

## Research on offset papers according to the possibility of their using in digital ink-jet printing techniques

### Introducing

The owners and the customers of ink-jet printing houses have been postulating for a long time that price evaluation connected with „clicks” and using papers suitable for ink-jet printing recommended by digital machine providers inhibit ink-jet technique development from economic point of view. From time to time there were some pieces of information about different kind of offset papers successfully printed with ink-jet technique. However, except for commercial brand and type of ink-jet printing, there were no researches or parameters defining these papers.

In K. Piłczyńska's dissertation [1] the research on offset papers (coated and uncoated) according to the possibility of their using in ink-jet printing was presented. It was assumed that offset papers are not suitable for digital printing of colour photographs. The criterium of choice is the widest gamut volume of prints made on them in comparison to gamut volume of prints made on suitable papers. The researches were done for two types of ink-jet machine – with aqueous pigment-based inks (Canon Imageprograf 8400) and UV-curable inks (Agfa Anapurna MV).

### Experimental

Initially, a research was done concerning gamut volume measuring because it was assumed that the biggest volume is the criterium of choosing papers for ink-jet printing.

Papers suitable for digital printing have either the widest gamut volume (the case of a device with aqueous inks) or one of the widest gamut volumes (as it happens in case of a device with UV-curable inks). However, especially in the case of printing with UV-curable inks, uncoated and coated papers in their maximum available grammage, have comparable gamut volumes. As far as the CIELAB colorimetric space and CIECAM color appearance model space are concerned, they have even higher values than papers suitable for ink-jet, whereas the uncoated and uncoated bulky papers in their minimum grammage exhibit the lowest gamut volume [2].

After gamut volumes definition, micro- and macrostructure research was initiated. Additionally, mechanical and physicochemical properties of the papers in question were checked.

### Results

According to the references [3÷5], paper grammage suitable for ink-jet should be bigger than 100 gsm. In case of aqueous inks, this value should even exceed 135 gsm. This is the reason why 170 gsm coated and uncoated woodfree papers were used for verifying research results. Other parameters were:

#### *Uncoated paper*

Grammage – about 170 gsm,  
 PPS roughness –  $4.0 \pm 0.5 \mu\text{m}$ ,  
 Water absorption according to Cobb60 –  $38 \pm 3 \text{ gsm}$   
 PDA parameters:  
 W –  $0.170 \pm 0.05$   
 Tmax –  $0.3 \pm 0.05 \text{ s}$   
 A30 –  $16.8 \pm 0.3 \text{ gsm}$   
 A60 –  $22.10 \pm 0.20 \text{ gsm}$   
 T95 –  $1.08 \pm 0.05\text{s}$ .

#### *Coated paper*

Grammage – about 170 gsm,  
 PPS roughness –  $2.5 \pm 0.5 \mu\text{m}$ ,  
 Water absorption according to Cobb60 –  $25 \pm 3 \text{ gsm}$   
 PDA parameters:  
 W –  $0.025 \pm 0.05$   
 Tmax –  $0.10 \pm 0.05 \text{ s}$ ,  
 A30 –  $17.6 \pm 0.3 \text{ gsm}$   
 A60 –  $25.0 \pm 1.0 \text{ gsm}$   
 T95 –  $2.00 \pm 0.10\text{s}$ .

### Discussion

Papers chosen for new research were printed with aqueous and UV curable inks. As in previous experiments, special test: ANSI IT8/7.3 color chart with 928 control patches was printed on all papers. The spectral reflectance of all patches was

Table 1: Gamut volume values

Type of paper and ink	Gamut volume in the space:		
	CIEXYZ	CIELAB	CIECAM02
1. UV curable ink, suitable paper	60 516,00	401 191,46	405 723,62
2. UV curable ink, uncoated paper 170 gsm	47 527,11	226 629,02	256 751,51
3. UV curable ink, uncoated paper 185 gsm	60 603,62	321 418,18	345 923,50
7. UV curable ink, coated paper 170 gsm	57 562,52	379 517,37	389 579,87
1. Aqueous-based ink, suitable paper	72 873,65	657 233,31	630 897,16
2. Aqueous-based ink, uncoated paper 170 gsm	48 405,18	164 257,22	192 871,91
3. Aqueous-based ink, uncoated paper 185 gsm	50 148,42	159 769,63	190 001,82

measured using SpectroScan (Gretag Macbeth) and colorimetric properties: illuminant D50 and standard color observer, angle 2°. Gamut volume values are presented in table 1.

Values in tables are volumes and thus cannot be negative. These are the absolute values.

