

Chemical Polyester Recycling II

The Progress of Teijin Chemical Fiber Recycling

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During the 5th China Int'l Recycled Polyester Fiber Market & Tech Forum Sept. 2-4, 2009, Shanghai, China, a summary about chemical recycling of polyethylene terephthalate was provided. One issue there was that fiber recycling is compared to recycling of PET bottles and film still within the fledgling stages with one big exception which is the Japanese company Teijin. Meanwhile Teijin has from the first closed loop fiber recycling Patagonia project extended these activities substantially. Teijin started in 1-2009 the closed loop recycling of ski-gloves with Swany America and in 10-2009 in China together with the Li Ning Group a closed loop for sportswear. A next cooperation with the British Marine to recycle Marine Clothing was started in 11-2009.

When we are looking at this development we easily will discover the potential of this closed loop fiber recycling which is on a worldwide scale almost incredible thinking about the military personal clothing, clothing of police, fire fighter, railway uniforms and so on. These applications are different to the apparel for the civil population. There are still pretty logistic bases available to design, collect and recycle the used workwear and utilities. This example should encourage large integrated polyester producer to follow.

In the following some recent available public information of Teijin to polyester fiber recycling is collected.



Teijin Fibers is striving to be friendly to the global environment, humans and various other creatures to make our society sustainable. We are taking initiatives to manufacture environmentally-friendly materials such as using recycled polyester materials which turn garbage into resources, and employing recycling systems for polyester products. Furthermore, we are developing synthetic fibers derived from plants based on the concept of carbon neutral, materials that do not use hazardous Substances as much as possible, and materials that create color without using dyestuff.

http://www.fibre2fashion.com/news/textiles-company-news/newsdetails.aspx?news_id=77352

Teijin launches first ever Chinese garment recycling program

September 21, 2009 (China)



The Teijin Group announced the first-ever program in China for collecting and recycling used garments, which it has launched in collaboration with Li Ning Company Limited, the nation's leading sports apparel company. Recycling will be carried out with ECO CIRCLE, an environmentally friendly closed-loop system incorporating the world's first technology for the chemical recycling of polyester, which Teijin Fibers introduced in 2002.

As part of the program, Li Ning has designed tennis and training wear using Teijin Fibers' chemically recycled ECO CIRCLE FIBERS, which are woven into textiles and dyed by Nantong Teijin Co., Limited, a Teijin group company based in Nantong, China. The inaugural 2009-10 winter lineup will be sold at 11 stores managed by Li Ning beginning in October.

Under the program, the Li Ning stores will accept these garments after they are worn out, from where they will be sent via Nantong Teijin to Teijin Fibers' Matsuyama plant in Japan. After chemical decomposition, they will be converted into polyester raw material offering purity comparable to that derived from petroleum. The raw material will then be turned into high-quality ECO CIRCLE FIBERS, which will be used to manufacture new recyclable products.

Repeated recycling achieved with the ECO CIRCLE system reduces both energy consumption and carbon dioxide emissions, each by approximately 80% compared to conventional petroleum-based processes that are used to produce polyester.

The global market for recyclable and recycled clothing is expanding, especially in Europe, the U.S. and Japan. Increased environmental consciousness in China, particularly among younger consumers, is also helping to fuel this trend in the world's largest nation as well. Li Ning, which shares Teijin's proactive commitment to environmental protection, has developed its lineup of tennis and training wear with a focus on Chinese consumers between the ages of 18 and 30, placing special emphasis on both fashion and comfort. The wear is also highly functional, combining water resistance to repel light raindrops and moisture permeability to enable perspiration to escape.

Teijin and Li Ning look forward to expanding the ECO CIRCLE program to help strengthen sustainability in the fast-growing Chinese market. Li Ning aims to expand its lineup of clothing made with environmentally friendly ECO CIRCLE FIBERS, as well as increase its sales locations to more than 100 within three years. "We are delighted that our first ECO CIRCLE member in China is Li Ning, the country's leading sports apparel company," said Norio Kamei, general manager, member of the board of Teijin Limited and president of Teijin Fibers Limited. "The need for environmental responsibility is becoming increasingly urgent, so it is of great significance that a major company like Li Ning has joined our ECO CIRCLE program to advance environmental protection in China. Teijin looks forward to working closely with Li Ning to demonstrate our mutual commitment to achieving sustainable, environmentally responsible societies."

