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Influence of dampening regime on gray balance and trapping in sheetfed offset printing

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1. Stability of printing process

Stability of printing process and the quality of printed products is determined by

Composition and parameters of dampening solution:

- pH
- conductivity
- Content of isopropanol
- tempriture

Interaction of fountain solution with inks

- Emulsification of the ink in the fountain solution

Dampening regime

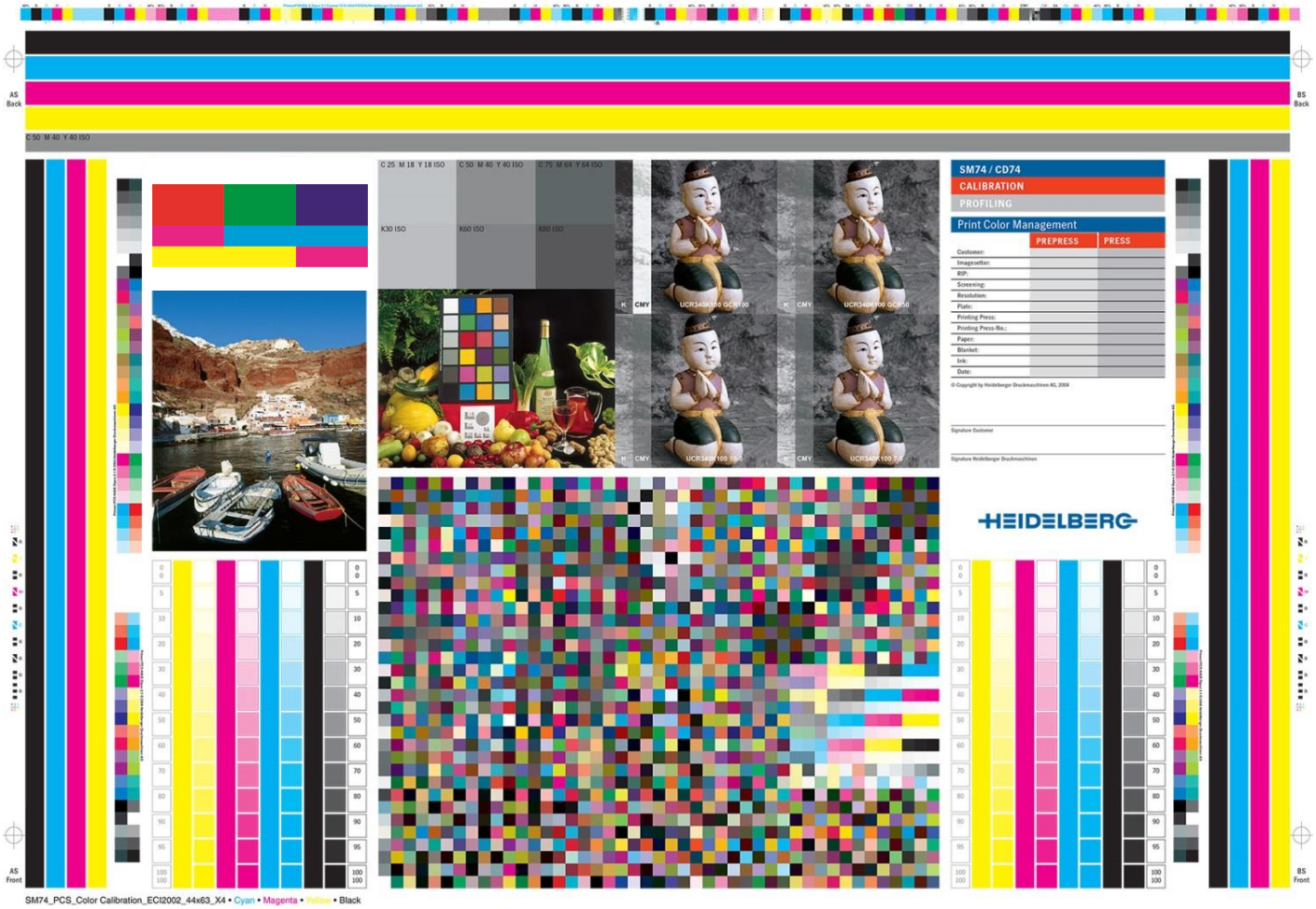
- Amount of fountain solution applied to the plate

2. Problem

In practice, printers use a large range of possibilities of dampening devices - from 25 to 80 (%).

