"Mastering the art of sustainable innovation" was the key theme of international textile machinery show Itma, a call that was well heeded by the companies exhibiting waterless, paperless or stitchless solutions in Milan last November.

A lighter footprint

Crowds were up by 20% at the 2015 edition of the textile machinery exhibition Itma, with visitor numbers nearing 123,000 and coming from almost 150 different countries. The number of exhibitors was also up by 20% with a total of 1,691 booths.

The edition's theme of sustainability was, hands down, the key message many exhibitors chose to focus on. For companies in performance fabrics or apparel looking to lighten their environmental footprint, a wide array of energy- and water-saving processes are coming to market.

Cleaner finishing

Finishing and dyeing are critical areas in the textile industry. The incentive to reduce or eliminate water, waste and energy from these processes is therefore high. Plasma finishes, such as those applied by Europlasma's low-pressure finishing machines, are considered waterless solutions. The Belgian company is focusing on outdoor and sports for its water-repellent finish PlasmaGuard. "Our coating is five or six times lighter than those of traditional wet processes; it measures between 50 to 250 nanometres. It is so light, it won't change the fabric's porosity," says Europlasma sales manager, Wim Huijsman. The low-pressure plasma finish can be applied roll-to-roll on fabrics or in a vacuum chamber for three-dimensional goods. "In plasma state, the chemicals become reactive and do not require any cross-linking agents," says Mr Huijsman. This means there is no longer any need for some of the many chemicals deemed necessary in wet processes. Mr Huijsman goes on to explain that plasma is also "five times more resource-efficient than conventional processes and consumes 50%

Rhodia's Amni Soul Eco, the first biodegradable polyamide 6.6, was launched with Brazilian fashion designer Ronaldo Fraga; several Brazilian brands will be using the yarn this year.

Zé Takahash / Ag. Fotosite

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Since 1951, the once-in-four-year international textile machinery show Itma has consistently been the place to discover new manufacturing and finishing processes, these seem to be ever more driven by environmental considerations.

ITMA 2015

less energy". Taiwanese textile conglomerate Formosa Taffeta recently acquired a machine and Mr Huijsman says Japanese sports brand Asics will be introducing PlasmaGuard in early 2016.

Other recent developments in the DWR category include new iterations of Barrier Eco, a fluorine-free finish developed by Swiss textile chemicals company HeiQ. In addition to specific formulations for cotton fabrics (Barrier ECO CEL) and polyester fabrics (Barrier ECO PES), Barrier Eco Dry is said to offer improved performance on all fibre types. The chemistry is based on "a hyper-branched three-dimensional polymer that repels water and snow" the company states.

Chemicals company Archroma has also developed a fluorocarbon-free DWR solution, known as Smart Repel Hydro. The patented finish is based on microencapsulated chemicals that repel water on cellulosic or synthetic fabrics. It is said to last 20 to 30 washes. "Smart Repel Hydro complies with Zero Discharge of Hazardous Chemicals (ZDHC)," says Beate Plückhan, European head of sales for the textile chemicals division.

In a more surprising sustainable move, the Reinach-based company's Earthcolors dyestuffs use natural ingredients that are by-products of the agri-food industry and sourced within a 500 km radius of the Archroma's plant located in Spain near Barcelona. "The substances include rosemary, almond shells and orange rinds and these are used to produce six different shades of red, brown or green. They are comparable to sulphur dyes," says Ms Plückhan. In a true eco-techno vein, these natural dyes come with a high-tech feature. Archroma is making a near-field communications (NFC) chip available to brands that want to tell the Earthcolors story. "This is our way of helping brands make traceability real," she adds.

Archroma says that more than 20 billion linear metres of printed textiles are produced every year, yet only some 2% are made with digital textile printers. To encourage the development of the paperless process, the company is rolling out a system designed to simplify colour management with Inkpresso, modelled on Nespresso machines. Instead of being ready-mixed with water, the Inkpresso dyestuffs are delivered in powder form, thereby reducing transportation costs.