Going forward, Teijin will continue to expand the presence of its products and technologies around the world, including the ECO CIRCLE recycling program, which now has more than 120 participating companies. Based in Tokyo and Osaka, Japan, Teijin is a global technology-driven group operating in five main fields: synthetic fibers (polyester fibers, carbon fibers and aramid fibers); films and plastics; pharmaceuticals and home health care; trading and retail; and IT and new products.

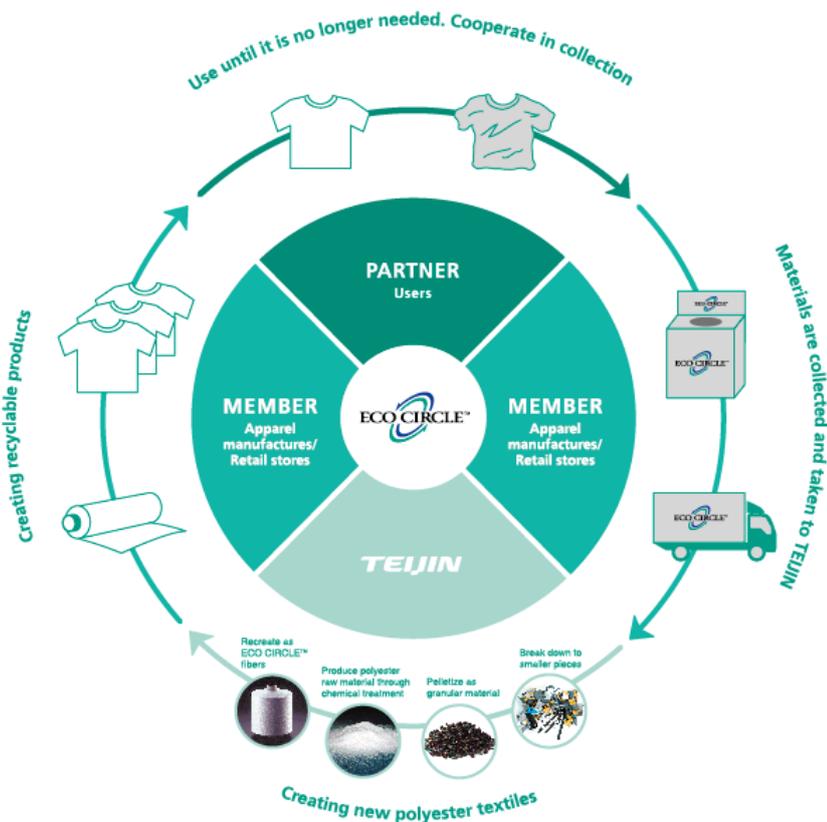
Li Ning brand was established in 1990. The brand gained a widespread reputation in the 1990 Asian Games. "Li Ning" sportswear was selected as the designated clothing of the 11th Asian Games. Dressing torch relay, Chinese and foreign reporters and the Chinese National Team for receiving medals in the Games. After more than 10 years of hard work, Li Ning has become the No.1 sporting goods brand among hundreds of millions of Chinese people. In 2004, Li Ning brand was successfully listed in Hong Kong, thus becoming the first listed China's sporting goods enterprise.

TEIJIN LIMITED

ECOCIRCLE® is Teijin Fibers' circulating recycling system. We are developing our products and conducting their collection and recycling in cooperation with apparel manufacturers in and outside of Japan who are working with us in this endeavor. Collected polyester products are disintegrated to molecular level, and then recycled into fibers of the same quality as ones made of oil. Because of this processing, we can avoid degrading quality which has been an issue of conventional recycling technology based on physical processing. In addition, because our technology allows us to use the same material as many times as we want, this reduces the consumption of oil resources and waste materials. Moreover, compared to manufacturing raw polyester materials from oil, it is possible to reduce both energy consumption and CO2 emission by about 80%*.

<*Source: "LCA Survey Report on Fiber Products" presented at Fiber Products 3R Committee (Ministry of Economy, Trade and Industry).