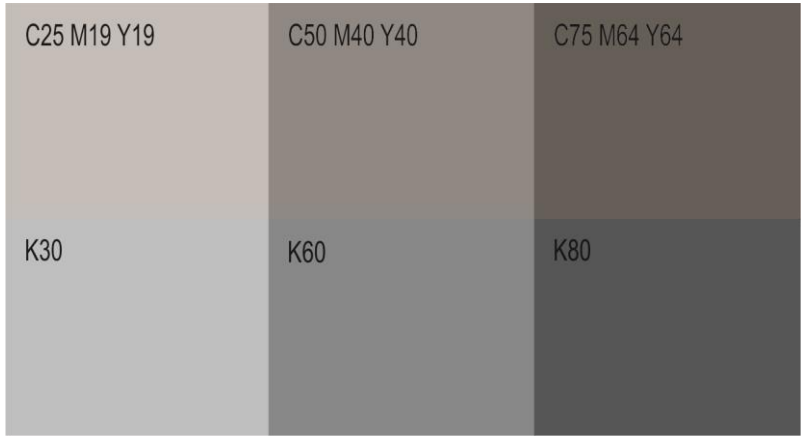
The reasons behind this are different: poor physical condition of inking and dampening devices, as well as the accuracy of their adjustment, deviations from required parameters of fountain solutions and inks, disparity of climatic conditions in workroom, low qualification of employee.

3. Materials and methods of the study

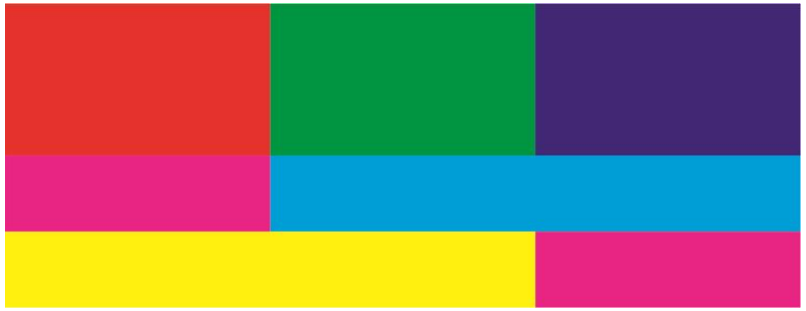


SM74_PCS_Color Calibration_ECI2002_44x63_X4

3. Materials and methods of the study



Paches for assess Gray Balance



Paches for assess Trapping

3. Materials and methods of the study

The machine for preparing plates:

Suprasetter A74

The test file was made on plates:

KODAK ELECTRA XD

Test print was performed:

machine	CD74-5+L
dampening device	CombiStar beta.c
quality control	Axis control

Paper:

matte coated
120 g/m2

3. Materials and methods of the study

Tested inks:

Novavit 918 (mineral + vegetable oil)

Novavit 700 (synthetic + vegetable oil)

Novaplast (vegetable oil)

Composition of the fountain solution:

Additive Varn Supreme – 3%

Isopropyl alchoho (isopropanol) – 9%

Parameters of the fountain solution:

pH – 5.2

Conductivitys – 1200 µS

Temperature – 10 ºC

Water hardness was determined using a reagent kit from the company ***Merck Chemicals***

The parameters of fountain solutions (pH, conductivity and temperature) were measured with ***WTWMulti 340i device***

The microclimate of the workshop:

Temprerature – 23 ºC

Relative humidity – 55%

3. Materials and methods of the study

Dependence of the gray balance changes from dampening parameters is evaluated by the equation

$$\Delta E = \sqrt{(L - L^*)^2 + (a - a^*)^2 + (b - b^*)^2}$$

The assessment of changes of trapping in accordance with ISO 13656 is evaluated by the formula of Preucil

$$T_P = \frac{D_3 - D_1}{D_2} \cdot 100$$

The emulsification ability of researched inks have been estimated by the method of Duke