Waterless dyeing

The dyeing method that uses supercritical carbon dioxide ($scCO_2$) to colour fabrics is another way the textile industry can reduce its water and chemicals use. A new player, Israel-based eCO2Dye has developed machines that dye yarns in spools, offering an alternative to DyeCoo's machines that dye fabrics in rolls. "We are looking to expand the possibilities of this technology," Effi Cohen, eCO2Dye CEO, told *WSA*. The dye specialist has partnered with a $scCO_2$ specialist, US-based Applied Separation and eCO2Dye's machines are made in the US. Three sizes are available (10, 50 and 100 kg) and the dye palette of 21 shades is "enough to match any colour," says Mr Cohen. Sewing threads can also be dyed in these machines, and as polyester is said to make up 95% of this market, big potential is seen there.

Supercritical CO_2 processes are considered faster as fabrics come out of the machines dry but they also use fewer chemicals, in part, says Mr Cohen, "because the dyestuffs are used pure, no binders or cross-linkers are necessary". Only polyester yarns can currently be dyed, but it is "only a matter of time before other materials have access to the technology," he says. A staunch supporter of this process, Mr Cohen

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believes it is "a game changer" and that within 10 years all materials will be dyed using CO_2.

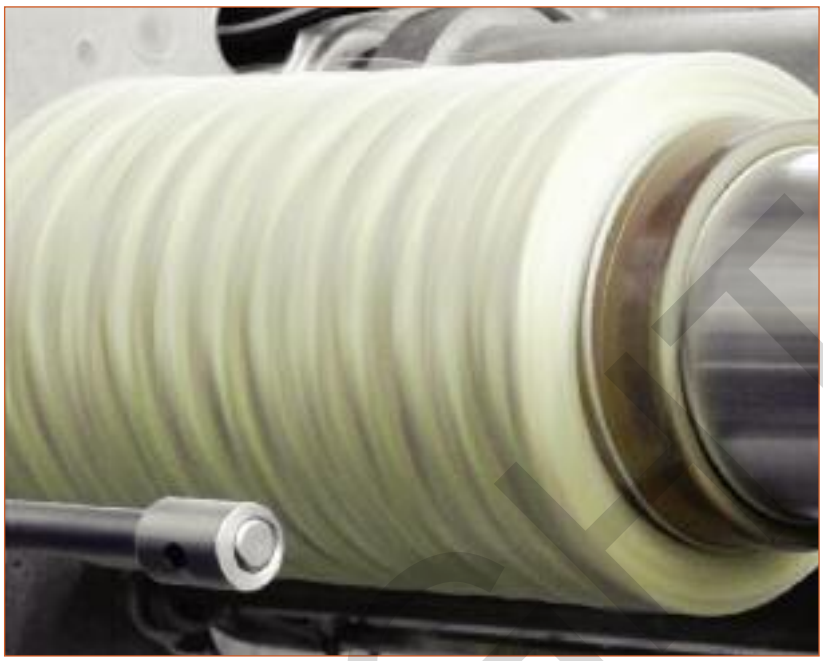
Making its first appearance at an ITMA show, Dutch company DyeCoo has a head start in this area, with a number of DyeOx machines already in operation, mostly in Asia (Thailand and Taiwan). These are said to dye more than 30 million metres of polyester fabric per annum. Though limited to synthetics, polyester, polyamide and blends of those fibres with elastane, the waterless process should shortly be used to dye other materials. "The only limit we have today is the availability of dyestuffs," Mats Blacker, DyeCoo CEO, told *WSA*, hoping that dye suppliers will invest in developing the necessary chemicals. In addition to energy and water savings, he says $scCO_2$ processes are more efficient than wet dyeing, achieve better colour fastness, more consistent results and less yellowing of light shades. Among the upcoming developments, the first woven fabrics to be dyed with the waterless process should be soon offered by Formosa Taffeta in Taiwan. It is, with Far Eastern New Century and Eclat, a DyeCoo client. Meanwhile DyeCoo is already working on the next step which is to offer antibacterial properties, "in general, we are looking to see what new features we can add during the process," says Mr Blacker.

Supercritical carbon dioxide is being used to remove dyes from textiles, a process that French company Separex has developed, picking up an award for best innovation in the category of sustainable textile processes. The company's DeDye process is said to decolourise polyester fabrics without affecting the quality of the fibres, thus giving them added value once recycled. The technology is currently in pre-industrial stage.

