Opinion

Environmental Chemistry

The Art of Upcycling Food Waste into Biofabrics

Scraps to Style and Solution for Environmental Pollution

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Could you imagine biofabrics—textiles made from food waste such as seaweed and tangerine peels—as a sustainable alternative to conventional materials? Guided by the principles of green chemistry, these biodegradable fabrics aim to reduce plastic pollution and promote efficient use of resources. The concept supports both environmental sustainability and circular economy practices by transforming discarded organic materials into useful, eco-friendly products.

Keywords: Sustainability; Food Wastes; Biofabrics; Green Chemistry; Ecosystem

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CAN YOU imagine walking down the street while wearing clothes made from food waste? Yes, the food that you did not want to finish during dinner, and had been thrown away without a second thought, could be transformed into everyday apparel.

Textiles, or fabrics, are a diverse group of materials used not only to make clothing but also to create furniture, medical equipment, bags, sports gear, the interior of cars, and much more. For this reason, the textile industry is a significant contributor to the global economy.

One role of scientists and engineers in the textile industry is to evaluate the environmental impacts of the products they produce and determine how those impacts can be mitigated (Ban, 2020). Environmental impacts in the fashion industry include greenhouse gas emissions, water pollution, and the production of massive amounts of waste (Dzhengiz et al., 2023). Because of these problems, sustainability has become a new focus in the fashion industry.

One solution would be to make "greener" products and embrace the concept of green chemistry. That means designing more eco-friendly materials and incorporating sustainable methods into the textile industry (Li et al., 2024). There are principles that guide the green chemistry movement. These include reducing waste, minimizing the use and creation of harmful chemicals, and using energy and natural resources more efficiently (Ahmad et al., 2024; Kurul et al., 2025; Patiño‐Ruiz et al., 2021).

As the world's fashion advances towards more "trendy" clothes, pollution on our planet continues to rise (Idoko et al., 2024). Gus Speth, the founder and former president of the World

Resources Institute, said that "I used to think the top environmental problems were biodiversity loss, ecosystems collapse and climate change. I thought that with 30 years of good science we could address those problems. But I was wrong. The top environmental problems are selfishness, greed and apathy… and to deal with those we need a spiritual and cultural transformation and we, (Lawyers) and scientists, don't know how to do that." But with the use of biofabrics, it can be proven wrong. The development and integration of bio-based textiles offer a promising avenue to mitigate the severe environmental footprint of the conventional fashion industry, which is a major contributor to water waste, carbon emissions, and landfill accumulation (Gazzola et al., 2025).

Using biofabrics, as it is called, may be the cause that significantly lowers our environmental problems related to the textile industry. Seaweed, tangerine peels, and many other food wastes that consist of fiber have been proposed as a potential alternative to conventional fibers (Roy et al., 2020). The use of organic and biodegradable materials also offers the advantage of reducing plastic pollution, as these fabrics can decompose naturally once thrown away (Rao et al., 2021). So, not only are we upcycling many wasted food scraps, but also making the products that were upcycled easier to decompose. It's like we are returning Mother Earth's resources back. An Italian activist, Livia Firth, and an advocate for sustainability, especially in the fashion industry, says, "Call it eco-fashion if you like, I think it's just common sense".

In sum, this pragmatic perspective underscores the growing recognition that environmental stewardship is not merely an ethical imperative but a logical necessity for long-term planetary and economic health. This shift towards sustainable practices in textiles, particularly through biomimicry and the utilization of agricultural by-products, represents a crucial step in re-evaluating the entire lifecycle of consumer goods, from sourcing to disposal (Rognoli et al., 2022; Wood, 2019). This evolution necessitates a fundamental rethinking of supply chains and consumer behavior to foster a truly circular economy where waste is minimized and resources are perpetually cycled (Chen et al., 2021; Musová et al., 2021). ■

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