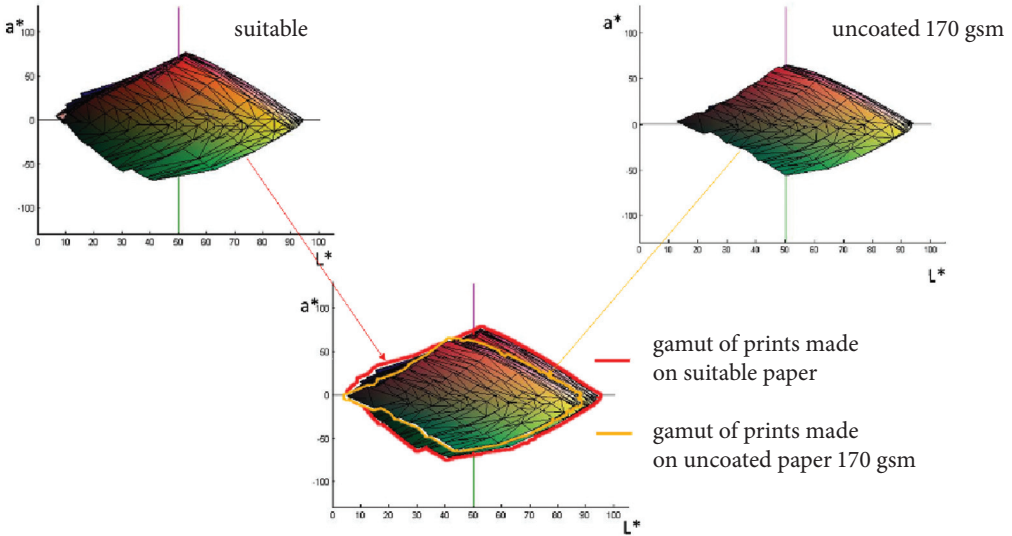


Fig. 1. Color gamut in CIELAB colorimetric space – prints made with UV inks, comparison of the ones made on suitable and uncoated paper (170 gsm)

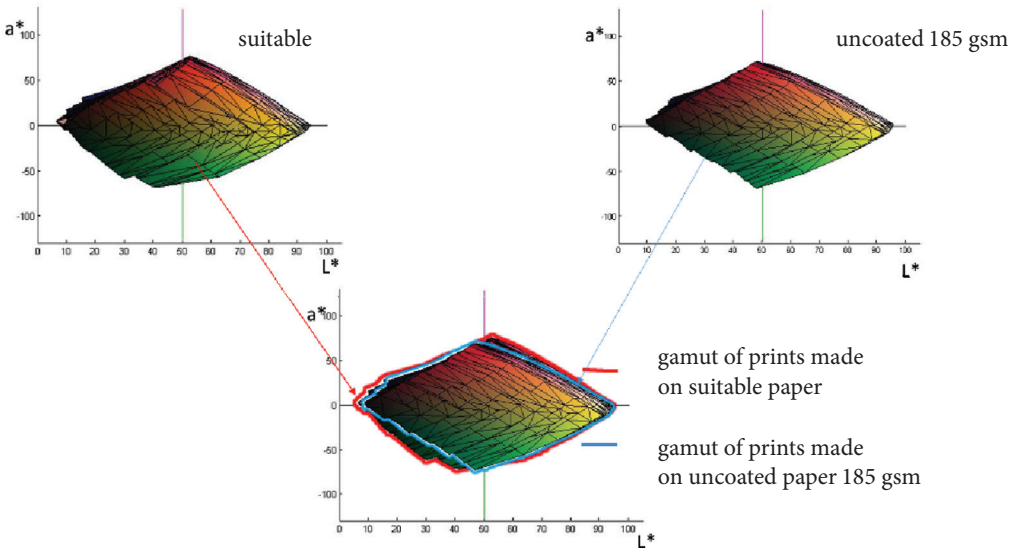


Fig. 2. Color gamut in CIELAB colorimetric space – prints made with UV inks, comparison of the ones made on suitable and uncoated paper (185 gsm)

Prints made with UV-based inks on chosen papers had very good gamut volumes – almost as good as the ones characterizing papers recommended by the machine supplier. The visualization of CIELAB is presented on figures 1 to 3. On every figure, the first space is the one characterizing prints made on machine-rec-

