

RESEARCH OF DIFFERENT PRINTING TECHNOLOGY ON TEXTILE

Žagaraitė K.¹, Gegeckienė L.¹, Kaubrienė-Stunžėnienė L.²

¹Kaunas University of Technology,

²Kaunas Vocational School of Household Services and Business

Abstract

This evaluation studies which printing method (thermal transfer printing, direct printing) on textile materials is a better quality. The aim is to select the most suitable method to produce unique press T-shirts comparing price, durability and quality during the same time.

This quality assessment study focused on three aspects: visual quality assessment, microscopic quality test and mechanical quality testing.

Visual study evaluated thermal transfer technology for suitability of single order feasibility by price and quality measures. The quality of the microscopic study showed that there are not significant differences between printing methods, but in order to print small items – thermal transfer printing technology is more practical. Mechanical quality studies were done with laundered shirts at various temperatures. Direct printing method T-shirts broke down under and are deemed unsuitable for single order use.

Keywords: *printing on textile, direct printing on textile, thermal transfer printing on textile.*

Introduction

Studies have been performed with the aim to determine which printing method (thermal transfer printing, direct printing) on the textile is better quality. The aim is to select the most suitable method to produce the unique press T-shirt comparing by price and quality during the same time. The following equipment was used, the prepared layout parameters, samples of test substance.

Features:

Semi-automatic thermo press HP3805D;

Kyocera Rainbow Textile Printer;

Roland CX-500 film cutter – plotter;

Microscope Dino Lite Premier;
Washing machine LG Direct Drive.

Thermo press parameters:

Temperature 170 °C;
Time 10–15.

Washing Machine parameters:

5 times 30 °C, cotton programs;
5 times 60 °C, cotton programs;

Layout options:

Number of colors: 6;
File Format: .pdf;
Resolution: 300 dpi
Color model: CMYK.

Computer programs:

Adobe Illustrator CC;
Corel Draw X6;
Dino Capture 2.0.

The samples are:

10 pcs. thermal transfer printing method for printing T-shirts;
10 pcs. direct printing method for printing T-shirts;

Test substance:

100% semi-combed cotton, weight 150 g / m².

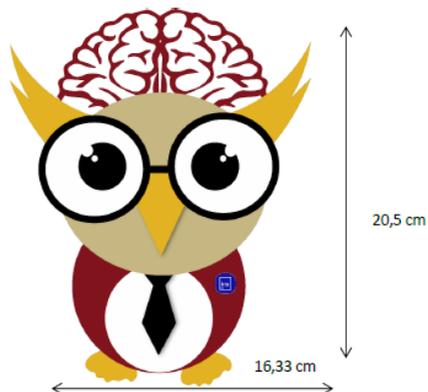


Fig.1. File layout ready for pressing in pdf format

Experimental details

There were two methods of printing on textiles analyzed – direct printing and thermal printing on textile.

Direct printing on textiles. Method: the printer directly prints on T-shirts in the same way as it does on paper. The paint is absorbed into the fabric and become an integral part of the cloth, so the feeling of wearing a product with this type of printing is extremely pleasant. This printing method is used for both white and color textiles. The white textile printing is very easy and fully absorbed into the fabric. Meanwhile, the color printing products are little bit harder. The reason is that technologically it has more layers. For the paint coat on the colored shirts firstly shirts are impregnated, and then printed with white ink layer according to the outline design and, finally, the desired design is printed in full flamboyance. Direct printing method is used when the design does not have the background, and there are many colors and transitions, shadows, a lot of vague lines with fine details. This method is ideal when you want to produce limited edition custom and get a similar effect as the press screen printing.

Thermal transfer printing. The process: thermal film printing is perfect when you want to print the simple forms of a logo, a variety of words, sentences, or vector graphic. Press lay principle: special film for textile cut out with plotter (slicers). Unnecessary parts of the film are removed and hot press pressed on the film on the textile product. This printing method is ideal for the production of a single order. Thermal printing can be carried on various kinds of fabrics and materials, it is important that the textile product is resistant to hot temperatures. Thermo pressing is recommended for use with a maximum of 5 colors. The color palette depends on the standard film producers color palette. Typically, the color palette can be found in all the most popular basic colors.

