



Hydrogen energy innovations for a Circular Economy and Zero Waste

Specializing in textiles, Yamagin is a company that develops innovative materials.

Founded in 2000, the company is headquartered in Tokyo with offices in Osaka, Shanghai, and Silicon Valley. With a small but talented staff of only six employees, the company is using its remarkable development capabilities to create innovations that lead to solutions to serious issues facing both fashion and the global environment.

In 2021, ZERO-TEX®, a multi-functional material that aims for zero waste, was launched. This material was utilized in the U.S. as a medical gown to be used in the medical field for Covid-19 infections, and a V-shaped recovery was achieved in sales that had been hit hard by the global pandemic.

Not content to rest on this success, the company went on to develop Biotech Works, an up-cycling platform that recovers apparel products and converts them to hydrogen. What is the driving force behind the company's continuous move forward and confident pursuit of innovation?

To find out, we interviewed Akihide Nishikawa, founder and CEO, and Miki Nitani, director and general manager of the sales department.



Pioneering digital and sustainable transformations that meet the needs of our times.

We can imagine and give shape to what is not yet possible. In line with the company's mission statement, "Make the move, make our future better." Yamagin creates value and has a positive impact on the earth and society by firmly linking and balancing environmental solutions and economic activities.

Jules Verne wrote, "Anything one man can imagine, other men can make real" and Yamagin's Mr. Nishikawa is, at a very fast pace, making a reality of what has until now only been imagined.



(Founder and CEO of Yamagin Ltd., Akihide Nishikawa)

- Apparel is not garbage.

Since the company's inception, Mr. Nishikawa has had a desire, through eco-business, to change the fact that Japan is less environmentally conscious than the U.S. and Europe.

Apparel products that are mass-produced with a large environmental impact are disposed of in quick cycle to protect brand value or to keep up with changing trends, resulting in large amounts of landfill waste or incineration, which generates greenhouse gases. Mr. Nishikawa's love of fashion is part of his strong motivation to somehow stop this vicious cycle.

"If no one else is doing anything about such a situation, I want to be the one to step up and start," he said. "If I can make even a small positive change in the world's serious issues, it will encourage me." The foundation of Yamagin's innovative challenges is its constant consideration of what can be done next, always with an eye to future generations.

ZERO-TEX® is a Multi-Functional Material Born of the Covid-19 Pandemic

- Initially developed as personal protective equipment (PPE) and medical gowns

The development of ZERO-TEX® began in 2020 with the onset of the Covid-19 pandemic. The impetus for the development came when we learned that medical gowns worn by healthcare workers were being discarded after a single use treating individual infected patients.



Medical gowns use more than twice as much fabric as regular clothing. If each gown were to be discarded after a single use, it would create a large amount of waste that ends up in landfills. Thinking of a way to make it possible to wash and use the fabric repeatedly instead of discarding it, Yamagin immediately began development of its vision.

Thus, ZERO-TEX® , which was launched as a product in April 2021, achieved sales of 5 million US dollars (about 550 million Japanese yen) in its first year in the U.S. and Japan, achieving a V-shaped recovery from the major economic damage due to the pandemic.

- Long Wearing Sustainability

The uniqueness of ZERO-TEX® lies in the fact that it has excellent and durable water repellency, while at the same time it has moisture release and breathability. Normally, as water repellency increases (as in a raincoat, for example), breathability is inversely proportional to the water repellency. ZERO-TEX® , however reduces discomfort caused by dampness and stickiness while being worn and remains dry and comfortable. In addition, ZERO-TEX® does not become electrically charged, making it safe for use with electro-medical equipment. These are very welcome features for medical personnel who treat infected patients for long periods of time.

Durability is also an important point when it comes to frequent washing, and ZERO-TEX® has been proven by a third-party organization to maintain these functionalities even after 100 wash and dry cycles.

- Traceability and collection system for recycling

So what happens to ZERO-TEX® after 100 washes?

ZERO-TEX® uses QR codes on its products and has introduced a dedicated application that alerts users when the material has been washed 100 times and has reached its expiration date.



To make the recycling collection system function efficiently in the Japanese market, we will target the uniforms of companies, stores, and schools. Items that have been used 100 times can be consolidated in a single collection location, which has the advantage of saving both the recycler and the collector time and effort.

Viruses and pollen do not adhere to this fabric and it is resistant to rain and ultraviolet rays. It is durable even after being put through washing machines and dryers.

