

Are Closed Loop Textiles the Future of Fashion?

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American consumers spent an average of \$1,604 on apparel and related services in 2013, according to figures from the U.S. Department of Commerce. Factor in that clothing prices in the U.S. have largely decreased since the '90s and that was a lot of frivolous consumption.

Disagree? An American Apparel & Footwear Association report showed that U.S. consumers bought roughly 63.7 garments each in 2013—that worked out at more than one item of clothing every week that year.

And given that the Environmental Protection Agency estimates that every American throws away an average of 10 pounds of apparel on an annual basis, the majority of those purchases likely ended up in a landfill.

While all that unnecessary spending is good for the economy, it's bad for the environment. Try these stats on for size: World fiber production reached a record 82 million tons in 2011, requiring 145 million tons of coal and a couple trillion gallons of water to produce, as highlighted in Elizabeth Cline's *Overdressed: The Shockingly High Cost of Cheap Fashion*.

Need that broken down even further? Some say it takes 2,900 gallons of water to make one pair of jeans.

Change is inevitable

With many of the world's main clothing manufacturing countries (think: China, Bangladesh, India and Pakistan) struggling from both water scarcity and pollution due to population growth and the rising demands of the apparel industry, it's clear that the supply chain needs to be re-evaluated.

"You cannot have infinite, unfettered growth and fast-fashion methods of consumption and production if you want to protect resources," stated Gwen Cunningham, a researcher and analyst with the [Circular Textiles Program](#), a sector-specific initiative within the Dutch cooperative Circle Economy that's focused on closing the loop for post-consumer textiles.

"The fashion industry is too dependent on natural resources and we must change how fashion is made," echoed Cecelia Br nnsten, sustainability business expert at Swedish fast-fashion retailer [H&M](#). "Fashionista or not, clothes are a necessity. However, the fashion industry requires large amounts of natural resources, lots of which can be reduced, recycled, substituted or eliminated."

Considering that H&M is largely responsible for helping to create the culture of throwaway clothing that exists today (along with Zara, Forever 21 and Primark), it makes sense that the retailer would want to implement measures that might minimize the toll its business takes on the environment—or at least try to dispel the theory that fast fashion and sustainability are mutually exclusive.

"It's about the best value, not the cheapest price," CEO Karl-John Persson said earlier this year, when H&M released a report underlining its commitment to going green. "And while we must be realistic about the fact that most customers are not prepared to pay more for added sustainability value, I am convinced that it will become an important differentiator in the future."

"We want to go from a linear production model to a circular one," Br nnsten continued. "To find ways to close the loop for textiles is crucial not just for the fashion industry but also for the global society and the entire planet's wellbeing."

That was the thought process behind the 2013 launch of H&M's in-store Garment Collecting Initiative, which to date has amassed more than 19,000 tons of unwanted clothing globally. The retailer released its first closed-loop products in February 2014, made with 20 percent recycled materials, and in September introduced 10 new denim styles made using cotton from the collected clothes.

"The initiative is foremost an environmental project. Short term, we have a clear vision to avoid waste and minimize the waste that goes to landfill; long term, we want to find a solution for reusing and recycling all textile fiber for new use," Br nnsten explained, adding, "It makes clear business sense: Creating a closed loop will mean immediate access to environmentally conscious raw materials for new garments."

Existing recycling methods for textiles are limited

Recycling textiles can be tricky, as blended-fiber fabrics make reprocessing a challenge, while old cotton clothes have to be shredded in order to be turned back into raw materials, shortening the staple length and thus the quality. (That's why it's rare to come across a garment featuring anything more than 20 percent recycled content.)

"For instance, existing methods are unable to separate dyes and other contaminants from the original fibers, meaning the resulting fabric will need to be over-dyed into gray or black," noted Cyndi Rhoades, founder and CEO of [Worn Again](#), a U.K.-based textile upcycling start-up. "Furthermore, once fibers have been mixed together, like in polyester and cotton blends, it's not yet possible to separate them, which is a massive hurdle."

But it's one her company is hoping to overcome. A partnership with H&M and luxury fashion firm Kering (via its Puma label), announced last March, aims to address those barriers by developing textile-to-textile chemical recycling

technology that can separate and extract polyester and cotton from old textiles.

The goal: To spin those reclaimed raw materials into fabric for new clothes, effectively creating a “circular resource model” for textiles.

“It’s about moving from a linear model where clothes are made, worn and eventually end up in a landfill—even if downcycled—to one where the raw materials that go into our clothes are recaptured and recirculated back into the supply chain as part of a continual cycle,” Rhoades offered, adding, “It is a world where textile waste is eradicated and the industry is engaged in a model which ensures the future supply of the building blocks that make up their products.”

What’s the hold up?

Worn Again’s technology is the first of its kind and still developing. Additionally, as Cunningham of the Circular Textiles Program pointed out, if the fiber composition of a garment is unknown, it cannot be upcycled.