4. Results

inks	damp. regime	C 25%; M 18%; Y 18%				C 50%; M 40%; Y 40%				C 75%; M 64%; Y 64%			
		L*	a*	b*	DE	L*	a*	b*	DE	L*	a*	b*	DE
Novavit 918	25%	81.56	1.23	-0.32	0	64.90	0.99	-1.37	0	46.07	-0.12	-2.49	0
	30%	82.13	1.19	-0.09	0.62	65.69	1.22	-1.16	0.85	46.52	0.39	-1.6	1.12
	35%	82.21	2.04	-0.91	0.76	65.51	2.4	-0.86	1.62	46.99	1.84	-1	2.63
	40%	81.98	1.72	-0.85	0.59	65.38	2.73	-0.65	1.82	47.80	1.78	-0.72	3.12
	45%	81.92	0.84	-0.81	0.72	66.23	0.77	-0.71	1.5	48.63	0.11	-0.55	3.22
	50%	82.27	1.1	-0.11	0.75	66.13	1.05	0.04	1.87	49.03	1.04	-0.16	3.94
	60%	82.08	1.09	0.02	0.64	67.13	1.08	1.47	1.76	49.14	0.31	0.31	4.18
Novavit 700	25%	80.63	0.74	-0.08	0	64.22	-0.02	-1.49	0	46.39	-0.98	-2.31	0
	30%	81.22	1.1	-1.1	1.23	64.41	0.61	-1.83	0.74	47.61	-0.43	-3.51	0.5
	35%	81.14	-0.02	-1.56	1.74	65.08	-0.56	-1.46	1.02	47.25	-1.96	-2.98	0.82
	40%	81.48	0.48	-1.26	1.48	65.01	0.34	-1.96	0.99	46.93	-0.59	-2.6	0.73
	45%	81.97	0.45	-0.88	1.59	64.77	0.09	-0.89	0.82	47.00	-0.53	-2.39	0.76
	50%	81.52	0.3	-1.52	1.75	65.18	-0.38	-1.68	1.04	46.74	-0.79	-3.38	1.03
	60%	81.25	0.47	-1.65	1.71	65.11	-0.17	-1.31	0.92	47.02	-0.54	-2.74	0.88
Novaplast	25%	80.37	1.07	-0.62	0	63.25	1.24	-0.85	0	45.30	-0.37	-1.19	0
	30%	80.38	1.08	-0.03	0.59	63.57	1.76	-0.37	0.63	45.68	-0.13	0.22	1.48
	40%	80.79	1.05	0.47	1.17	63.54	0.34	0.69	1.76	48.69	-0.98	0.79	3.97
	50%	81.25	0.46	0.85	1.82	64.58	0.28	1.72	3.05	48.15	-0.39	1.98	4.26
	60%	80.78	0.22	0.83	1.73	63.42	0	1.92	3.03	49.07	-1.3	0.74	4.34

Table 1. Values of L, a, b and ΔE of patch test form for the three series of inks depending on dampening regime

4. Results

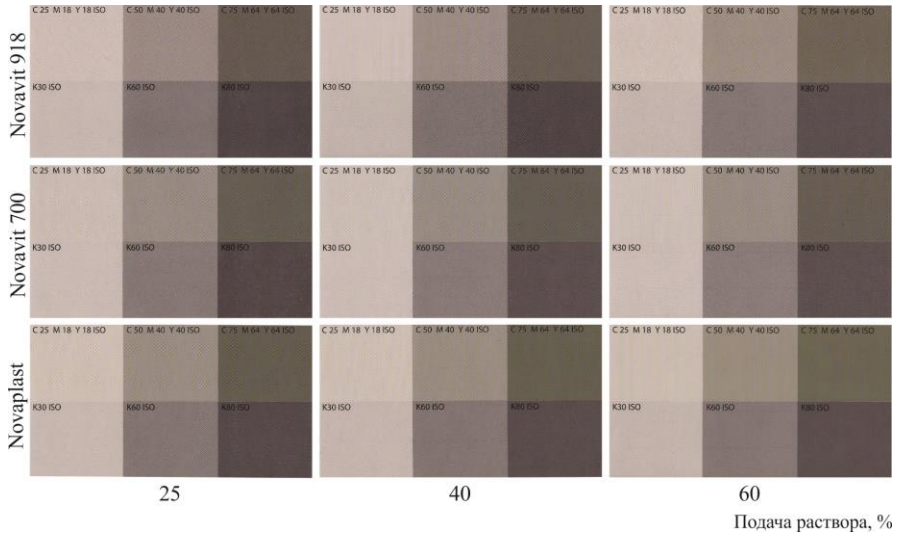


Figure 2. Fragments of gray balance changes depending on of fountain solution feed, scanned with test impressions.