Results

Printing techniques on textile were tested by visual quality assessment, microscopic quality study and mechanical quality testing.

The visual quality assessment. The first difference was the image surface – thermal transfer printing glossy and direct – opaque. Visually, the layout looks the same size, but after measuring appeared the difference, although not large, the size is still not equal: thermal transfer printing dimensions $25,8 \times 20,6$ cm, and direct printing – $26,7 \times 20,5$ cm. The initial layout dimensions were $20,5 \times 16,33$ cm, it can be seen that by both press technologies the image increased. Further evaluation criteria and the results are presented in Table 1.

Table 1. Evaluation Criteria

Evaluation Criteria	The press type	
	Thermal printing	Direct Printing
Color	4	4
Brightness	Bright	Bright
Glossiness	Glossy	Matted
Layer thickness	Feels	Does not feel
Outside objects	Yes	Yes
Small parts extraction	High	Low
Price	10 EUR/pcs plus taxes	11 EUR/pcs plus taxes

After the visual inspection, evaluation of each T-shirt prints (thermal transfer and direct printing), color, brightness, gloss, thickness, outside objects, small parts extraction, the price, it was found that the highest quality samples are T-shirts printed with thermal transfer printing technology.

Microscopic quality test. Microscopic examination was done by choosing two increasing sizes – 50 times and 220 times. During the study were used the microscope Dino Lite Premier and computer Dino Capture 2.0 program, the measure was one of the selected element widths. During the study were measured three samples of each printing method and derived their average.

Thermal transfer printing selected item width increased to 50× range from 0.109 mm to 0.126 mm (Fig 2). Increasing element 220× width ranging from 0.371 mm to 0.514 mm (Fig 3). Direct printing element enhancers 50× width varies from 0,086 mm to 0,108 mm (Fig 2), an increase 220× – from 0.257 mm to 0.343 mm (Fig 3).

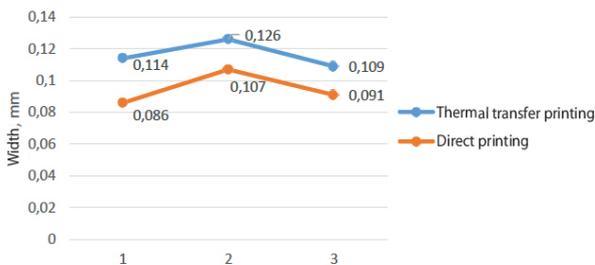


Fig 2. Comparison of measured element widths (titrated 50×)

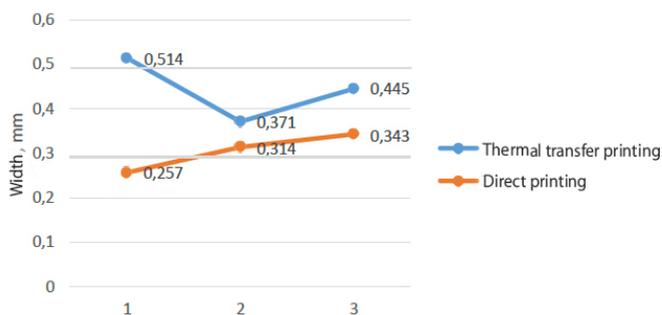


Fig 3. Comparison of measured element widths (titrated 220×)

The biggest thermal printing element width increased 50× is 0,126 mm, 220× – 0,514 mm. Direct printing element increasing the maximum width is 0,108 mm 50×, 220× – 0,343 mm. Thus, it can be said that the thermal release required more space graphics batches.

It is obvious that in the thermal printing examples the stitches cannot be visible through loaded paint and direct printing examples paint absorbed into threads and the stitches can be seen (Fig 4).



Fig. 4. Thermal transfer printing (the first) and direct printing (the second), the sample (50×)

Mechanical quality test. To find out the print quality and durability were the mechanical quality survey – carried out 5 times to wash 30 °C and 5 times the 60 °C. 30 °C is recommended to wash cotton, and 60 °C selected to check what is going to double the higher temperature, or T-shirts quality significantly deteriorates.