“Labels are usually inaccurate and hand-sorting is time-consuming and costly,” she said, adding, “Currently there is no accurate or efficient way to sort post-consumer textiles based on their material composition and therefore high-value recycling or circular use of textile resources has not been an option to date.”

That’s why one of the initiative’s core projects, called the Textile Sorting Project, is developing a tool that can separate collected garments according to fiber composition using NIR (near infrared) technology.

“Automated fiber sorting will enable low-grade textiles to be used as quality feedstock for high-value mechanical and chemical recycling processes,” she continued. Combined with Worn Again’s advances in separating poly-cotton (the two are partners), it could pave the way for old clothes—and the consumers that own them—to become an essential cog in the supply chain.

But that doesn’t completely solve the issue of quality, which is where [Re:newcell](#) comes in. The Swedish company, founded in 2012 by a group of researchers from the Royal Institute of Technology in Stockholm and a small investment company, has been working on a process that can recycle cotton and other cellulosic textiles into a dissolving pulp that can then be turned into new fibers such as viscose and lyocell.

“Recent tests show that fibers produced from Re:newcell pulp are of very high quality and can compete with virgin fibers on most parameters,” shared Louise Norlin, a business developer at Re:newcell, noting that the company considers the process ready to produce 3,000 tons of pulp per year. “It has now been tested on a large laboratory scale and a number of garments have been produced in cooperation with other Swedish organizations.”

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Earlier this year, two Swedish School of Textiles students created a white T-shirt using only Re:newcell fibers recycled from blue jeans. Tests found the garment to be comparable with other high-quality fibers when it came to dyestuff absorption, tenacity (in both wet and dry conditions) and withstanding high abrasion.

“We believe that we will see two types of fashion [in the future]: fast and slow,” Norlin said. “Fast fashion will have a short lifetime but a very efficient recycling system, thereby not requiring much virgin resources. Slow fashion will not be as easy to recycle but will have a very high quality, which means that it should not need to be recycled very often.”

She added, “The closed loop is essential for the fast-fashion loop going forward, while slow fashion will not be as dependent on the closed loop.”

[Speedo](#), a PVH Corp. licensee, has dived headfirst into the circular economy, too. Through a partnership with Italian yarn maker [Aquafil](#), the storied swimwear brand is converting scraps from the cutting table back into Econyl, a synthetic textile made using other such waste as abandoned fishing nets and old carpets.

“We were looking for a nylon fabric that was not only recycled, but recyclable. Until now, it was not possible for nylon and spandex fabrics to be recycled as the technology did not exist to separate the two fibers,” said Kristine Lebow, Speedo U.S.A.’s senior director of merchandising and design. “I have been personally motivated for a long time to be able to recycle swimwear and in a ‘what if’ conversation with our product development team and Carvico, our fabric supplier, it came to light that Aquafil had just developed the extraction and regeneration process and were looking for a brand to partner with.”

Masami Shigematsu, softlines development senior director, continued, “Typically when fibers are recycled the end result is a downgraded version of the initial product. What makes the Econyl fiber so exciting for Speedo is that Aquafil is able to regenerate the nylon to its original structure.”

Japanese company Teijin, meanwhile, has figured out a way to recycle polyester products multiple times without reducing the quality. Dubbed [Eco Circle](#), the closed-loop system relies on secondhand polyester apparel instead of petroleum—claiming to reduce CO2 emissions by 77 percent—to make new fabric that’s just as good as what the discarded clothes were initially made from.

“We encourage participating companies such as fashion and sports apparel brands to develop recyclable products made mainly with polyester, so that they can be collected and recycled with Teijin’s chemical recycling technologies for polyester to produce raw material equivalent to that made from petroleum,” offered Ricky Miyatake, Teijin’s general manager of sustainability programs.

What’s next?

Seattle-based start-up [Evrru](#) asserts that in the future, all clothing should be created “by first considering its final life.” Until that day comes, the company’s patent-pending technology creates a regenerative supply of bio-based fiber through the renewal of old cotton clothes.

“We’ve developed a technology that breaks down post-consumer cotton garments to the molecular level and are able to engineer a pristine new fiber that’s a finer denier than silk and stronger than cotton; it’s not rayon, lyocell or cotton—Evrru will be a new generic fiber classification,” explained Stacy Flynn, who co-founded the company in 2011 with

Christopher Stanev, a textile chemist and engineer.

“The way we make the fiber cuts negative environmental impact by 70 percent, compared to any other fiber alternative,” Flynn shared, adding, “It also has more available dye sites so it loves color. We’re looking at a massive reduction in resources needed for dying Evrnu fiber and the potential to use natural and botanical-based dye systems very efficiently.”

But, as Cunningham of the Circular Textiles Program highlighted, recycling technologies need investment in order to scale and commercialize.

“Brands need to step up to the plate and not only demand these new materials but put material (post-industrial, pre-consumer and post-consumer) back into the system,” she stressed. “In the long term, we see that working with recycled content will protect against inevitable resource scarcity and the price volatility that comes with it; that is, recycled fiber will be a stable, low cost alternative to virgin.”

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