THE RIGHT CHEMISTRY

Jan Baden explains how a new digital process could address the need for a more sustainable and ecologically sound approach to the chemical treatment of textiles

Jan Baden, CEO and founder of druckprozess

Digital printing machine for textile treatment. The DigiTEXpro project will last until the third quarter of 2021

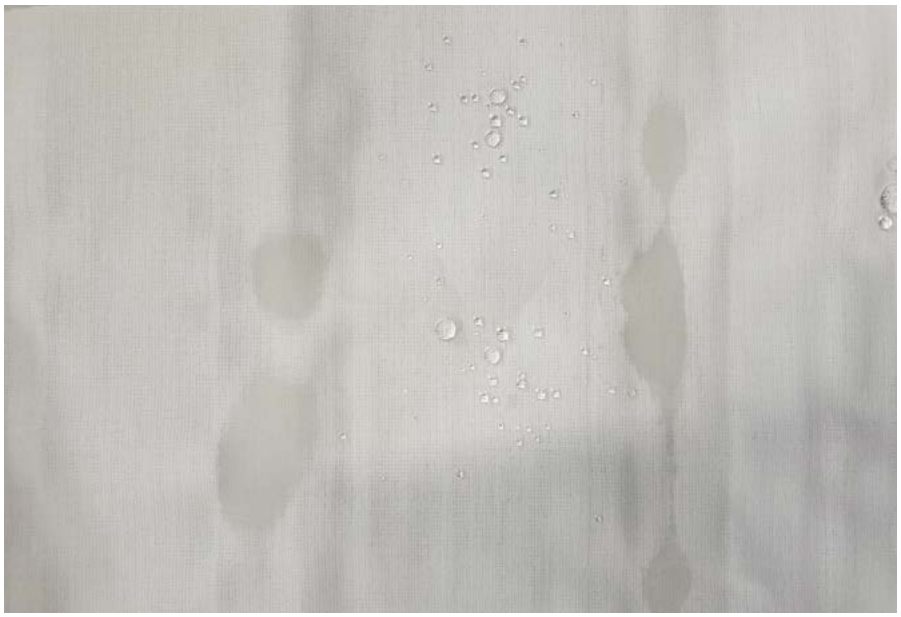
For a couple of years now, digital printing such as inkjet printing has been a fast-growing technology for coloration in the textiles industry. Only about 30% of textiles are printed and from this third only a small percentage is printed digitally today. On the other hand, about 90% of textiles produced are chemically treated to achieve their functionality and final characteristics.

Nowadays, textile functionalities and characteristics are highly diverse, ranging from, for example: flame retardant, antiviral and hydrophobic properties, to textiles that decompose pollutants, repel mosquitoes and are stain-resistant. All these functionalities require different chemistry, and product customisation is increasing.

THE CHALLENGE

The chemical treatment of textiles is mainly done by analogue processes, e.g. with traditional textile padding mangle machines (foulard machines). Impregnation of the textile in a padding machine is carried out in a trough that is filled with the textile chemicals. With that and comparable analogue technologies, the chemical mix is homogeneously distributed all over the textile. However, the drawbacks of these traditional analogue processes are a high volume of water required to dilute the chemicals, a large amount of chemicals (e.g. to fill the trough), a high consumption of energy to dry the textiles after chemical application and a lot of waste material due to the quantity of water mixed with chemicals which remains in the trough as waste water. An innovative and more sustainable technical approach seems to be needed to

"DigiTEXpro's aim is to digitalise the analogue process of chemically treating textiles"



This textile has been digitally treated with chemistry formulations to obtain both hydrophobic and hydrophilic properties. Water forms droplets with high contact angle on hydrophobic areas, whereas on hydrophilic areas the water penetrates the material

