

Conditions in Digital Printing of Packaging on the Print Quality

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Abstract

The differences among particular gamuts of the prints in relation to the conditions in digital printing process such as temperature and quality of the offset rubber blanket re presented in the work. The influence of the natural and accelerated ageing of prints on their optical stability is discussed.

Introduction

Colorimetry is the most rigorous method for colour calibration. This evaluation is based on the determination of the kind of distance in a colour space, which has to be minimised through the adjustment of a set of technical parameters corresponding to a reproduction process.¹

Colour management can be contrasted with conventional colour in which the user impressen a test form containing numerous targets to characterise the printing process, analyses the targets with spectrophotometer and visually and derives scanner settings necessary to reproduce optimal colour.²

The gamut changes of digital prints when produced with different offset rubber blankets at different temperatures are monitored in this work. Except that the changes in optical stability of prints caused by exposing to accelerated and natural ageing have been discussed.

Experimental

Colour prints made on the digital offset printing machine Indigo E-Print 1000+ are used in the researches. It was printed with the new offset rubber blanket and with the used one which had already printed 80000 prints. The temperature range from 125-140°C in steps of 5°C was used in printing process.

Test form has been designed by using the standard ISO and ECI patterns. It has been created in Adobe Photoshop application. The part presenting the ECI measuring segment consists of 210 patches of different combinations of colour values of the subtractive analysis, generated by the vector graphics in steps of 5%.

The printing substrate Century Soho for Indigo (Fedrigoni), Symbol Freelifelife Satin gloss White was used.

In further analysis such prints which were accelerated or naturally aged were observed. For accelerated ageing the climate chamber was used in the following conditions: temperature 80°C, humidity 65%, without radiation.

For measuring the three-stimulus values X-Rite DTP 41 spectrophotometers with the illumination geometry of 45°/0° was used. The measured values of the determined print series for each 210 patches were expressed in CIE XYZ values. From the middle values CIE XYZ, by using the application Colour Open, the values CIE L*a*b* were obtained in order to enable the construction of gamut of the described series samples in the three-dimensional unified space

Results and Discussion

With the aim to explain and define the relations connected to the topic of gamut, which describe the characteristics of different reproductions are presented in 2D and 3D graphs. The comparative presentations of different gamuts of reproductions for particular comparison criterion have been given.

Such two dimensional and three dimensional gamut presentations of digital print made by the new offset rubber blanket for different temperatures are given in figure 1a, while such gamut presentation for prints made by the used offset rubber blanket which had already printed 80000 prints are given in figure 1b.

Two dimensional presentation gives comparative presentation of different gamuts in CIE L*a*b* colour space in regard to a* and b* coordinates for the lightness L*=50%. Such gamut comparison shows the gamut characteristics at only one lightness value, and not at the remaining 99 combinations. The characteristic of the three dimensional gamut presentations of reproductions is the gamut presentation at all the values of lightness for four different observation angles (0°, 90°, 180° and 270°) in regard to axis of lightness into the CIE L*a*b* color space.

The increase of gamut by using the new offset rubber blanket is visible from the results. The decrease of value in yellow and green are with the usage of the new offset rubber blanket at the temperature of 135°C can be noticed, which denotes the decreased possibility of objective reproduction.

In figure 2 the gamuts of accelerated and natural aged prints are presented.