Thermal transfer printing technology printed T-shirts got the white spots in the image, but printing did not unstuck and remained fairly high quality. Direct printing technology printed T-shirts lost image brightness, color worn out. So, after five washings direct printing T-shirt quality is different from the thermal transfer printing. Thermal transfer press technology image remained bright, shiny as it was; the image got wrinkled, but easily ironed without any damage (Fig 5).

Washing 5 times 60 °C temperature images was quite similar to washing 30 °C temperatures. The difference is visible in direct printing technology T-shirts – very faded color (Fig 6). Thus, it can be said that the temperature does not have a significant effect on the temperature, the quality deteriorated since the number of washes.

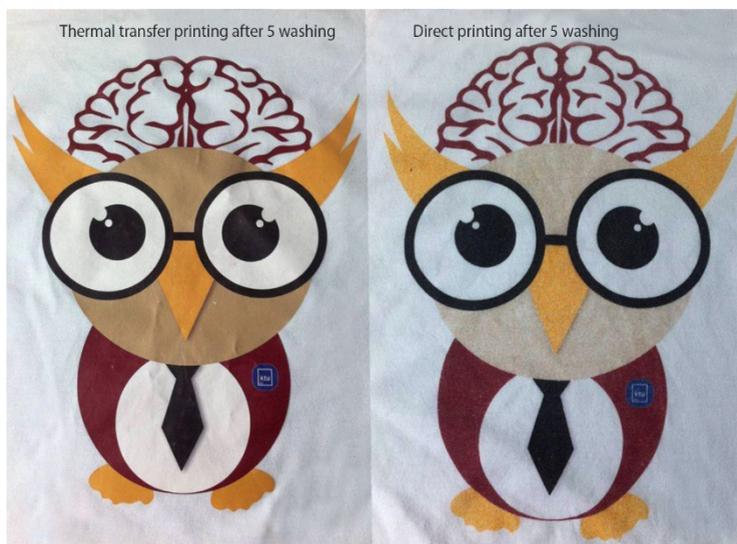


Fig 5. Thermal transfer printing (the first) and direct printing (second) 30 °C



Fig 6. Thermal transfer printing (the first) and direct printing (second) temperature 60°C

Discussion

The advantages and disadvantages of direct printing and thermo printing on textile has been reviewed.

Direct printing on textile advantages: Can implement individual or mass produced designs; Printed T-Shirts are comfortable and user friendly; it is possible to produce individual orders while maintaining a competitive price.

Direct printing on textile disadvantages: the color printing products can have irregular results, material fibers can be seen; colors can change after the first washing cycle; sometimes possible color matching inaccuracies.

Thermo press advantages: Smooth and consistent results; long life cycle; competitive pricing even with individual orders; can be used with cotton and natural material or synthetic.

Thermo press disadvantages: it is recommended to use no more than 5 colors; colors may vary depending depending on the manufacturer.

Thermal printing T-shirts have higher overall quality. Thermal technology for printing T-shirts elements the widths has been greater than printed with direct printing technology. Widths differences are not very large, they seek to 0,021 mm in 50 times magnification, and 0,137 mm in 220 times magnification, so both the thermal printing and direct printing methods re-

quiring similar print material area. To the naked eye, the difference is almost invisible.

By mechanical test Thermo printing T-shirts got better results, the color was still bright after 5 washing and brighter comparing to direct printing T-shirts. Direct printing T-shirts may fade after as few as 5 washings. Thermo printing T-shirts may have white spots; however the printing adhered and had better results than direct printing T-shirts.

Conclusions

This quality assessment study focused on three aspects: visual quality assessment, microscopic quality test and mechanical quality test.

Visual study evaluated thermal transfer technology for suitability of single order feasibility by price and quality measures.

The quality of the microscopic study showed that there are not significant differences between printing methods, but in order to print small items – thermal transfer printing technology is more practical.

Mechanical quality studies were done with laundered shirts at various temperatures. Thermal transfer printing technology samples were visually evaluated for quality, material breakdown, images remaining vivid and spotting. Direct printing method for printing t-shirts lost their original colors, so they less suitable for a single order.

References

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