It also has high thermal diffusivity and contact cooling properties, making it effective in preventing heatstroke in the summer, a feature that will be appreciated by both workers and students.

- Comfortable, Safe, and Sustainable into the Future

ZERO-TEX®'s three "ZERO" goals:

Zero infections, Zero disposables, and Zero impact on the earth.

In line with our desire to reduce the amount of garbage to zero, our research and development in Silicon Valley have led to Biotech Works, a new project that allows for the collection and recycling of materials after use.

Upcycling project "Biotech Works" from Silicon Valley

- Collecting discarded apparel products and eliminating waste

After worn to their limits, ZERO-TEX® products are collected through the process described above. Biotech Works is a project to convert recovered apparel products into hydrogen, a renewable energy source.



The upcycling process can be tracked by users who have purchased and used ZERO-TEX® products and by checking through data visualization, they can realize that their actions are having a significant impact on sustainability.

In line with the Sustainable Development Goal 12 "responsible consumption and production," the residues from the recycling process are processed into cement, and the CO₂ is effectively utilized by converting it into dry ice. The company is thoroughly committed to its philosophy of "not producing waste and not burning waste."

We visualize a mechanism that connects the four elements of 1) product collection, 2) sorting, 3) conversion into hydrogen, and 4) community contribution. A key feature is that the conversion to renewable energy can be done locally for local consumption. For example, what is collected in the U.S. can be processed in the U.S. and similarly for Japan. The company aims to reduce emissions in the supply chain and transportation as much as possible.

- Ultimately, we want to recycle all apparel products

When asked why he would go to such lengths, Nishikawa replied, "Let's compare it to human blood. Let the arteries represent economic activity and veins represent the collection system."

The blood flowing in the arteries from the heart provides the power for activity, and the blood circulating in the body returns via the veins, right? If we translate this to the global environment, we see it as a condition where the veins are not functioning, so the blood does not return to the heart, or if it does return, it returns contaminated."

This is no way to sustain a living organism.

And it is easy to imagine that the cleaner the blood coming back from the veins, the healthier the body will be and the longer the healthy life span will be.

As NIKE and NETFLIX have stated "if the Earth does not survive, our business will not survive," and solving environmental issues is central to their corporate purpose. It is important to commit to the fundamental principle of keeping the Earth alive and to work on it responsibly.

- Major companies are paying attention to the potential for innovation

Yamagin exhibited the company's technologies at the Sustainable Fashion and DX EXPO in October 2021 and April 2022.

In 2021, the company mainly promoted ZERO-TEX®, but in April 2022, it decided to fully launch Biotech Works and exhibit it in a large booth along with a hydrogen car display.



(Yamagin booth at the Sustainable Fashion and DX EXPO, a hydrogen car display)

The event was a gathering place for many people involved in the sustainable fashion and apparel industry, and there were also contacts from major Japanese and international companies.

Is it only apparel that can be recycled in this way? The interest generated by our innovations led to inquiries from the food industry, as well as others in the apparel industry, asking if they could work together with us on resource recovery methods and energy production through recycling, showing that many companies are interested in progress related to recycling and establishing efficient recovery mechanisms.

