





#### **In short**

- **A new generation of 'greener' synthetic fibres are entering the textiles market**
- **The fibres are based on polymers derived from plants rather than petrochemicals**
- **Class (Creativity, Lifestyle and Sustainable Synergy) is one project that brings manufacturers of these textiles together with the designers who use them**

consultant Kate Fletcher, author of *Sustainable fashion and textiles: design journeys*, published in January. 'There are statistics that indicate consumer willingness to choose more responsibly [produced] fibres, and growth in the ethical clothing market is increasing very rapidly – albeit from a very small base.' Market research from Globescan Eurisko back in 2005 showed that 85 per cent of Italian consumers, closely followed by Germans, Canadians, Britons and finally Americans (79 per cent), would be happy to pay an extra 10 per cent for a product that does not harm people and the environment.

'The retail industry is fuelling demand,' says Josef Spikyers of CIRFS, the European man-made fibres industry association. 'Also regulators, such as the European Commission, have responded by promoting the eco-label to set environmental criteria for fabrics.' However, Spikyers says all CIRFS's research shows that consumers still look first at performance and cost; and then at environmental considerations.

And here's the rub – alternative fibres come with a premium price tag attached. What's more, sometimes they can't match their mainstream competitors when it comes to a range of performance properties, says Spikyers. Take fibres like Ingeo, made from poly(lactic acid) or PLA. 'PLA fibres are the biggest player,' says Spikyers, 'but they are so far only used in niche markets because they cost several times more than regular polyester and their performance properties are not so good. The problem is that the melting point of the polymer is lower and this sets limitations on its production and its applications. For example, ironing temperatures are limited.'

There are drawbacks, agrees Fletcher. 'But, what's critical is that something is being done – people are taking action and making changes to meet the goal of sustainability.'

#### **Image is everything**

Given time and more investment, both Fletcher and Spikyers agree that these products will match their natural competition. But launching any new fibre into an already crowded marketplace is difficult. 'I think the niche perception – all sustainable clothes are beige or can't be washed enough – is changing,' says Fletcher. 'There's a buzz around alternative materials at trend shows.'

**Green is the new black: novel synthetic fibres are derived from plants**

Companies like NatureWorks are prepared to wait. 'Polyester took many years to break through because in the beginning, nobody understood how to process and dye it,' says Charon. 'The apparel industry is always hungry for new ideas and products that can offer new aesthetics or performance benefits. Once these are tested and applied, the industry relies on good communication throughout the chain to take this message of innovation to the end consumer.'

Marketing these fibres is critical. 'It can be very hard for the "green" voices to be heard; they can be marginalised and overwhelmed by the mainstream,' says Sandy MacLellan, textile designer and developer. That's why he teamed up with Giusy Bettoni, a marketing and PR consultant, to launch Class (Creativity, Lifestyle and Sustainable Synergy) last September at Milan Fashion Week, which brings these niche products together under one umbrella.

'Producers of sustainable fabrics can find it hard to get their fabrics seen by designers, and designers can struggle to source environmentally friendly fabrics,' explains MacLellan. 'Class aims to get each side talking to the other. Producers get a chance to show off their latest "green" fabrics fresh out of the lab, and designers get a one-stop shop in our showroom in Milan.'

Producers can also take advantage of marketing advice in the drive to make sustainability chic. But the bottom line from the designers is: clothes have to perform well and look good to survive the market.

To be included in Class, manufacturers don't have to tick all the 'green' boxes. They just need to have taken one or more steps in the right direction, whether that's improving their manufacturing processes or raw materials sourcing, or developing organic dyes. 'This is a developmental journey, bringing these products towards the market,' explains MacLellan. 'But I am convinced that there will be a shift in the future where these responsible products are the norm.'

NatureWorks – a joint venture between Cargill of the US and Teijin of Japan – is one of Class's partners. It launched Ingeo in 2003 as the world's first man-made fibre derived from annually renewable resources (corn in this case).

Ingeo is based on PLA. First discovered in 1932, PLA is a linear aliphatic thermoplastic polyester



derived from plant matter. Initially, its uses were limited to biomedical applications, such as sutures, but over the past decade, NatureWorks has developed commercially viable large-scale operations to produce PLA for use in packaging and fibres. It produces Ingeo at its facility in Blair, Nebraska, in the US, which has a PLA capacity of 140 000 tonnes per annum.

PLA is made by extracting the starch from plants and converting it into a fermentable sugar, such as glucose, by enzymatic hydrolysis. NatureWorks currently uses corn, but it is working to develop new conversion technologies that use feedstocks such as corn stover (the residue left in the field), grasses, wheat and rice straws, and bagasse (the residue of sugar cane production).

Fermentation of the plant sugars produces lactic acid. When water is removed, a cyclic intermediate dimer – lactide – is produced. NatureWorks has patented a process involving ring-opening polymerisation of the dimer under heat, without the need for solvent, using tin-based catalysts.

The trick is to synthesise both lactide and PLA in the melt rather than using solvents during the polymerisation process. This has both environmental and economic benefits, Charon explains. It avoids handling large quantities, along with the potential for fugitive emissions.

**Silky, synthetic fabric nylon was first introduced in 1935**

**A model displays an Ingeo dress on the catwalk**



Processing solvent streams and removing them from the polymer also consumes a lot of energy. NatureWorks uses distillation to purify the lactide, which results in higher yields when compared to solvent recrystallisation, which can lose more than 10 per cent of the crude lactide.

### The green label

So what exactly are the environmental credentials of Ingeo? According to the company, the cradle-to-factory-gate production process of NatureWorks' biopolymer uses 62–68 per cent less fossil fuel resources than traditional plastic materials, such as PET. No fossil fuel resources are required to build the polymer chain and the required electricity is produced by wind power. In all, this means that greenhouse gas emissions are down by 80–90 per cent. Products can be composted in industrial composting facilities and, in the future, may be chemically recyclable (back to the monomer).

But, for anyone who has ever melted a polyester shirt to their iron, Ingeo does have its drawbacks. It can only be ironed at low temperatures. But Charon insists that this shouldn't pose a practical problem, as, like polyester, it doesn't crease very much.

Another corn-based fibre is Sorona, made by DuPont from 1,3-propanediol (PDO) and a petrochemical-based monomer. DuPont pioneered a way to produce PDO from corn sugar using a patented, proprietary fermentation process. Sorona contains 37 per cent renewably-sourced ingredients by weight, according to Dawson Winch of DuPont Applied BioSciences.

In 2004, DuPont formed a joint venture with Tate & Lyle, a major corn-based products company with expertise in fermentation processes, to produce Bio-PDO. The Bio-PDO plant, in Loudon, Tennessee, in the US, is the world's largest aerobic fermentation plant and is capable of producing 100 million pounds of Bio-PDO annually.

According to Winch the production of Sorona has an impressive list of environmental benefits: it is based on renewable feedstocks; it produces 63 per cent less greenhouse gas emissions than that of an equal amount of fossil fuel-based nylon; and it uses 30 per cent less energy.

It doesn't have the famous tenacity of nylon, but the company says it