Comparison in the CO2 emission includes incinerated materials.>



Imagine if all of the PET bottles were melted down and recycled into new ones. Would we realize that they were once thrown away? Expecting a recycled product to be different in quality and have

variations has become second nature to us. ECO CIRCLE™ is TEIJIN's world-first, closed-loop recycling system for polyester products. After textile products are collected, they are broken down and processed to create new polyester fiber with no compromises in quality or variations. Will you also participate in perpetual recycling?

Teijin launches recycling program for used polyester ski gloves

January 16, 2009 (Japan)



Teijin Limited, a Japan-based global polyester polymers, fibers and textiles company and Swany America Corp., a leading manufacturer of ski gloves and mittens renowned for their enduring construction and cold weather performance, announced today the launch of a closed-loop recycling program for used polyester ski gloves.

As part of the collaboration, Swany America will use Teijin Fiber's ECO STORM(r), a recyclable, waterproof and breathable material made from recycled fibers laminated with a highly durable thin polyester film, for a new glove in its 2009-2010 winter lineup. The ECO-X-the world's first recyclable ski glove-will be available at retail stores in the United States, Canada and Europe beginning in September 2009.

This joint program also will include the collection and recycling of used products through Teijin Fibers' recycling system, called ECO CIRCLE(tm). Customers will be invited to mail their worn-out ECO-X gloves to Swany America using special envelopes supplied at the time of purchase. The gloves' polyurethane palms will be cut off at Swany Warehouse in Johnston, New York and recycled domestically.

The remaining polyester parts, such as shells, insulation, waterproof and breathable inserts and hollow core inner linings, will be sent to Teijin Fibers' Matsuyama plant in Ehime Prefecture, Japan, where they will be chemically decomposed and converted into new polyester raw material at a recycling facility.

The ECO CIRCLE system incorporates the world's first chemical-recycling technology to decompose polyester for conversion into new polyester raw material offering purity comparable to that derived from petroleum. The repeatable recycling system reduces energy consumption and carbon dioxide emissions by approximately 80% each compared to the production of polyester materials from petroleum.

ECO STORM is the world's first recyclable, high-performance waterproof and moisture-permeable material made of recycled fibers. As it is made of polyester, ECO STORM can be recycled with ECO CIRCLE. With hydrostatic resistance of 20,000mmH₂O and moisture permeability of 15,000g/m² in a 24-hour period, ECO STORM is ideal for sportswear, outdoor gear and uniforms. Swany America's ECO-X, however, will be the first ski gloves made with ECO STORM.

Teijin Fibers, which registered the 100th member in its ECO CIRCLE recycling program last year, aims to expand its presence in the global sportswear industry. Together, Swany America and Teijin Fibers plan to enhance their commitment to environmentally friendly initiatives with the targeted launch of four items made with ECO STORM for Swany's 2010-2011 lineup.

Swany America will exhibit ECO-X at the SnowSports Trade Show (SIA.09), which will be held at the Mandalay Bay Convention Center in Las Vegas from January 27 to January 30.

About ECO CIRCLE™:

Developed by Teijin Fibers, ECO CIRCLE is a closed-loop recycling system for used polyester products. The system employs the world's first technology for chemical recycling, which chemically decomposes polyester for conversion into new polyester raw materials that offer purity comparable to those derived from petroleum.

November 18, 2009

**Teijin Launches First Closed-Loop Polyester-Recycling Program for
Marine Clothing Industry
— Collaboration with Henri Lloyd —**

Teijin Fibers Limited

Teijin Fibers Limited announced today the first-ever program in the marine clothing industry for collecting and recycling used garments, launched in collaboration with Henri Lloyd, a major global brand of marine apparel based in the United Kingdom. Recycling will be carried out with *ECO CIRCLE*, an environmentally friendly closed-loop system incorporating the world's first technology for the chemical recycling of polyester, which Teijin Fibers introduced in 2002.

Teijin Fibers' *ECO STORM*, a recyclable, waterproof and breathable material made from recycled fibers laminated with a highly durable thin polyester film, will be incorporated in sailing wear featured in Henri Lloyd's 2010 Blue Eco Range. The inaugural lineup will include the Blue Eco Jacket and Hi Fit trousers, both of which are windproof, waterproof and highly breathable. The Blue Eco products will be available in Henri Lloyd's own stores and its wholesale account network in the UK as well as the USA, Australia, across Europe and Japan.