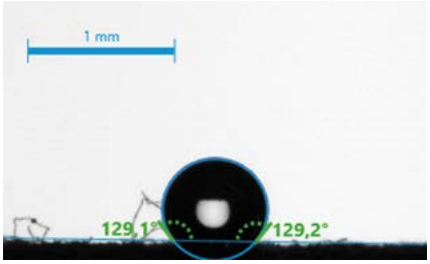


Fig.1: Water contact angle of a hydrophobic-treated cotton

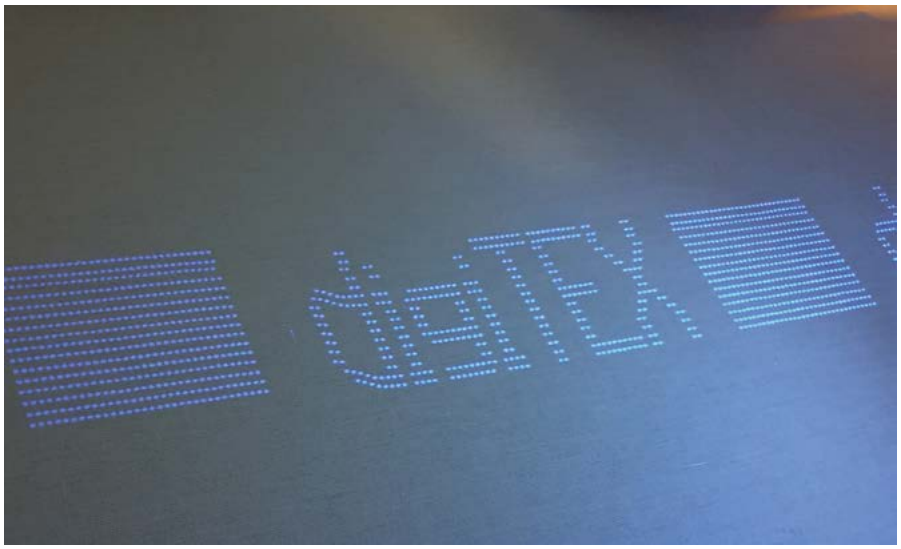


Fig.2: Digital printed optical brightener on cotton

meet the increasing ecological requirements as well as the requirements of the market that is facing a high product diversification.

CHEMICAL TEXTILE TREATMENT

The interdisciplinary team behind the DigiTEXpro project is addressing this topic and aims to develop a digital process based on technologies such as inkjet printing for chemical textile treatment. The project team consists of four German companies:

druckprozess, Suchy Textilmaschinenbau, Textilausrüstung Pfand, Zschimmer & Schwarz Mohsdorf and the German research institute STFI e.V.

- druckprozess is a provider of the inkjet technology for industrial applications. It sets up and tunes the print parameters, and develops new business models for this technology.
- Suchy Textilmaschinenbau is a manufacturer of textile machinery equipment and has a fundamental knowledge about special mechanical engineering for the textile industry.
- Textilausrüstung Pfand is a contract finisher of textiles and an expert in very delicate substrates.
- Zschimmer & Schwarz Mohsdorf is a manufacturer of textile auxiliaries with the ability to modify chemical formulations to become printable whilst maintaining functionality, even with an overall lower volume – thus facilitating higher-concentrated formulations with more intense chemical activity than those applied in analogue processes.
- STFI e.V. is the textile research institute of Saxony, and completes the partnership by testing and validating the samples.

By joining forces in this way, the project's aim is to digitalise the analogue process of the chemical treatment of textiles.

Fig. 3a: Cross-sectional image of a digitally-treated textile using minimum dot size (treatment made visible by blue colour)

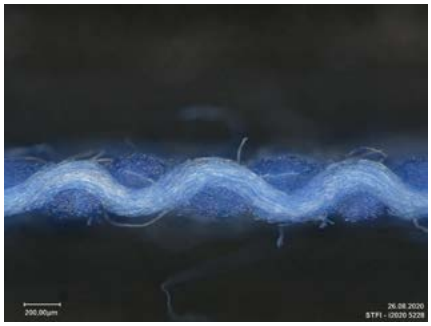


Fig. 3b: Textile that has been digitally treated using maximum dot size

PROGRESS

After research into the potential of digital printing technologies, a demonstration model was developed in 2019 and presented to the public at ITMA (International Textile Machinery Association) in Barcelona, the biggest tradeshow for textile machinery. The demonstrator can deposit about 60g/m² of chemicals while operating with a speed of 30m/min in single-pass mode. This performance is equivalent to the analogue process. Because the changeover from one chemical treatment to another one is much faster and produces low chemical waste, total productivity becomes higher and the process is more environmentally friendly.

Since the deposition process is fully digital, both a complete coverage/coating of the fabric as well as the deposition of the chemicals in patterns is possible. The combination of different functionalities on one textile in different areas will be investigated as well as the combination of multiple treatments.

ACHIEVEMENTS

Selected chemical auxiliaries such as hydrophilic or hydrophobic substances (see **Fig. 1**), optical brighteners (see **Fig. 2**) as well as flame-retardants were formulated to jettable inks and successfully applied on different textiles. Further functional formulations for the digital printing process to produce textiles with anti-bacterial and anti-wrinkle properties are still under development.

Since the deposition process is digital and the chemistry is applied in discrete, tiny droplets, required quantities of the functional substances can vary depending on the textile material and structure, and can also vary on one and the same textile depending on the position (of the treatment). With the minimum drop size, only the outer surface of the fibre is chemically treated (see **Fig 3a**), while with the maximum drop size, the full fibre is covered and penetrated with the functional substance (see **Fig. 3b**).

"Formulations to produce textiles with anti-bacterial and anti-wrinkle properties are under development"

The parameters need to be predicted and qualified and very often fine-tuned. These parameters can be stored in a database and make it convenient and secure for the operator to choose and re-open the settings for the production.

Overall sustainable impact is expected to be huge, because waste is reduced by 80–90% per batch; overall consumption of chemistry is reduced; less energy is needed to dry the textile afterwards; and finally, waste water from cleaning the system between different productions and batches is reduced compared to an analogue process.

DigiTEXpro is an ongoing project, which will last until the third quarter of 2021. The project is funded by the Federal German Ministry for Education and Research (BMBF) under the 'Twenty20 – Partnership for Innovation (German: Zwanzig20 – Partnerschaft für Innovation)' programme. ■

Jan Baden is CEO and founder of druckprozess

Further information:
druckprozess GmbH & Co. KG., Eisenach, Germany
tel: +49 3691 621 400
email: info@druckprozess.com
web: www.druckprozess.com