4. Results

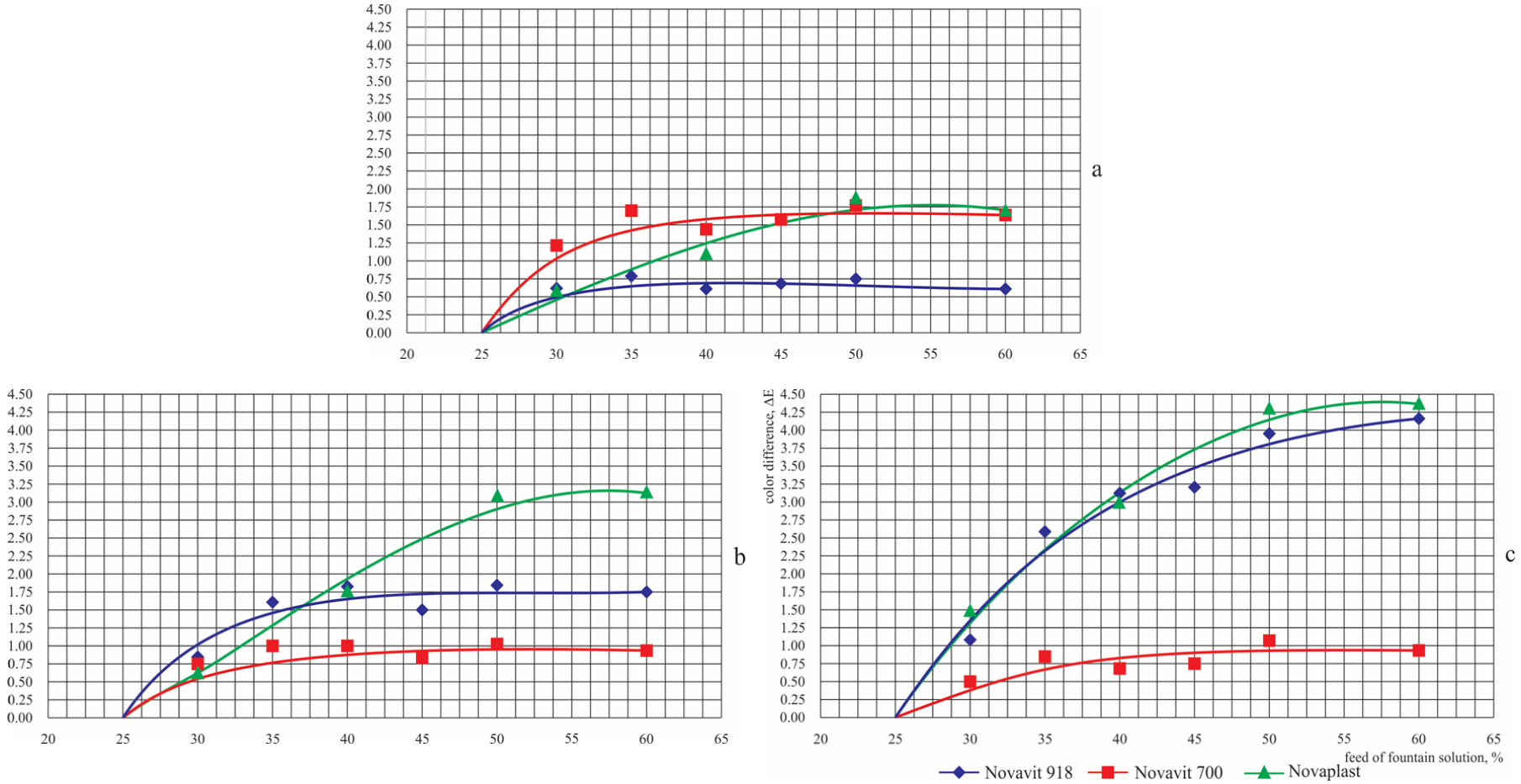


Figure 3. Dependence of gray balance from dampening regime:
a-C25,M19,Y19; b - C50,M40,Y40; c – C75,M64,Y64

4. Results

damp. regime	Novavit 918			Novavit 700			Novaplast		
	Red	Green	Blue	Red	Green	Blue	Red	Green	Blue
	Tp								
25%	60.8	76.9	68.6	63.8	75.4	64.8	62.4	76.3	65.6
30%	60.6	78.3	69.3	61.4	76.3	67.9	64.8	78.4	65
35%	63.2	78.8	72.5	62.3	77.2	68.2	-	-	-
40%	65.3	81.5	71.1	63.5	77.6	67.1	64.4	77.4	68.4
45%	63.8	80.9	71.5	64.6	79.1	69.2	-	-	-
50%	65.5	80.2	72.8	64.9	78.7	69.7	68.5	81.8	70.8
60%	68.3	87.6	75.1	65.3	79.2	70.9	70.9	84.5	73.1