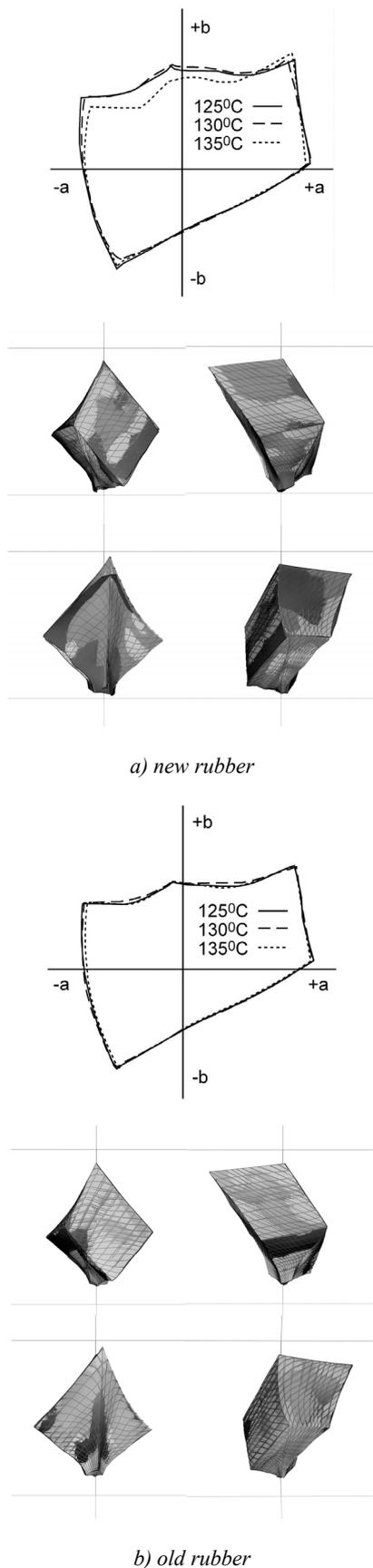


Figure 1. Two dimensional and three dimensional gamut presentations of prints made with different offset rubber blankets at different temperatures.

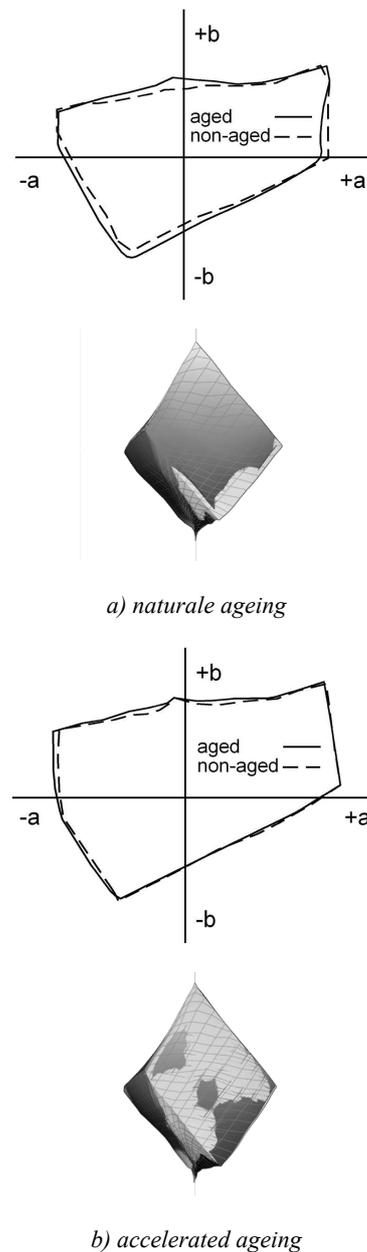


Figure 2. Presentations of print gamuts in regard to the ageing conditions

Comparing the gamuts of accelerated prints one can notice considerably smaller increase in purple area in relation to the naturally aged print. The reason for that can be reactions initiated by ageing, which cause the changes of the printing substrate characteristics or pigment in the ElectroInk composition.

Measurements of $L^*a^*b^*$ values of the printing substrate in relation to the ageing conditions show changes in lightness-darkness ($L^* 95,97$, $L^* 94,17$). However, not only the change in lightness happen but also the shifts happen in red-green and yellow-blue coordinates (non aged substrate: $a^* 1,53$ $b^* -2,23$; aged substrate: $a^* 0,40$, $b^* 4,01$).

Conclusion

The investigation results show that the gamut size of the digital print can be influenced by the quality of the offset rubber blanket and temperature values in digital offset printing on base of electrophotography. The gamut change was also noticed in relation to the ageing conditions of the digital print. Except the change in lightness-darkness the shifts in red- green and yellow-blue coordinates of the substrate were noticed in dependence on the ageing conditions of prints.

The results of the investigation will contribute to better knowledge of the influence of conditions of printing process on the possibilities of the objective reproduction and permanence of the prints.

References

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Biographies

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