



Writ in Water

By Maria C. Thiry

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Water sustains all. ~Thales of Miletus

Most people don't think about clean, fresh water, unless they live in a region where that commodity is scarce. Despite our planet being covered mostly by water, only a small fraction of that water is of the kind necessary for living things.

Humans don't just need water to drink or grow our food. We also utilize great amounts of fresh water for industry, and one of the most water-intensive industries is textiles. "The textile industry is a huge water user, all along the supply chain: from growing cotton, to wet processing, to consumer care," says dye and chemical supplier DyStar's John Easton.

And Not a Drop to Drink

According to the United Nations Environment Programme (UNEP), of the total volume of water on Earth (1.4 billion km³), only 35 million km³ is freshwater—but only a portion of that is usable—about one percent, or 200,000 km³, of fresh, clean water available for plants, animals, and humans on the planet. (www.unwater.org/statistics_res.html)

“Water is the blood of the textile industry,” says N. Chandran, chair and managing director of the Eastman Group (which includes India Dyeing Mills). “Especially for wet processing. Ironically, textile processing needs very clean water—which it then proceeds to make dirty.” According to René Hermse of chemical supplier Tanatex, on average, 70 liters of water is required for every kilogram of processed textile.

Many mills don’t clean the great amounts of water that they’ve contaminated. Consultant Tom Hawthorn says that, in some cases, “untreated or barely treated effluent (some only neutralize the pH of the effluent) is just run off to open sewers, which can permeate to the water tables and pollute the [drinking] water.”

In addition to the textile industry’s great thirst, and habit of fouling water resources, the regions of the world where the industry has migrated often suffer water scarcity. “Textile manufacturing has moved to water-stressed regions of the world,” notes Paul Raybin, chief sustainability and marketing officer at AirDye Solutions. “High quality water tends to be more plentiful where labor costs are higher, and vice versa.”

The problem will only get worse without international action. According to Rainer Roesch, head of marketing and application development for chemical and dye supplier Clariant, “Our customers may not yet see the impact of water scarcity, but it is only a question of time before water shortages become a reality and take their toll in terms of water costs and availability.”

“The population is constantly growing, and we all need water to live and grow food, as well as to dye and finish fabric,” says Chris Parkes, national sales manager for fabric supplier Concept III. “But nobody is volunteering to walk around naked. We are going to continue to make clothes. What we need to do is figure out how to use fewer resources when we make fabric, but have the same quality and price.”



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Nothing is softer or more flexible than water, yet nothing can resist it. ~Lao Tzu

Suppliers serving the textile industry have acknowledged the importance of water conservation for a number of years. Many of the fibers, dyes, and chemicals used in fabric processing, along with associated machinery and processes, are designed to conserve resources, especially water.

Fibers & Chemicals

By means of water, we give life to everything. ~Koran

Water conservation can begin with the fiber. Parkes says that fabric mill Kingwhale has created fibers that use less water during dyeing. “Low Impact



The Excel yarn dyeing machine is designed to dye with less water, a 1:2 liquor ratio.

Technology (LIT) is a special modification of the molecules of the polyester base during the construction of the fiber,” explains Parkes. “It allows the LIT modified yarns to take on dye more quickly, using less dye and without the heat and pressure of conventional dyeing.” According to Kingwhale president, James Huang, “Depending on the amount of LIT fiber in a fabric, the overall water and energy savings can be very substantial. An average fleece fabric can save over 8 gallons of water per garment.”

Pretreatment is also a water-intensive phase of fabric production. Hermse says Tanatex Chemicals has developed a new *Be Green* concept, based on a low temperature peroxide activator, “that can reduce water and energy consumption up to 50%.” Roesch says that Clariant’s Imerol Blue, “allows high bleaching performance [of cellulosics] without rinsing and draining.” Compared to conventional bleaching, says Roesch, water usage is reduced by up to 65%.

Dyeing has received a good bit of attention over the years in terms of reducing water consumption—reducing water during dyeing also reduces energy costs and process times. This translates easily into cost savings. Low-water liquor ratios are common in the industry. Easton recommends high fixation dyes with easy wash off characteristics, and Chandran recommends “high exhausting dyes [that] are biodegradable, as well as biodegradable chemicals and auxiliaries...[which] will help to reduce the cost of recycling water.”

Roesch also recommends that dyehouses try alternative dyes. He says that Clariant’s Pad/Sizing Ox process, part of the company’s Advanced Denim concept, replaces indigo dyes for jeans with sulfur dyes. “The impact on water consumption is tremendous: a massive reduction of water usage—up to 92%, creating practically no waste water,” Roesch says.

Besides “Right-First-Time dyeing techniques involving good lab-to-bulk correlation procedures and robust dyeing processes based on intelligent dye selection,” Easton also recommends process improvements like “correct production scheduling so [dyehouses] don’t have to clean down after a



black shade to dye a yellow,” and “efficient washing off techniques, such as continuous open width with counterflow washing.”

Machinery

Thousands have lived without love, not one without water. ~W.H. Auden

As well as fiber, dye and chemical, and process improvements, recent years have seen many textile machinery improvements in regards to water conservation. For example, says Patagonia’s Todd Copeland, dyeing machines boast far lower liquor ratios. “Airflow dyeing has a liquor ratio of 1:3 for polyester and 1:4.5 for cotton, compared to 1:10 for conventional jet dyeing,” notes Raybin.

New technologies, like supercritical CO₂ dyeing, are now reaching production scale, says Copeland. Digital printing technologies, which require extremely little water, are also reaching production scale. Raybin’s AirDye technology “offers a way to get color onto synthetic fabrics without water at all,” he says.