Table. 2. Dependance of trapping of three series of inks from dampening regime

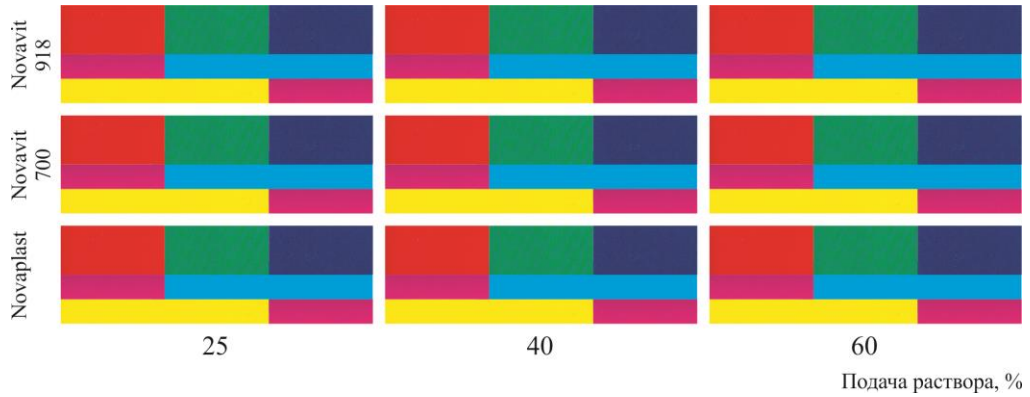


Figure 4. Fragments of trapping depending on the feed of fountain solution scanned from test impressions.

