcement to the material for stitching. Freeze dried material was steamed, molded into shape and re-dried before construction. Stitches were made using a combination of machine and hand stitching. Several Velcro closures were used to minimize the amount of stitching needed in the garment.

Design Contribution and Innovation. The significance of this piece lies in the use of the vegetable leather like material, in addition to the freeze dried material in a more fitted garment than has been previously attempted. Additionally, a new type of freeze dried material was developed and utilized for this design.

Conclusion. One major limitation of all types of this material used in this piece is the stiffness and lack of drape-ability. The freeze dried material needed to be steamed, shaped and re-dried before construction. The vegetable leather type of material was stiff and lacked the flexibility of other materials. This material is also very delicate and not capable of holding closures like zippers. The materials' delicate nature made shaping the garment particularly difficult. In order to hold the stitching, the garment also had to be lined with a plain weave cotton fabric.

References.

Carmicheal, A. (2015). *Man-Made Fibers Continue To Grow.* Retrieved December 17th, 2016 from: http://www.textileworld.com/textile-world/fiber-world/2015/02/man-made-fibers-continue-to-grow/

Hong, R. (2016). *Growing Fabric.* Retrieved January 1st, 201 from: https://oss.adm.ntu.edu.sg /a150051/2016/01/24/growing-clothes/

Lee, Y.A., & Ghalachyan, A. (2015). RETHINK: Wearing Kombucha in Santa Fe. *ITAA Annual Conference Proceedings: Design Presentations.* Santa Fe, NM.

World Wildlife Fund (2016). *Cotton Farming*. Retrieved December 23rd, 2016 from: http://wwf. panda.org/about_our_earth/about_freshwater/freshwater_problems/thirsty_crops/cotton/

Visual Impact.

Front View

Back View

Side View

Detail