Innovative fibres

New developments in fibres were another highlight at Itma, with upstart casein fibre maker Qmilk making its first appearance there. "The company did not even exist when the previous edition took place in 2011. Now we have a pilot plant and we can spin fibre and make nonwoven materials," Anke Domaske, Qmilk founder and CEO, told *WSA*. Her determination to create a casein yarn without any petrochemical ingredient remains quite challenging. "The chemistry used up till now to make casein fibres involves the use of chlorides, formaldehyde and plasticisers, substances that are not ecological. What we are doing has never been done before and therefore even the best textile engineers do not have any experience in this area," she says.

Qmilk was also present at Expo Milano in the French Pavilion's Textifood section featuring all food-derived textiles. But not only is Qmilk made with milk (that is unsuitable for consumption), it is in fact edible. The entrepreneur actually swallowed a few wisps of Qmilk fibre while saying this. More seriously, it has successfully passed tests for antibacterial action (staphylococcus and E. coli) and biodegradability. It is also temperature-regulating and, says Ms Domaske, warmer than wool. She adds that the fibre can be dyed in cold water, with natural dyestuffs, and takes up colour quickly. Its unique set of characteristics drew much interest at the show, from companies looking to use the fibre pure or in blends with wool, viscose or cotton, to remain on the natural side of the fibre spectrum, says Ms Domaske.



German start-up Qmilk is now in pilot production phase and produces staple and filament yarns. The all-natural casein material is said to be temperature regulating, antibacterial and biodegradable.

Qmilk

Amni Soul Eco, also a biodegradable polymer, is one of the newest products to come out the R&D department of Brazil-based polyamide producer Rhodia, a division of the Belgian chemicals group Solvay. The polyamide 6.6 yarn has been modified to biodegrade in "proper" conditions in around three years. "The presence of humidity and bacteria is necessary," says Pierre Hansu Pak, research and innovation engineer at Rhodia, adding that "the textile disappears completely, leaving barely any residue." The additive was developed in-house, a task that took nearly five years to accomplish. The challenge, Mr Pak told *WSA*, is that adding any new ingredient to a superfine filament measuring some 10 microns will almost always have an effect on other processing parameters.

Amni Soul Eco is also recyclable, says Mayra Montel, marketing manager, adding that Rhodia intends to make all of its polyamide 6.6 yarns biodegradable in the future. The first product of this series has already been used by Brazilian brands and will be in stores in 2016. Production capacity of the yarn, that is 10% more expensive than a conventional polyamide 6.6, is said to be 15,000 tonnes per year.

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Stitchless manufacturing

Flat-bed knitting machines produce semi-finished garments that require little or no stitching. For Shima Seiki, Itma 2015 was an important date in the history of its Whole Garment technology, introduced 20 years ago at an Itma show that also took place in Milan. "This technology was actually launched ahead of time," Masaki Karasuno, creative director of the company's planning group, informed *WSA*. "Dr Shima, the company president, had first planned to introduce it in the year 2000 but stepped up its launch in anticipation of a sharp increase in Chinese manufacturing." Since then the company's V-bed knitting machines have been vastly improved upon. The machines have shrunk in size, some combine two V-beds and productivity has also gone up. A new 13-gauge machine was on display, along with what the company calls 2.5 dimensional product manufacturing, a shade short of three-dimensionality. This development is particularly promising for shoe uppers. Another new Shima Seiki machine combines knitting with woven effects, producing a hybrid textile structure the company is calling Kneave, as in the fusion of knit and weave.

With regard to sustainability, Whole Garment knitting produces little to no waste and lead times are particularly low. Mr Karasuno calculates that it takes only five days for a product to go from factory floor to retail floor.

From fibre to shop, sustainable solutions are being developed for every single stage of the textile- and garment-making process. Whatever their scope, any improvement, however small, is welcome in an industry facing increased pressure to lighten its impact on the environment.



Japanese flat-bed knitting machine maker Shima Seiki has made progress in its WholeGarment technology that enables the production of three dimensional clothing and shoe uppers.

Shima Seiki