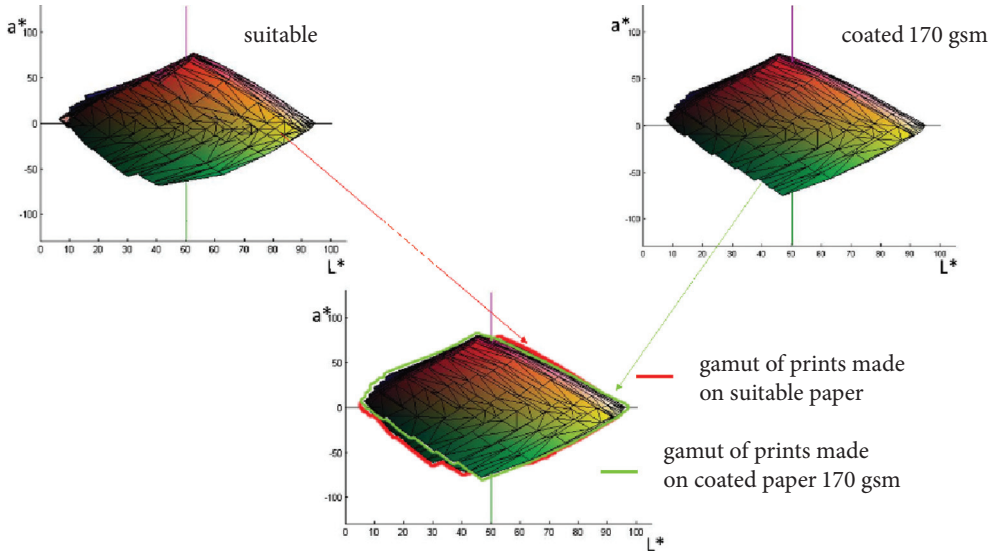


Fig. 3. Color gamut in CIELAB colorimetric space – prints made with UV inks, comparison of the ones made on suitable and coated paper (170 gsm)

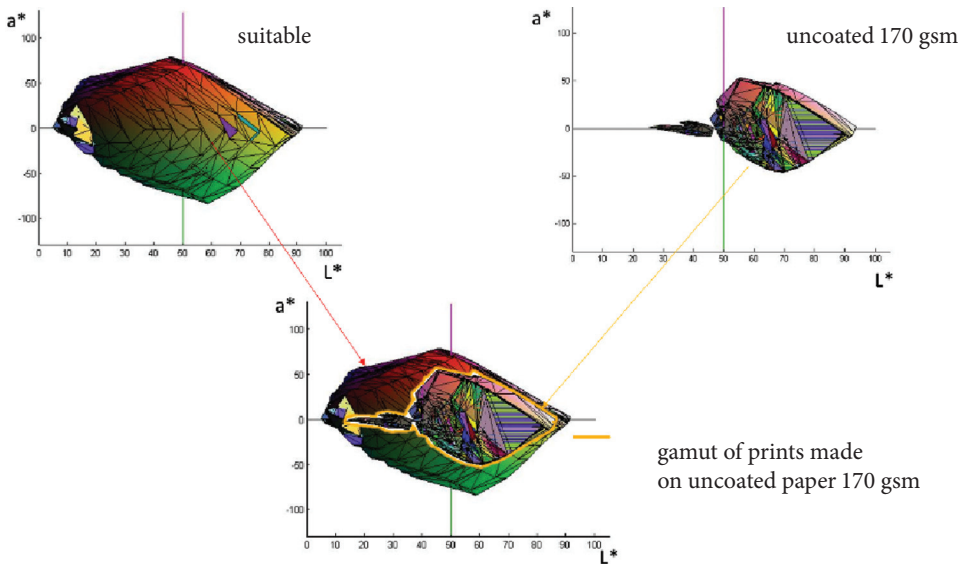


Fig. 4. Color gamut in CIELAB colorimetric space – prints made with aqueous inks, comparison of the ones made on suitable and uncoated paper (170 gsm)

