

Clothing made from tea byproduct could improve health of fashion industry

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Young-A Lee and her research team have designed a vest and shoe prototype from the cellulosic fiber grown in this lab. ([Larger image](#)) Photos by Christopher Gannon

AMES, Iowa – Rows of shallow plastic bins cover nearly every available space inside one of the textile and clothing labs in LeBaron Hall. The lab is really more of a “greenhouse,” but it is far different from the other greenhouses on the Iowa State University campus.

Instead of soil and seeds, each plastic bin contains a gel-like film consisting of cellulose fibers – a byproduct of kombucha tea – that feeds off a mixture of vinegar and sugar. The film is grown by using a symbiotic colony of bacteria and yeast (SCOBY). Young-A Lee, an associate professor of [apparel, merchandising and design](#) at Iowa State, says the properties of this SCOBY film are similar to leather once it’s harvested and dried, and can be used to make clothing, shoes or handbags.

In a chapter of the book “Sustainable Fibers for Fashion Industry,” Lee writes about the results of her case study of



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Quick look

The fashion industry generates a lot of waste, which is why a team of Iowa State University researchers developed a new fiber that's 100 percent biodegradable. Researchers are testing the fiber – made from a green tea byproduct – to see if it's a viable alternative.

Quote

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Young-A Lee, associate professor of apparel, merchandising and design

cellulosic fiber. The material has been tested for other applications, such as cosmetics, foods and biomedical tissue for wound dressing, but it is relatively new to the apparel industry. The fact that the fiber is 100 percent biodegradable is a significant benefit for the fashion industry, which by its very nature generates a lot of waste, Lee said.



Cellulosic fiber growing in the lab
([Larger image](#))

“Fashion, to most people, is an ephemeral expression of culture, art, and technology manifesting itself in form. Fashion companies keep producing new materials and clothing, from season to season, year to year, to fulfill consumers’ desire and needs,” Lee said. “Think about where these items eventually go. They will take tremendous underground spaces of the Earth like other trash.”

The cellulose fiber reduces waste by creating a continuous cycle of reuse or regeneration, what is known as cradle-to-cradle design, Lee said. Even if clothing is recycled or repurposed, it still eventually ends up in the trash. Lee envisions a truly sustainable fabric or material that is biodegradable and goes back into the soil as a nutrient rather than taking up space in a landfill. And using the SCOBY gives new purpose to the tea byproduct, lessening the fashion industry’s dependence on nonrenewable materials.

Product development and testing

Working with a novel fiber is not without its challenges. Lee and her research team received a grant from the Environmental Protection Agency to develop sustainable clothing and shoes from the harvested cellulosic fiber. They’ve conducted several tests to determine if the SCOBY-based cellulosic fiber is a viable alternative to leather for the fashion industry.



Shoes made from the new fiber
([Larger image](#))

The tests revealed that one of the biggest problems is moisture absorption from the air and the person wearing the vest or shoes. The moisture softens the material and makes it less durable. Researchers also discovered that cold conditions make it brittle.

Mass production is another issue to confront. Lee says it takes around three to four weeks, depending on temperature and room conditions, to grow the material in the lab. Her team is working on how, and if it is possible, to reduce the growth cycle for mass production.

“It does not take that long to make



certain synthetic materials, but for this new material we are proposing, it requires a certain amount of time to grow, dry, and treat the material within specific conditions,” Lee said. “If our experimental effort from this EPA project is successful, this cellulose-based renewable fabric can be an alternate future where we move to a cradle-to-cradle system, instead of relying on materials derived from unsustainable sources.”



Vest prototype ([Larger image](#))

Despite the challenges, Lee says this is a necessary step forward. More is at stake than just the waste from cheap, disposable clothing. The chemicals used to make the synthetic materials and dye fabrics can contaminate the water and soil, Lee said. The fashion industry is working to do better, but consumers must also be on board.

“Socially conscious awareness from the consumer end plays a lot,” Lee said. “Employees who work in the fashion industry need to be fully educated on this movement. The industry cannot shift things at one time. It is all about people in this industry. The key is changing their values to consider the betterment of people and the planet in a long run, instead of focusing on a consumer's short-coming interest.”

What do consumers think?

Supporting an environmentally friendly brand is important for many consumers, but the look and feel of the clothing will drive purchase decisions. Lee and her team surveyed college students to gauge their response to a vest prototype made from the cellulose fiber. The majority thought it was made of leather, rawhide, paper or plastic.



Harvested and dried cellulosic fiber ([Larger image](#))

Survey participants were most concerned about the color and texture of the material, and questioned the comfort, durability and care. They had a positive attitude about the material because of its sustainability, and thought it was an interesting alternative to leather. However, their willingness to purchase a product made of this material was not as high. Still, Lee is confident that researchers can successfully work through these concerns and provide a safer and viable option to benefit people on many different levels. Lee and her research team hope it will prompt consumers to think about what they can do to promote and support sustainable fashion practices.