What we can and cannot do alone

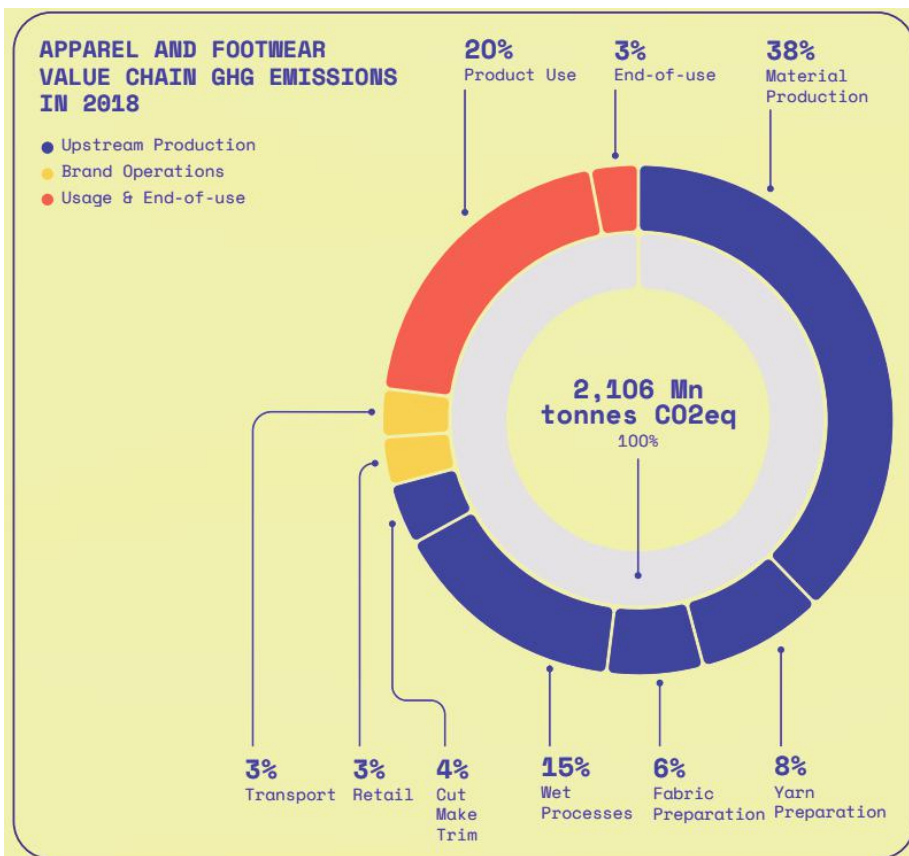


(Yamagin's message displayed at the Sustainable Fashion and DX EXPO)

• I don't want to be the bad guy because I love fashion

I love the feeling when you put on new clothes and you decide on an outfit that you like. When you try on a new outfit and it suits you better than you thought it would, you feel like a new you. Fashion is something that gives joy and richness to our lives. We don't want it to be something that makes us feel a sense of guilt. For this reason, we must not turn a blind eye to the negative impact that the fashion and apparel industry has on the environment.

According to a McKinsey & Company report, the apparel industry emitted 2.1 billion tons of CO2 as of 2018.



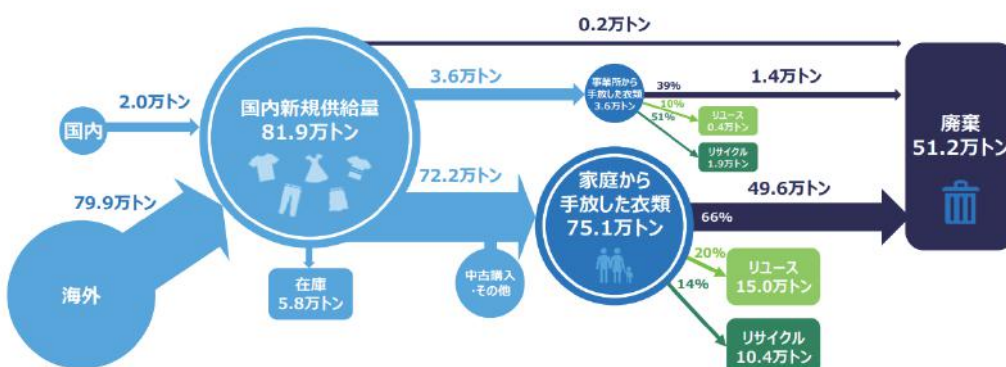
(Source of photo: <https://www.mckinsey.com/~media/mckinsey/industries/retail/our%20insights/fashion%20on%20climate/fashion-on-climate-full-report.pdf>, McKinsey&Company, 2020)

The textile and apparel industry was listed second in the ranking of environmentally polluting industries by the United Nations Conference on Trade and Development (UNCTAD), after the oil industry, which ranked first.

The industry uses enough water (93 billion cubic meters) to meet the needs of 5 million people annually and dumps the equivalent of 3 million barrels of oil (about 500,000 tons) of plastic material into the ocean. It also emits more carbon than the international airline and shipping industries combined.

In Japan, the amount of new supply in 2020 will total 819,000 tons, while the amount discarded will total 512,000 tons, and only 15.6% of the total amount will be recycled.