Under the program, Henri Lloyds Blue Eco partners will accept these garments from their customers after they are worn out, from where they will be sent to Teijin Fibers' Matsuyama plant in Japan. After chemical decomposition, they will be converted into polyester raw material offering purity comparable to that derived from petroleum. The raw material will then be turned into high-quality *ECO CIRCLE* FIBERS, which will be used to manufacture new recyclable products.

Repeated recycling achieved with the *ECO CIRCLE* system significantly reduces both energy consumption and carbon dioxide emissions compared to conventional petroleum-based processes that are used to produce polyester.

ECO STORM is the world's first recyclable, high-performance waterproof and breathable material made of recycled fibers. As it is made of polyester, *ECO STORM* can be recycled with *ECO CIRCLE*. With excellent hydrostatic resistance and moisture permeability, *ECO STORM* is ideal for sailing apparel, outdoor gear and uniforms.

Blue Eco is the start of Henri Lloyd's commitment to develop more environmentally friendly apparel and further developments are expected.

"We are very pleased that Henri Lloyd, a leader in technical marine clothing, has joined our *ECO CIRCLE* program to help advance environmental protection," said Norio Kamei, President and CEO of Teijin Fibers Limited. "*ECO CIRCLE* is an innovative system that employs unprecedented chemical recycling technology to enable repeatable recycling of used products with no qualitative deterioration. We are delighted with the launch of Blue Eco Range and look forward to working closely with Henri Lloyd to contribute to recycling-oriented sustainability."

Talking about effects of these products Paul Strzelecki, Joint Chief Executive of Henri Lloyd said: "This is a positive first step on a long journey to become a more environmentally friendly company. It is also a very exciting time, particularly with our exclusive marine wear association with Teijin who are pioneers in this field. We not only aim to significantly reduce CO2 emissions into the environment but also want to provide our customers with an opportunity to actively participate in the mission to help preserve our oceans. We look forward to further developments in this area, and hope the 'infinite loop' recycling system will set the course for the future of marine clothing manufacturing."

Going forward, Teijin Fibers will continue to expand the presence of its products and technologies around the world, including the *ECO CIRCLE* recycling program, which now has more than 120 participating companies.

The Henri Lloyd Blue Eco Jacket received 'Most ECO-Friendly Product Certificate' at the 2009 DAME Award, which was announced on November 17 at the METS (Marine Equipment Trade Show) in Amsterdam, the Netherlands.



About *ECO CIRCLE*

Developed by Teijin Fibers, *ECO CIRCLE* is a closed-loop recycling system for used polyester products. The system employs the world's first technology for chemical recycling, which chemically decomposes polyester for conversion into new polyester raw materials that offer purity comparable to those derived from petroleum. Teijin Fibers cooperates with over 120 registered apparel and sportswear manufacturers worldwide for the development and manufacture of products made from recyclable materials, as well as to collect and recycle these products at the end of their useful lives.

Overseas members include major manufacturers such as Patagonia Inc. in the U.S. and Quiksilver Europe in France.

About the Teijin Group

Based in Tokyo and Osaka, Japan, Teijin is a global technology-driven group operating in five main fields: synthetic fibers (polyester fibers, carbon fibers and aramid fibers); films and plastics; pharmaceuticals and home health care; trading and retail; and IT and new products. Teijin Limited, the holding company for the Teijin Group, is listed on the Tokyo and Osaka stock exchanges. The group had consolidated sales of USD 9.4 billion (JPY 943.4 billion, USD 1=JPY 100) in fiscal 2008 and employs 19,453 people worldwide, with 169 companies around the world.

About Teijin Fibers Limited

Based in Osaka, Japan, Teijin Fibers Limited is the core company of the Teijin Group's polyester fibers business, conducting R&D, manufacturing and marketing of materials and textiles made from polymer and polyester fibers. For more information, please visit www.teijinfiber.com/english

About Henri Lloyd

British specialist clothing brand Henri Lloyd, was founded in Manchester, England in 1963 by Mr. Henri Strzelecki. The family run company is widely regarded as one of the market leaders in technical sailing and lifestyle apparel having pioneered the development of fabrics, garment design and products for over 45 years. Henri Lloyd's association with the world's sailing elite including the early pioneers of solo circumnavigation and exploration including Sir Francis Chichester and Sir Robin Knox-Johnston, and more recently triple Olympic Gold Medallist Ben Ainslie, has allowed Henri Lloyd to stay at the forefront of intelligent innovation. Henri Lloyd has a strong international presence and distributes to 41 countries. For more information, please visit www.henrilloyd.com

