

Researcher develops sustainable green tea-based leather alternative

November 4 2019, by Charlotte Tuggle



This prototype of the green tea material-based shoe is a sustainable alternative to leather dress shoes. It was created by Auburn researcher Young-A Lee. Credit: Auburn University at Montgomery

A global movement to make shoes more sustainable is growing, according to the USDA. Studies show that the materials commonly used to make footwear contribute to environmental deterioration and can have negative effects on workers' health.

In response to this problem, Auburn University researcher Young-A Lee and her research team developed a promising biodegradable material alternative to leather using the byproducts of fermented green tea through an Environmental Protection Agency-funded grant.

Today's dress shoes are most commonly made from a variety of rubber, leather and [synthetic materials](#) that take decades to decompose. Lee, in her most current research into this topic collaborating with her former doctoral student, Changhyun Nam at Iowa State University, proposed testing the viability of a sustainable, multi-layered cellulosic material in comparison with traditional footwear materials. They hypothesized that the biodegradable and traditional materials would have similar properties when it came to how comfortable, durable and thermal-resistant the shoes would be for the wearer.

Lee was inspired by cradle-to-cradle design framework, which is a principle focused on the renewability of products. She said her curiosity about turning [food waste](#) into fashion was what sparked the research.

"Our research team was looking for sustainability design practices starting from fiber, to product design and development to the end—consumers. We started to explore alternative materials for leather and synthetic textiles, focusing more on natural fibers," Lee said. "At the same time, we also searched whether there is any way for us to use byproducts from various industries to generate new materials for apparel-related products."

In her research at Iowa State University, Lee found that a green tea-based cellulosic material behaved the same way as leather, without the same negative environmental side effects. However, a single layer of this material may soften in rain or snow and lose its durability. But by layering this material with other ecofriendly fabrics, a much more durable product can be created.

Men's leather dress shoes are made up of the upper and inner shells, the insole, the midsole and the outsole. Leather is commonly used because of its durable, flexible and stylish qualities. When the researchers combined an outer shell of cellulosic material with a hemp-based fabric on the inside, then used recycled denim to bond the two together, the result was an ecofriendly product comparable to the style and durability of a leather dress [shoe](#).

Once a similar-looking shoe prototype was designed, Lee's research team tested its thickness, weight, air permeability, thermal comfort, tensile strength and wettability as compared to commercially available leather. After testing, researchers found that the sustainable model has the potential to be used as the entire shell of the shoe due to its lightness and airflow capability coupled with the durable nature of the fermented green tea-based material. In terms of thermal comfort, the sustainable model provided similar or even better results than the leather model.



Sustainable materials can be dyed to look like leather using leftover coffee

grounds. Credit: Auburn University at Montgomery

Additional phases of the ground-breaking research consisted of human wear trials using the model to further confirm this finding.

As for the wearer's comfort and performance ability, the sustainable model provided more benefits than the leather model. They also found that the two shoes had similar levels of break force and flexibility, meaning that overall, the shoes would last for the same amount of time and withstand the same amount of pressure before being damaged. The only value in which the leather shoe had an advantage over the sustainable shoe was in wettability—the measure of how water permeable the material is and how long it takes to dry.

Lee said this project is still under investigation while researchers explore ways to make the shoes less water-absorbent before they're viable for daily wear. But with the research at hand, Lee said it's a great start for a more sustainable design.

"Fashion, to most people, is an ephemeral expression of culture, art and technology manifesting itself in form," Lee said. "Fashion companies keep producing new materials and clothing, from season to season, year to year, to fulfill consumers' desire and needs. This is really the time to think about where these items eventually go. We really need to think about new ways of creating sustainable materials and products made out of those, which contributes to the betterment of people, the planet and our society. Along that line, I as an educator need to be proactive to educate future apparel designers and developers to be change agents to lead this sustainable, healthy movement in the industry."

The study concluded that the multi-layered, biodegradable material

presented great potential as a substitute to [leather](#). The significance of this finding will inform future explorations into sustainable apparel and footwear practices in the industry.

From this line of research, work has also been done to create various types of renewable products including baby shoes, vests and bags, with the potential to create more sustainable apparel.

Associate Dean for Research Jennifer Kerpelman said this type of research exemplifies the use of science to find practical solutions to everyday problems.

"As a human scientist, Dr. Lee is conducting research that represents the innovation necessary to meet the needs of the consumer market while also supporting the planet's health and sustainability," Kerpelman said. "Her collaborative project demonstrates the value of integrating expertise across disciplines, considering potential partnerships with the industry and attending to critical elements for educating the next generation of designers."

More information: Changyun Nam et al. Multilayered Cellulosic Material as a Leather Alternative in the Footwear Industry, *Clothing and Textiles Research Journal* (2018). [DOI: 10.1177/0887302X18784214](https://doi.org/10.1177/0887302X18784214)

Provided by Auburn University at Montgomery

Citation: Researcher develops sustainable green tea-based leather alternative (2019, November 4) retrieved 26 April 2024 from <https://phys.org/news/2019-11-sustainable-green-tea-based-leather-alternative.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private

study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.