Reducing urea in textile wastewater

By **Madelaine Cornforth** 05 August 2019

Chemical specialties producer Lamberti talks to Madelaine Cornforth about the company's new chemicals for reducing urea in textile wastewater.

When digitally printing, urea is used to help the reactive ink fixate to the dyestuff and increase the vibrancy of colour on the ink. This is because it increases the solubility of the dyes in water, enhancing the intensity of the dyes used. It also retains moisture, even once the substrate is dried, and this boosts the colour yield of the dye during the fixation stage. However, urea, also known as carbamide, can be harmful to the environment, as well as to human skin (with prolonged contact).

Untreated textile wastewater pollutes water sources

Once the fabric is printed or dyed (and steamed) it is then washed to remove any unfixed dyes or chemical residue. This wastewater or textile effluent, if it is untreated, can enter water supplies and oceans. The alternative is to treat the fabric, but this can be expensive.

Urea contains nitrogen (N), which can work as a fertiliser, particularly for algae and seaweed. When the urea has worked its way into water sources it can cause seaweed to grow at an accelerated pace or algae blooms – a rapid increase in the population of algae in freshwater or marine water systems. This increases the toxicity in the water and can impede marine life as the oxygen and light in the water is severely reduced.

It is not only reactive dyes that use urea for fixation, but acid dyes, too, for substrates such as wool, silk or polyamide fabrics. However, acid dyes require much less urea than reactive dyes and reactive prints make up a much larger proportion of the market share than acid dyes.

But an Italian company – a producer of chemical specialties for a broad range of industrial applications such as textile printing – has a solution to this growing problem. The company is set to introduce two new products that can reduce the quantity of urea in the printing recipe: the COMPOUND JET R/LU; and the PRINTEX R/LU. These chemicals need less urea and therefore release less nitrogen into rivers and seas, leaving dyestuff fixation properties and colour vibrancy unchanged.

Maurizio Gallucci, technical printing manager, explains: “Conventional printing with reactive dyes uses a certain amount of urea in its printing recipe (more for viscose than for cotton).” But as the digital textile printing market has grown, so too has the need for fabric pre-treatment, meaning the quantity of urea used worldwide has become huge. “Consequently, we are faced with an issue about the high quantity of azo component in wastewater and the high cost to clean the water,” adds Gallucci. “New technology aims to reduce the amount of urea involved either in conventional printing or in digital printing (pre-treatment) by promoting chemicals developed for this purpose.”

Claudia Cioce, R&D innovation at Lamberti, notes that there are many benefits to these new chemicals: “The great benefit is the reduction of the amount of urea that is to be used in printing pastes, or pre-treatment liquors in case of digital printing. In fact, with our technology, the reduction of urea is around 45-50% when printing on viscose and around 70% when printing on cotton.”

Importantly, there is also a cost benefit. Pietro Cusaro, business manager textiles at Lamberti, explains this using an example of a medium-sized EU-based textile printing facility. “Such a facility could produce an average of 85,000m3/year worth of urea polluted wastewater that must be treated,” he says. “Considering treatment costs around €1.5eur/m3, the total cost is €127.500/year.

“If the urea is replaced with our new products, it could reduce the cost treatment at €1/m3, which is €85,000 annually. Thus, an annual saving of €42,500 – a 33% reduction in manufacturing costs.”

The challenge, however, is to keep the performance of the pre-treatment high, particularly when it comes to “fixation, colour yield, colour tone, even though a reduced amount of urea is used,” he says.

Cioce explains how Lamberti has managed to achieve this: “Urea is a multitasking molecule with respect to the process of reactive dye fixation. It acts as a solvent for the dye and a humectant [a hygroscopic substance used to keep things moist], cellulose fibres swelling agent. From the very beginning of our experimentation we were aware that there is no molecule that can replace urea *tout-court* – therefore we have worked on identifying different molecules, each of which having a well-defined function, that when mixed all together are able to mimic the effect of urea.”

Gallucci says: “Our R&D worked to develop products able to guarantee the closest performances [in terms of dyestuffs colour strength, colour brightness, fibre coverage], in comparison with recipes that contain high amount of urea.”

With textile wastewater and its treatment now a global issue, companies are keen to test chemicals such as Lamberti’s. And with the boom of digital textile printing continuing, the time is right for these new innovations to help clean up the industry.

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