STUDY OF THE INFLUENCE OF FABRIC ON IMAGE REPRODUCTION IN DIRECT INKJET PRINTING

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***Abstract.** The influence of fabric structure on the quality of direct inkjet printing was investigated. Tests on three types of natural fabrics showed that the weave and structure of the yarns affect the uniformity of ink application. Printing with a white backing improves color reproduction but highlights the textile's relief. The results emphasize the need to take into account the characteristics of textiles for high-quality printing.*

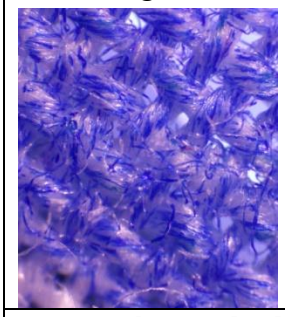
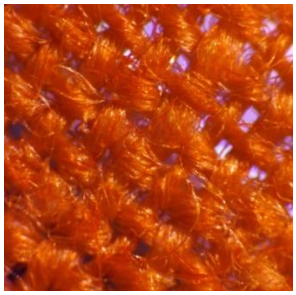
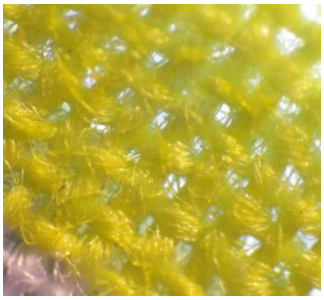
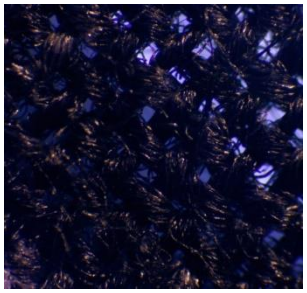
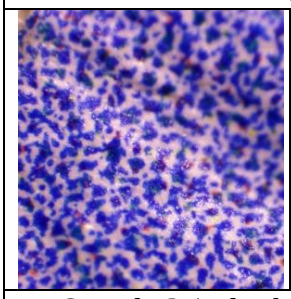
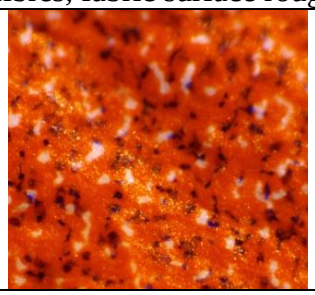
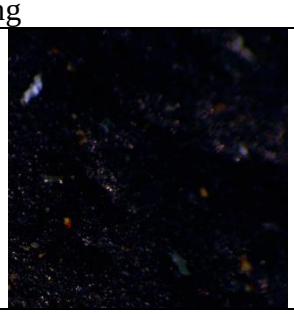
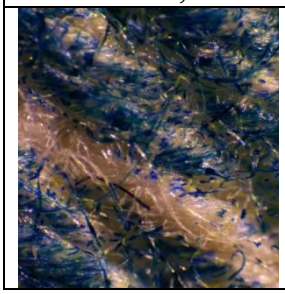
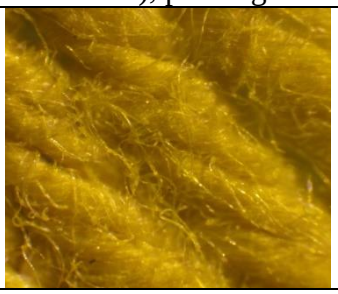
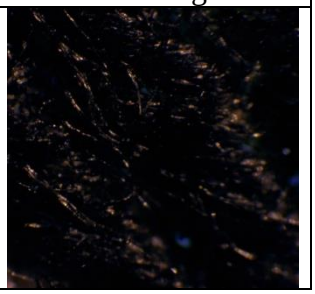
The quality of inkjet image reproduction on textile materials largely depends on the physical and chemical characteristics of the substrate, including its composition, surface texture, and ink absorption capacity. The interaction between ink composition and fabric properties determines the spectral characteristics of color, the uniformity of ink deposition, adhesion, drying kinetics, and overall print quality. Advances in material pretreatment, ink formulation, and digital color management strategies play a crucial role in enhancing color accuracy and consistency.

This study investigates the influence of fabric characteristics on image reproduction in direct inkjet printing of natural textiles. An Epson SureColor F2000 inkjet printer was used to print images on three fabric samples with different thicknesses, colors, and weave structures. Printing was performed both with and without a white underlayer.

The results indicate that Sample 1 exhibits complete and uniform ink absorption for magenta, yellow, and black inks, whereas cyan ink deposition appears somewhat non-uniform, which becomes more evident upon magnification, as illustrated in Table 1. The weave type and yarn structure significantly affect the continuity and uniformity of ink deposition. In Sample 1, the yarns consist of loosely twisted fibers, contributing to a soft and voluminous texture. In Sample 2 (with a white underlayer), the image is formed on a rigid white film that adheres to the fabric surface under heat and pressure. As a result, the weave structure remains distinctly visible on the image surface, as shown in Table 1. The more pronounced the weave structure, the more it affects image visibility when applying a white underlayer. Test fields in CMYK on fabrics with a white underlayer exhibit noticeable contamination from other inks.

Sample 3 features a dense twill weave, characterized by a uniform and distinctly textured denim-like relief, where the threads form diagonal ridges on the fabric surface. When printing on Sample 3, ink deposition is uneven due to the relief structure of the fabric, creating a visual effect where the ink appears darker in recessed areas. Consequently, printing without a white underlayer on such fabrics results in a characteristic striped pattern. Moreover, the more pronounced the fabric texture, the greater its influence on the overall image perception, which is attributed to the thermosetting process required for ink fixation.

Table 1 – Printed test fields of fabric samples

Sample 1 (white thin fabric, plain weave, thread width 0.17 mm, thread consists of twisted fibres, fabric surface is rough), printing without white backing			
C	M	Y	K
			
Sample 2 (color light mocha, plain weave, thread width 0.41 mm, thread consists of twisted fibres, fabric surface rough) printing with white backing			
			
Sample 3 (color beige, twill weave, thread width 0.33 mm, thread consists of tightly twisted fibres, fabric surface is embossed with jeans texture), printing without white backing			
			

Samples 2 and 3 exhibit a characteristic warm beige hue, whereas Sample 1, in contrast, demonstrates a cool-toned hue shifted towards the blue-violet region. Additionally, Samples 2 and 3 have a lower lightness value, resulting in reduced brightness and saturation of printed images when a white underlayer is not used. Furthermore, in the absence of a white underlayer, the hue of the substrate introduces distortions in the perceived color properties of the prints.

The findings indicate that the type of weave and yarn structure significantly influence the continuity and uniformity of ink deposition. It has been observed that in yarns composed of weakly twisted fibers, ink partially coats the individual fibers forming the primary thread. The dense twill weave, which creates a uniform and distinctly textured denim pattern, leads to inconsistencies in ink deposition due to the relief structure of the fabric. In recessed areas, the printed image appears visually darker. To mitigate the influence of surface texture on image reproduction in embossed fabrics, the application of a white underlayer is recommended.