However, unlike dyes and chemicals, which can be replaced relatively easily—or processes, which simply require information, training, and commitment to implement—machinery often requires substantial capital investment.

According to Hawthorn, much of the textile industry is working with older machinery “not considerate of water usage.” New machines can preserve a great amount of water, since it’s a valued design feature. However, many mills can’t afford new equipment, particularly if their old machines still function adequately. In addition, the current textile machinery market is flooded with good second-hand equipment from closed mills. Hawthorn says, “second-hand machines are rarely screened for [water conservation] by the buyers because the buyers are not educated in this sector and want a bargain.” So, while the technology to conserve water is out there, economic pressure slows the adoption of that technology.

Reduce, Reuse, Recycle

We forget that the water cycle and the life cycle are one. ~Jacques Cousteau

The old sustainability mantra of “reduce, reuse, recycle” can be applied to water consumption as well. The initial, and most important, step is reducing the quantity of water used in production. As noted, many new products and processes are engineered to that end. It is also possible to reuse and recycle water as well.

According to Easton, this is not only possible but, “many dyehouses and laundries [are] doing this already. A wide variety of techniques are available, but no one solution fits all dyehouses. Each system has to be tailored to the production environment.”

The Importance of Water Footprint

In 2009, outdoor gear and clothing brand Patagonia began tracking the company’s water use—including its water footprint on its online “footprint chronicles” of transparency and resource tracking. Elissa Loughman, environmental analyst for Patagonia, notes that “we make products all over the world. Different regions all over the world have different water scarcity issues.”

As one way to focus on these issues, Patagonia joined a case study by Donald Bren at the School of Environmental Science & Management at the University of California—Santa Barbara. Bren supervised a Masters program developing water footprinting methodology that examined the water used to make one t-shirt for Patagonia. The study developed a map tracing water use, water stress, and water scarcity. “*Water stress* takes into account the available water versus the need for water,” explains Loughman. “It’s an important indicator.”



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Hawthorn says rinse water is often reused, but “the machines need to be modified in some way to dump water to a separate reservoir for recycling. The problem is [that] we need to be sure that recycled water will not affect the accuracy of the washing through chemical carry over into the recycle baths.”

Chandran also says that while mills need fresh water to process fabric, “this water need not be from natural sources. Water today can be treated efficiently, and 100% of the water can be recycled. India Dyeing Mills, of which I am the managing director, recycles all its water. We do not discharge any water.”

Raybin says mills that reuse their water become more sensitive to keeping it cleaner at every step of processing. “Cleaner water is in better condition for reuse.” And that leads, ultimately, to effluent. Reusing water not only reduces the amount of effluent a mill produces, but ensures that the effluent is cleaner. “The key element to cleaning up effluent is to be able to reuse water,” says Raybin. “Once you take control of your water, you watch what you put into it so that it’s easier to clean [on the discharge end],” agrees Copeland.

Consumers

We are a water-drinking people, and we are allowing every brook to be defiled. ~George Bird Grinnel

The now-famous lifecycle analysis done by Levi Strauss & Co. indicated that textile manufacturers were not the only textile-related drain on the water supply. “A significant amount of water use comes from the consumer side of the equation,” says Elissa Loughman, environmental analyst for Patagonia.

Simply put, consumers need to wash their clothes less often, says Hawthorn. Besides using untold gallons of water, “washing reduces the life span of the garment so we need to make another one, which takes even more water,” he says.

Loughman says that consumer behavior is something that the textile industry has little control over. Two things brands *can* do, she believes, is “provide education to consumers... [and] design products that require less garment care.”

As a way to design clothing that requires less washing, Darrell Burnette, the North America business development manager for antimicrobial supplier Sanitized, suggests antimicrobials, especially for activewear. Burnette says that “antimicrobial-treated products provide two advantages—they require less laundering and at lower water temperatures. With the integrated hygiene function, customers may wear clothing items several times before washing them.”



Challenges for The Future

In time and with water, everything changes.

~Leonardo da Vinci

According to Raybin, “if the industry wants to grow and prosper, it needs to find ways of dyeing fabric without or with drastically reduced consumption of water.”

Despite the urgency of the problem, the textile industry has been slow to change. “The cost of water and water treatment determines whether or not factories are willing to invest [in water conservation and reuse], and how much,” says Copeland.

Chandran explains there is a real need to create cheaper technologies to clean water. “The biggest challenge lies in breaking down dyes, as well as salt.” Raybin says that solutions are gradually coming out. The problem is accelerating the adoption rate. “The largest concern is over the rate of adoption of these solutions. Many in the textile industry may wait until they are *forced* to do something.”

Hawthorn notes that “the market general over-capacity means that when the big companies shop

for sourcing, they choose [a mill] that has reasonable quality and low cost. Normally, this is the one that has no effluent treatment and dumps to open sewers.” Hawthorn says that mills show international buyers their effluent treatment system “just to pass some polite time. They are not really interested [in sustainability], in my experience.” So, in the race to the cheapest fabric, what *will* mills and buyers pay attention to? Hawthorn believes that if you truly want clean water, “you must legislate and enforce it. Companies understand being penalized financially very well.”

Raybin points out that more and more plants are adopting more sustainable low-water use and water-reclamation solutions, but “the industry is slow to change. We need pull from consumers or push from the regulatory bodies.”

The problems of water stress and water scarcity won’t improve without serious work. “The textile industry can’t continue this way,” says Raybin. “To survive, the industry has to get ahead of the problem. We can’t just be followers.”



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