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<http://www.teijin.co.jp/english/news/2009/ebd091118.html>

Recyclable high-performance, waterproof and breathable material Increasingly adopted by overseas apparel companies



Outdoor wear using *ECO STORM*

For waterproof/breathable materials used for outdoor or sports jackets and rain wear, water-repellent, waterproof properties and wind break performance is required on the outer surface as well as is moisture permeability on the inner surface to realize quick outward diffusion of sweat and moisture. For this reason, coating or lamination of fluorocarbon resins or polyurethane and others have been typically introduced with fiber materials such as nylon. However, it was not easy to recycle these waterproof/breathable as being fabricated by different materials. The trend in this field, where differentiation via function has become difficult, is toward high value-added materials capable of differentiation.

Responding to rising needs for eco-friendly products and recyclable materials, in 2007, Teijin Fibers Limited developed 100% polyester *ECO STORM*, a highly functional waterproof/breathable material made from recycled fibers via chemical recycling. The sales of this product is growing smoothly, mainly for outdoor and apparel products by domestic and overseas companies.

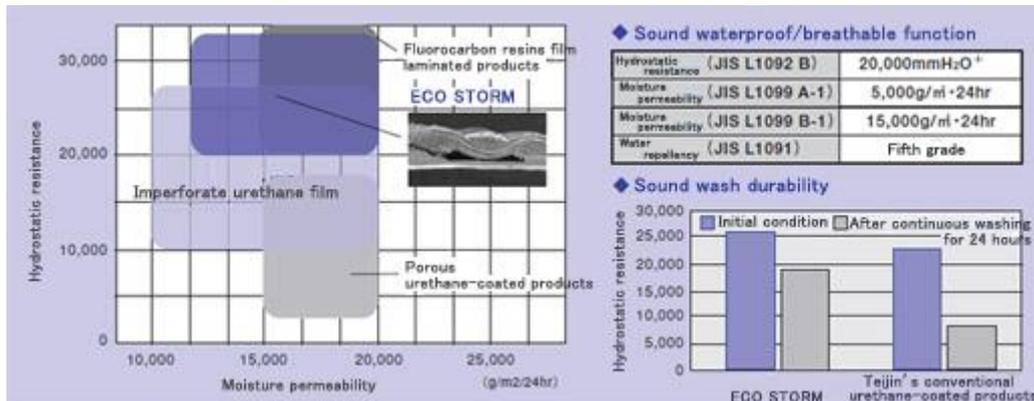
ECO STORM is manufactured by laminating thin-type polyester film with excellent hydrostatic resistance, moisture-permeability and durability on high-density fabrics made from chemical recycled fiber *ECOPETPLUS*. *ECO STORM* is lightweight, thin, soft, and highly durable as well as having high waterproof and water-repellent properties, moisture permeability and wind break performance, all required for waterproof/breathable materials. Furthermore, hazardous gasses formed by its combustion can be kept to the minimum due to the non-use of organic solvent in the laminate polyester film production. This material can be recycled to produce new fibers through *ECO CIRCLE*, a recycling system that Teijin Fibers Limited is implementing. This system drastically reduces oil use, garbage output, energy consumption and CO₂ emission.



ECO-X

ECO STORM has been adopted by foreign companies: Patagonia in the United States for hard shells (high-performance waterproof/breathable jackets) and for *ECO-X*, first-in-the-world recyclable ski gloves (the product in the photograph is to be introduced in U.S.A., Canada and Europe in September, 2009), developed jointly with Swany America of the United States. Used products to be discarded will be recycled as new polyester products through *ECO CIRCLE* system by their group companies.

Concerns about the environment and the recycling are expected to draw increasing attention in the future. Teijin Fibers Limited will work to expand the use of *ECO STORM* for *ECO CIRCLE* member companies, including domestic and overseas outdoor and apparel product companies as well as domestic uniform manufacturers and to grow its product lineup related to recycling.



http://www.teijin.co.jp/english/rd/rd13_12.html