RISE TO THE CHALLENGE: SPINNOVA AND FIBRIA

The Finnish and Brazilian companies are developing a cellulosic fibre that uses a mechanical process to turn the fibre into yarn, doing away with the need for most chemicals, water and energy.

Spinning threads from green gold

Wearing a waistcoat, tie and pocket square made of its novel cellulose textile, Spinnova CEO Janne Poranen and wife Nina greeted Finland's president as part of Presidential Independence Day celebrations at the Palace in Helsinki last December. It was the first time the material had been presented to the public and was an indication of its potential uses, once testing and development phases have concluded. "Not everybody noticed what I had on, I am not that well known in Finland!" laughs Mr Poranen. "But after the reception we had a lot of interviews and public interest."

Launched as a spin-off from the VTT Technical Research Centre of Finland in 2014, Spinnova claims to have developed a way of reducing wood pulp to a polymer and regenerating cellulosic filaments "without complex chemical processes". "We are not dissolving anything, that's the big difference," Mr Poranen tells *WSA*.

Spinnova co-founder Juha Salmela had the idea for the yarn when he was a senior scientist at VTT, working alongside silk researchers at the University of Oxford. The discussions helped him to see the similarities between the construction of a spider's web and the formation of wood fibres.

The invention is based on fibre suspension flows, rheology, and how a fibre flow can be controlled in such a way that it forms a yarn. The first trials at VTT showed that wood yarn could be made by passing pulp through a pinhole, so long as the fibres passed through in the right position. The method was developed up to laboratory scale at VTT, when it was felt it warranted dedicated research in the form a new company, Spinnova.

"We are confident that it works and there are no longer any technological challenges," explains Mr Poranen. "We have our pilot in Finland, and the next stage is to upscale the pilot, and then to increase production to a level where the textile companies can test their applications."

He envisages that by next year, the bigger



Finland's abundant forests provide a vast source of raw material for Spinnova

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pilot will be in operation and they will be ready to work on the industrial-scale plant.

Cotton replacement

Spinnova claims its manufacturing method consumes 99% less water and 80% less energy than cotton production and could "revolutionise both the textile and forest industry and generate significant business in the future". Based on its technology and on Finland's forestry reserves (especially in spruce and pine), Spinnova has claimed it has the capacity, in theory, to replace the world's entire cotton production.

It has already won an international biorefinery contest organised by Finland's Ministry of Economic Affairs and Employment and was highlighted as one of the country's brightest start-ups. It was named one of the top 10 European cleantech start-up companies at the 2016 European Venture Summit in Düsseldorf and has been selected as one of FabricLink Network's Top 10 textile Innovations for 2017.

Brazil connection

At the start of July, Brazilian company Fibria, which employs 15,000 and has an annual production capacity of 5.4 million tons of pulp and more than 300,000 tons of paper, bought an 18% stake in Spinnova for €5 million. The company said it saw a "capacity to offer solutions for problems related to climate change and the low-carbon economy".

The deal was brokered by Finnish consultancy Pöyry and includes a seat on the board. Fibria has invested in the pilot production line and production on a pre-commercial scale. If the project reaches the commercial phase, the two companies could create a joint venture for producing and marketing products.



The waistcoat and bowtie that made their debut at the Presidential Palace in Helsinki.

Nina Poranen

"The partnership strengthens Fibria's positioning for the development of new high-value products that complement our global leadership in eucalyptus pulp production," says Fibria's CEO, Marcelo Castelli.

Fibria is the world's biggest producer of eucalyptus pulp – it operates vast forests across six Brazilian states and will use this as the feedstock if it is proved commercially viable. When Spinnova started its research, it believed long-fibre cellulose from spruce and pine were best suited, but Poranen confirms the short-fibre eucalyptus now works equally well. "What



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we are producing today is more or less like a staple fibre," he explains. "We would use the same technology for both long and short fibres, but with some differences. Almost all the cellulose-based raw materials we have used have worked quite nicely, so it is not limited to the long fibres now."

Supermaterial

Cellulose is the "supermaterial of the future", according to VTT, Aalto University, Tampere University of Technology and the University of Vaasa, who between them received a €4.9 million research grant from Tekes, the Finnish Funding Agency for Innovation. The researchers are working to develop new applications within the Design Driven Value Chains in the World of Cellulose (DWoC) 2.0 project, which will run until April 2018. Applications include non-wovens for interiors, foams for footwear and padding for helmets. "There is a strong belief in Finland's future as one of the superpowers in a new cellulose industry," says VTT.

"The government programme emphasises the importance of the bioeconomy for Finland's future and economic renewal," says project coordinator Johanna Buchert. "Renewal necessitates giant research-driven leaps, risk taking and national investment in research and innovation. Wood – the 'green gold' of Finland – is a renewable raw material and wood cellulose can be converted to a golden opportunity when we find new added value applications alongside the traditional paper and pulp industry."

Spinnova's yarn was one application to be born from the programme, and its properties can be altered to suit the end application, according to Mr Poranen. The aim is to produce fibres that are processed using the same spinning technology as other apparel yarns, and there are also non-woven applications that are being considered. "We have to meet the same properties and same qualities that, for example, viscose and cotton fibres have today. But, of course, there are easier applications to start with and then more difficult ones that we are aiming for later."

Spinnova has also attracted outside investment from parties and investment firms including the former chief technology officer of Nokia and one of the world's leading cellulose companies, Lenzing, the maker of Modal and Tencel. "Lenzing is a great partner because they are the innovation leader when it comes to wood-based textiles," says Poranen. "The reason they are interested is they see that this is maybe a breakthrough for the future, and that's why they are following what we are doing."

Cheaper than cotton

The breakthrough will be a necessary one, according to Poranen, who sees the dominance of cotton in the world textile industry as a "disaster" because of the resources it consumes. "Many people do not know how bad it is, because they feel good when they are wearing cotton, it is cheap and other aspects are more important…but in the future we have to find something better."



3D printing of cellulose on fabric, part of the DWoC project.

Eeva Suorlahti

As well as the environmental benefits – using raw materials that are sustainable, recyclable and biodegradable, and a process that uses comparatively little water, chemicals and energy – it is reportedly cost effective. "We believe that we can be even cheaper than cotton, so we are not only sustainable but we can also meet the cost or pricing as well."

While the claim that it could replace cotton production seems unlikely, at least in the short term, there seems to be a place in the textile mix for a cost-effective cellulose product with a small environmental footprint, especially as brands and consumers grow more aware of the impact of fast fashion and chemicals, and as resources grow scarcer. "That is our only goal," concludes Poranen, on the environmental challenge. "We would really like to make at least a small change by what we are doing."

Spinnova

- Developing a yarn thread technology that originated at VTT
- Based in Jyväskylä, Finland
- Founded by Janne Poranen and Juha Salmela
- Financed by Fibria, Markku Kaloniemi, Yrjö Neuvo, Timo Soininen, VTT Ventures, Lenzing and Besodos
- Established in 2014

Fibria

- A pulp and paper company
- Based in São Paulo, Brazil
- Operates forests in six Brazilian states, and four pulp mills
- Biggest producer of eucalyptus from planted forests
- Employs 15,000
- Established in 2009 from the merger of two pulp giants

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