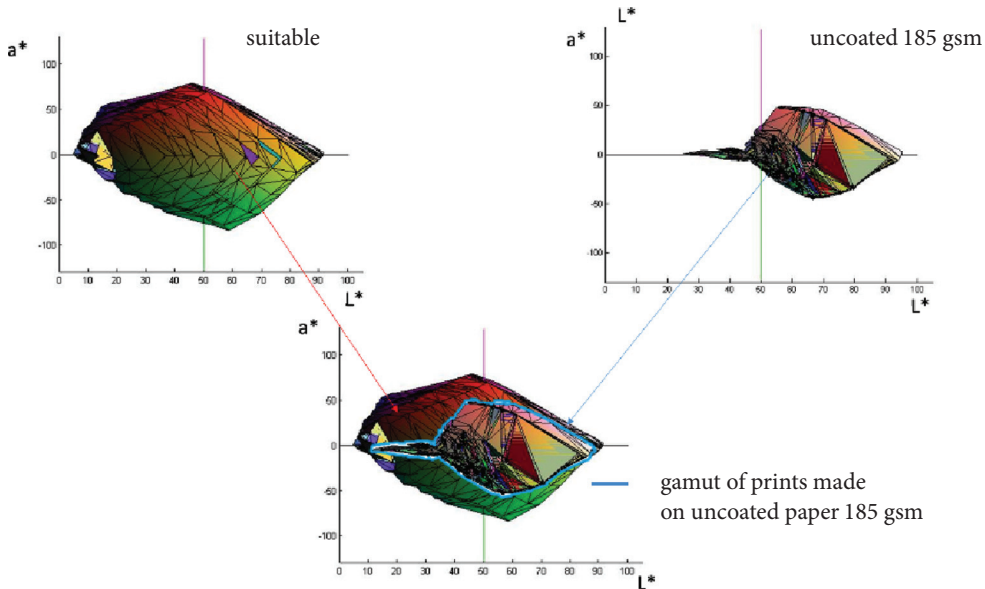


Fig. 5. Color gamut in CIELAB colorimetric space – prints made with aqueous inks, comparison of the ones made on suitable and uncoated paper (185 gsm)

ommended paper, the second space is the one characterizing prints made on offset paper and the third space is the combination of two previous spaces. Thanks to such combination it is easier to notice the differences in gamut volumes.

First, it is visible that prints made with aqueous inks on offset uncoated papers have lower gamut volume than the ones made on suitable paper. On the other hand, their volume is wider than volume of prints made on offset paper used in previous research. What is more, those new papers have lower grammage than the ones used in previous experiment. However, their gamut volumes are wider.

Unfortunately, there were problems with making prints on coated paper. Because of wrong type of coating, ink wasn't properly absorbed. Prints were very wet and they didn't dry at all.

The visualization of CIELAB is presented on figures 4–5. It is made similar to the visualization of prints with UV inks.

### Conclusion

The research confirmed the thesis that in ink-jet printing (especially with UV-cured inks) it is possible to use not only papers suitable for this technique but also papers traditionally used in offset printing. The exception is printing multi-colour photograph jobs.

To sum up, it isn't necessary to choose paper for ink-jet printing because of producer or name – the choice can be made by knowing only parameters defined in this article.

The possibility of using offset papers is defined by 4 parameters. For technical purpose the most important are: grammage, roughness and Cobb 60 indicator. PDA indicator is determined only in research laboratories and not in production conditions. Three parameters defining the possibility of using „analogue” papers in ink-jet printing are basic technical indicators which should be mentioned in papers’ technical data. If not, customers can ask a producer about them and retrieve the relevant data with ease.

### References

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4. Graczyk T., *Sześć kryteriów oceny jakości papierów do cyfrowego druku kolorowego*, „Przegląd Papierniczy”, 1999, no. 3, p. 145–146. ISSN 00332291.
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### Streszczenie

*Badanie papierów offsetowych pod kątem ich zastosowania w technikach drukowania natryskowego*

Właściciele i klienci drukarni natryskowych od dłuższego już czasu postulowali, że stosowany obecnie system rozliczeń, od tzw. „kliku” oraz stosowanie papierów specjalnie produkowanych do drukowania natryskowego polecanych przez dostawców sprzętu drukującego hamują ze względów ekonomicznych rozwój techniki natryskowej. Od czasu do czasu pojawiały się informacje o zastosowaniu z powodzeniem takiego czy innego papieru offsetowego do konkretnej techniki natryskowej. Poza marką handlową i rodzajem zastosowanej odmiany drukowania natryskowego nie było innych badań czy też parametrów jakie muszą te dobrze zadrukowane papiery spełniać.

W pracy autorstwa Katarzyny Piłczyńskiej przedstawiono badania papierów offsetowych powlekanych i niepowlekanych pod kątem możliwości ich stosowania w drukowaniu natryskowym. Przyjęto założenie, że w doborze papierów należy pominąć papiery przeznaczone do natryskowego drukowania wielobarwnych zdjęć fotograficznych. Jako kryterium przyjęto największą objętość przestrzeni barw odtwarzalnych (objętość gamutu), uzyskaną w drukowaniu natryskowym dla papierów offsetowych w stosunku do papierów specjalnie produkowanych (dedykowanych) do danej maszyny. W ramach badań wyznaczono parametry predestynujące papiery offsetowe do drukowania cyfrowego natryskowego.