4. Results

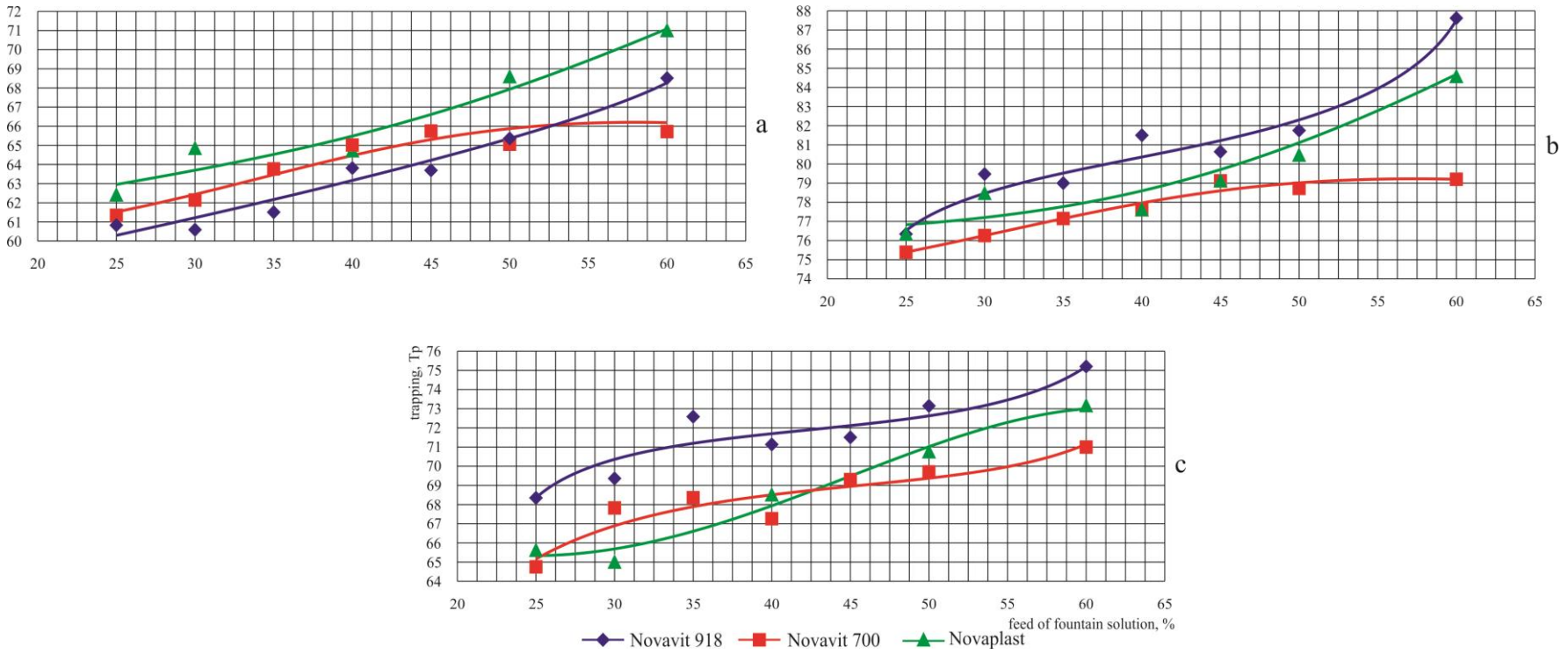


Figure 5. Dependance of trapping (Tp) from dampening regime: a – red zone, b – green zone, c – blue zone.

- Red zone: Novavit 918 60.8-68.3; Novavit 700 63.8-65.3; Novaplast 62.4-70.9;
- Green zone: Novavit 918 76.9-87.6; Novavit 700 75.4-79.2; Novaplast 76.3-84.5;
- Blue zone: Novavit 918 68.6-75.1; Novavit 700 75.4-79.2; Novaplast 65.6-73.1;

4. Results

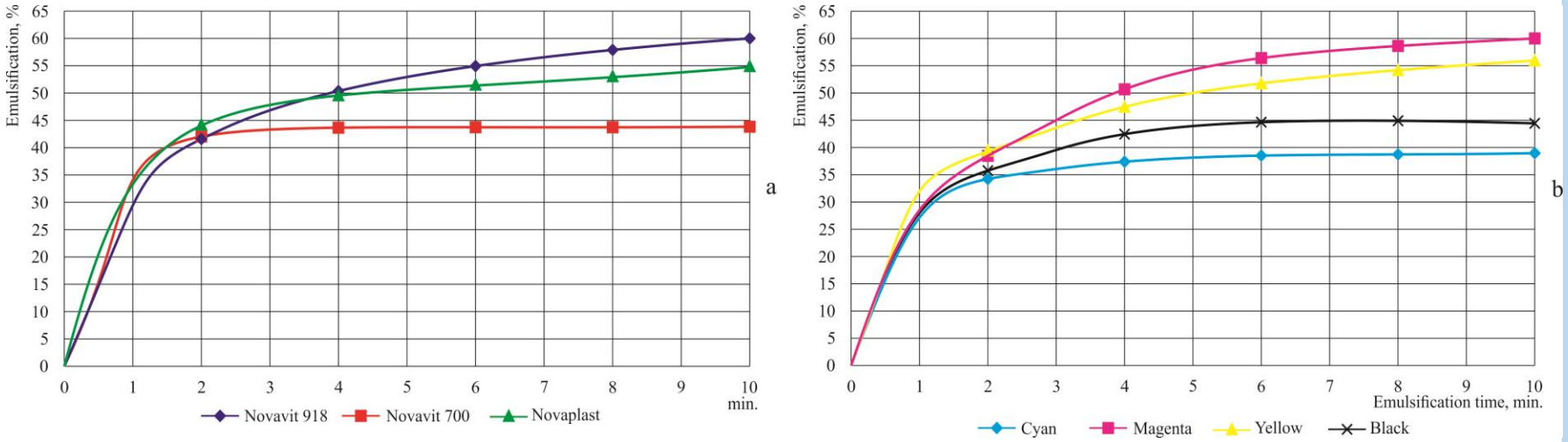


Figure 6. Emulsifying properties of (a) magenta ink series Novavit 918, Novavit 700, Novaplast and (b) CMYK series Novavit 918.

5. Conclusions

1. The effect of dampening regimes on the printing plate on qualitative characteristics of prints such as gray balance and trapping while printing with three ink types, differing by composition of fluid binding phase was studied.

2. Values of gray balance and trapping are increasing with the increase in supply of fountain solution on the plate. Their quantitative values and intensity changes are different for each of the studied series of inks and correspond to the following order: Novavit 700 < Novaplast ≈ Novavit 918.

3. Relationship between the emulsifying properties of inks and the influence on the amount of the fountain solution feed parameters on gray balance and trapping is revealed. Increase of emulsifiability of studied inks exactly corresponds to series of increasing parameters of gray balance and trapping.

6. Any questions ?

Thank You for your attention