ASK THE EXPERT: IMPROVEMENTS IN DYEING PROCESSES

Our question-and-answer series with prominent textile academics continues in 2013, with Dr Rita Kant, associate professor at the University Institute of Fashion Technology at Panjab University in Chandigarh, India, answering questions on the subject of improvements in dyeing processes.

Better colour

Adding colour to fibres, yarns or fabrics is an area of the textile supply chain that has been of particular concern as the industry strives to have a lower environmental impact. Improvements are emerging, however.

Question: Chemicals manufacturers aim to come up with innovations that will help fabric manufacturers reduce the amount of time, the amount of chemicals, the amount of water and the amount of energy required to dye fabric. In the last five years, which ideas have you come across that, in your view, really can make a difference? In which of the four areas (time, chemicals, water and energy) do you believe the biggest obstacles remain?

Answer: The textile industry is notorious for consuming vast amounts of water. However, it is possible to run wastewater-free textile dyeing and finishing operations by using a new range of holistic textile finishing solutions that are specifically designed to save water, energy and chemicals (WEC) as well as time. Some of these commercial technologies have given proven remedies for favourable impact on resource management. These innovations include dyeing and finishing machinery, which manufacturers have developed to reduce the amount of water

Improved non-toxic dyes now enable high colour-yield and fixation rates, low energy consumption, reduced production costs and improved ecological performance.

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needed to process fabrics, yarns and apparel.

These include machinery using:

a. Low-liquor-ratio jet dyeing technology.

b. Air dyeing technology

c. Dry dye technology, which uses pressurised CO_2 in place of water to dye T-shirts and other garments.

d. Bio blasting with enzymes during the dyeing process, which involves combining the bleach clean-up and dyeing stages, significantly reducing energy and water consumption compared to a non-combined process. This saves up to 90 minutes processing time as compared to running the bleach clean-up process separately.

e. Diaphragm filtration systems that consist of ultra-filtration and reverse osmosis processes that allow water, valuable materials and waste energy to be recovered.

At the same time improvements in textile dyes and chemicals are offering improved dyes that enable much higher exhaustion and fixation rates while requiring less than half the salt that traditional dyes needed. These high-fixation dyes usually incorporate two different reactive groups within the molecular structure of the dye. This reduces the amount of chemicals discharged in wastewater as well as the amount of water needed for dyeing and finishing operations. Other new technologies that aim to reduce effluent load, time and WEC consumption are bio-scouring, the use of bio-catalyst in desizing and bleach clean-up, and cold batch pad dyeing.

Of all of these, the use of machinery for low-liquor-ratio jet dyeing, air dyeing and dry dye technology as well as the use of improved high-fixation dyes can really make a difference by way of reducing effluent and making the textile industry's use of water resources more sustainable.

Q: Why do you believe there is, currently, a trend towards natural dyeing rather than synthetic and what major changes do you believe this is will bring to the textile industry in 2013?

A: The textile industry is showing a preference for natural dyes due to increasing concern about the harmful effects of chemicals and synthetic products on life on earth. The environment is fundamentally connected to everything that life needs to survive. If the industry continues to pollute water, air and soil with chemicals it will slowly lead to illnesses and starvation resulting in a life that is not only short but also unhealthy.



Dr Rita Kant, associate professor at the University Institute of Fashion Technology at Panjab University in Chandigarh, India.

Panjab University

Since the discovery of synthetic dyes in 1856 and the consequent preference for these colourants over natural dyes in the textile industry, the environment has continued to be degraded and depleted of its resources.

Textile mills have been discharging millions of litres of hazardous waste from their dyeing and finishing units. This sludge is a breeding ground for bacteria and viruses. Chemicals from the colloidal waste evaporate into the air we breathe. These are absorbed through our skin and show up as allergic reactions. A lot of these compounds are carcinogenic and are also likely to cause brain malfunction and genetic disorders.

The organic waste not only affects the quality of drinking water but it is often of a high temperature and pH and interferes with water treatment systems; it corrodes sewerage pipes, increasing their maintenance cost. Metallic ions present in impure water have a negative impact on textile processing, resulting in yellowed and dull-shade fabrics. Textile processors face a tough challenge in 2013. The textile industry will have to use innovative technologies and work towards using eco-friendly processes to conserve resources and energy. Governments are likely to take stringent measures keeping in mind ecological parameters and a focus on sustainable growth in the support they give to the research and development strategies of textile processors.

Q: What are your hopes for improvements in the near future in the way textile firms manage the waste that dyeing processes generate?

A: In the near future textile companies will make sincere efforts to manage the waste that dyeing processes generate. Producers as well as consumers are already increasingly becoming aware of incredibly hazardous compounds that are being 'coughed' into the rivers and agricultural land, besides also tainting local drinking water. They are realising that much of the pollution can be prevented by use of

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materials, processes, or practices that reduce or eliminate waste. Cleaner production is thus being successfully sought and implemented in most areas of the textile sector.

Besides it is being largely understood that significant financial saving and product and environmental improvements can be made by relatively low-cost and straightforward interventions. Adoption of water waste treatment systems in the mills is a good method as it reduces the amount of water pollution. Use of cationic reagents to enhance dye fixation and use of carbon dioxide to replace water as a dye transfer medium are some of the new methods being used for reducing the pollution load in textile dyeing.

The importance of observing specific pollution control laws, savings in money and improving public image are clearly understood.

As such one can be hopeful of companies recognising the potential of adopting new technology for a safer and a cleaner environment in the times to come.

Q: Which steps would you like to see developers of fibres take to make dyeing processes cleaner and more efficient?

A: Companies should take steps to adopt practices and reuse process water and steam condensate, make optimum use of energy-intensive machines, use automated dye dispensing systems, employ computerised dyeing technology for precise control of temperature, timing of chemical feeds, water additions, pH, cycle times and so on. The industry should use newer technologies like non-toxic treatment of cotton fibre, cold pad batch processing, and enzyme technology in bleaching treatment as some of the methods for reducing resource-use and saving costs. Such steps are needed to help make the textile industry more sustainable.

Q: In your experience, how much consideration do trends experts give to the technological challenges presented by dyeing processes when announcing what colours will be in fashion in a coming season?

A: Every stage of a textile product's lifecycle has environmental impacts, from fibre production through manufacturing and retailing to laundering and disposal by consumers. Of late more and more fashion makers are seen to believe in ethical fashion and are trying to focus on minimum environmental damage.

Awareness of sustainable dyeing solutions among trend experts seems to be catching up and one does find seeds of change spreading amongst manufacturers. Colour forecasters could perhaps work in collaboration with dye suppliers, who are already aware of this phenomenon and are offering improved non-toxic dyes that enable high colour-yield and fixation rates, low energy consumption, reduced production costs and improved ecological performance. This way the entire supply chain can remain committed to changing the way this business is done, resulting in minimising the impact on the environment.

Giorgio Armani's eco projects, using recycled denim, recycled wool, recycled cross-dyed cotton, eco-washing, and polyester from plastic bottles, offer a good example.