2020年版 衣類のマテリアルフロー



出所: 株式会社日本総合研究所作成

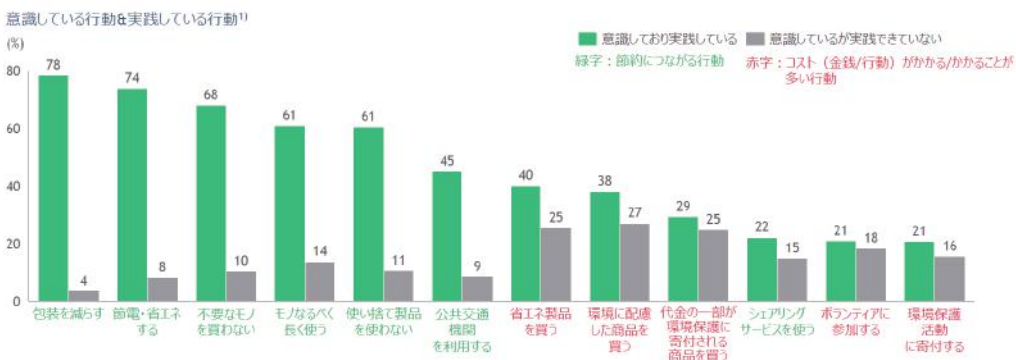
(Source of photo: https://www.env.go.jp/policy/pdf/st_fashion_and_environment_r2gaiyo.pdf, The Japan Research Institute, Limited in 2020)

There is a wide range of things that apparel manufacturers, brands, and supply chains can and should do to achieve sustainable fashion: Reducing overproduction, reducing return rates, repairing products, introducing sharing services, using recycled materials in packaging materials, and saving energy in stores. At the same time, it goes without saying that there is a dire need for consumers to make changes to their behavior to reduce fashion and apparel waste.

- A world where ethics and recycling are the norm

Although interest in and awareness of sustainability and the SDGs are rapidly spreading in Japan, there are still a certain number of indifferent consumers, and the number of consumers who say they would purchase products with low environmental impact "even if the price is high" is still relatively small.

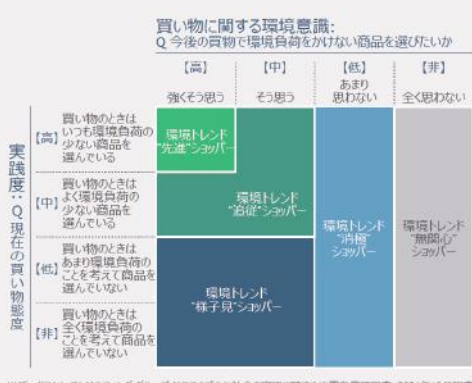
地球温暖化/気候変動のために、節約につながる行動は実践率が高いが、追加でコスト（金銭/行動）がかかる行動は意識していても実践できない割合が比較的高い



1. 以下の質問に対してそれぞれ「実践したい」「まあ実践したい」「実践している」「まあ実践している」に回答した人の合計の割合
 質問文: 地球温暖化/気候変動問題に向けて、あなたは次のそれぞれについて、今後の程度実践したいと思っていますか
 : 地球温暖化/気候変動問題に向けて、あなたは次のそれぞれについて、現在の程度実践していますか
 出所: Boston Consulting Group サステナブルな社会の実現に関する消費者意識調査 (2021年12月調査)

買い物への意識 x 実践度で消費者をセグメンテーションした場合、時系列で大きな変化は見られない

環境に関する消費者のセグメンテーション



出所: Boston Consulting Group サステナブルな社会の実現に関する消費者意識調査 (2021年12月調査)

"I love Japan, so I'm honestly sad about the current situation." said Nishikawa. "I would like to raise the overall level of awareness, rather than adjusting to accommodate a lower level just because some people are less environmentally conscious or because ethical consumption is not widespread. Instead of a "lose-lose", mindset where people give up because they feel that they can't do anything about the situation, I am confident that we can make "win-win" the standard. I want to aim for that without giving up," he says enthusiastically.

Incorporating sustainability into business models and corporate strategies to improve the relationship between fashion and the environment should be normalized regardless of the size of the business.

Consumers should also be conscious of how products are produced, recycled, reused, and disposed of, rather than simply buying them because they are cheap.

Each individual's participation in and practice of sustainable activities will lead to a large impact, which will change the future of apparel and fashion.

To quote Jack Ma, founder of Alibaba, whom Mr. Nishikawa respects, "The opportunity always lies where people complain."

"The more people that say it is impossible, the more motivated I become. I really want to improve the global environment, and I want to use this technology to help more people in a direct way."