Effect of Surface Coating of Paper on Measuring Spectral Values

Prof. Mona Mostafa Abu Tabl
Professor of Qulity Control Systems, at Printing, Puplishing & Packaging Department - Faculty of Applied Arts, Helwan University
monaabutabl@yahoo.com

Prof. / Ali Mahmoud El-Khafif
Former Dean of Faculty - Professor of Printing Systems, at Printing, Puplishing & Packaging Department - Faculty of Applied Arts, Helwan University
ahkom86@hotmail.com

Dr. Chemist/ Adel Mohyeldin Gabre Hanafi
PhD - Philosophy of Science - Organic Chemistry Executive Director of Research and Development - Paints and Chemical Industries Co. – Pachin
adelmohy@pachin.net

Designer. Mohamed El-Said Mahmoud
Photo-Mechanical Designer - Egyption Mint Authority - Ministry of Finance
moh_alassar2000@yahoo.com

Introduction:

The printing industry has become more dvelopment than before, as well as the challenges that related to quality and consistency of colors results, especially with the repetition of printing operations in the packaging field.

The using of measurment devices is very important due to the many changes that occur on printing materials in general and on paper and inks in particular.

And thier were many sources of cellulose plants and other sources of paper manufacturing, as well as the entry of recycling operations in this industry, and also many producing companies are manufacturing paper with different technology in the world.

Also there are a several companies producing inks and the development of the manufacture of chemical›s Pigment compounds and sources of oils, resins and other additives.

All of that factors made it necessary and to use measurment devices, especially in the production of repeated printing to ensure the stability of results and quality control in each process.

In this research we will highlight on the most important types of paper in general and especially the paper that used in this research.

And we will print models of the fourteen basic colors of the Pantone and will make measurements using the spectrophotometer to register and monitor the differences resulting from the different surface finishing of the paper coated - glossy/matt and uncoated.

As well as registered the results and values of the difference between the print samples and Pantone.

In this research, we will highlight on the colors deviations with the different surface finishing of the paper and fixed the other factors to identify the reasons that lead to the deviation of the results with the use of the same materials and equipment and using of different types of finishing surface of paper.

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Key Words: Coated Paper - Finishing Surface - Pantone.

The aim of the research:

1 - Studying the types of paper surface finishing.
2 - Explain the importance of using measurment devices in print production.

The problem of research:

In neglecting the role of color guides as a basic partner in all steps of print production as a tool that coordinates color standards and Spetrophotometer.

The importance of research:

Explain the Effect of surface finishing of paper on color measurments in print production.

The theoretical part of research:

This part studying the types of paper that used in research.

1 - Coated paper:

Paper coated with compound or polymer to improve paper properties, including weight, surface gloss and surface smoothness of paper material.
In this research we will use to kind of coated paper (glossy/matt).

a- Coated paper matt made in china:

Description	**Unit**	**Coated/ matt**		
Basic weight	gm/m2	**150**	**157**	**200**
Thickness	Micron	**4 ± 148**	**5 ± 155**	**6 ± 168**
Opacity	%	**1.5 ± 98.0**		

b- Coated paper glossy European-made Sabbi brand :

Description	**Unit**	**Coated/ gloss**
Basic weight	gm/m2	150
Thickness	Micron	2 ± 130
Opacity	%	1.5 ± 96
Roughness	Micron	1.1 ≥
Gloss	%	5 ± 66

2 - Uncoated paper:

The paper used in this research is Italian brand BLANCOFLASH.

Description	**Iso**	- / +	**Unit**	**Uncoted/BLANCOFLASH**			
Basic weight	ISO536	%5	جرام/م2	85	140	200	400
Thickness	ISO534	%5	ميكرون	98	157	220	424
Whiteness	ISO11475	3	%	158	158	158	158
Roughness Bendtsen device	ISO 2--8791	30	m / ml	120	120	120	120
Roughness	ISO2471	<	%	90	95	--	--

The practical part of research:

In the practical part of this research we will prepare the materials, the measuring devices, the plates and the printing machine.

We proceed the following steps:

1 - Printing test models for 14 colors of special inks on uncoated paper and matt/glossy coated paper.

2 - Make spectral measurements for each color sample on each paper material.

3 - Results comparison with original Pantone and standard Pantone according to CIE Lab measurements and measurements in Photoshop image processing program.

Final results of colored samples:

a- Coated Glossy Paper:

Pantone Color	Photoshop			Prited Pantone			Measurement			Ink ΔE	Paper ΔE
	L*	a*	b*	L*	a*	b*	L*	a*	b*		
Yellow	89	3-	112	89	1.2-	107	80.	4.4	43.	3.58	1.06
Yellow 012	87	4	114	87	2	113	76.	13.	42.	3.47	1.06
Orange 021	64	62	86	61	64	84	52.	60.	29	5.30	1.06
Warm Red	58	70	50	58	69	47	46.	66.	23	3.03	1.06
Red032	54	74	46	54	71	41	43.	68.	22	7.80	1.06
Rubine Red	44	77	9	38	70	8	35.	65.	10.	4.70	1.06
Rhodamine Red	52	77	16-	43	69	15-	42.	68.	9.4-	3.35	1.06

Purple	48	65	42-	50	65	44-	36.	53.	-	3.60	1.06
Violet	24	46	66-	19	51	68-	24.	20.	-	11.00	1.06
Blue072	20	38	78-	15	42	76-	31.	12	-	10.00	1.06
Reflex Blue	19	26	68-	16	27	66-	29.	1.4	-	8.60	1.06
Process Blue	49	33-	54-	45	33-	54-	45	26-	-	4.80	1.06
Green	58	77-	2	59	79-	3.6	49.	-	1.2	3.40	1.06
Black	16	1	3	16	2	3.5	17	-	0.5	4.09	1.06

b- Uncoated Glossy:

Pantone Color	Photoshop Library			Measurement Sample			Ink ΔE	Paper ΔE
	L*	a*	b*	L*	a*	b*		
Yellow	92	2-	95	81.8	3.60	38.7	9.70	6.80
Yellow 012	89	5	95	79.5	8.76	37.1	13.40	6.80
Orange 021	68	56	63	57.2	51.4	27.1	3.21	6.80
Warm Red	64	62	39	53.0	55.8	18.6	2.10	6.80
Red032	60	64	30	51.8	55.5	17.7	1.96	6.80
Rubine Red	54	61	3	45.8	51	1.4	2.13	6.80
Rhodamine Red	85	63	10-	55.9	47.4	13.7-	11.1	6.80
Purple	54	54	33-	51.8	36.1	31.2-	8.30	6.80
Violet	44	27	43-	42.8	13.2	34.4-	6.5	6.80
Blue072	33	19	55-	37.6	10.4	44.9-	7.90	6.80
Reflex Blue	32	12	45-	36	1.53	29.8-	6.5	6.80
Process Blue	49	21-	48-	51	21.5-	42.5-	5.80	6.80
Green	59	59-	1	54.9	37.8-	0.75-	6.20	6.80
Black	39	2	4	34.4	0.83	1.14	1.77	6.80

c- Coated Matt Paper:

Pantone Color	Photoshop Library			Measurement Paper			Measurement		
	L*	a*	b*	L*	a*	b*	L*	a*	b*
Yellow	90	2-	110	92.6	0.34	0.79-	82.6	3.12	43.9
Yellow 012	87	4	108	92.6	0.34	0.79-	76.92	10.92	41.52
Orange 021	62	63	76	92.6	0.34	0.79-	53.55	60.28	29.50
Warm Red	62	64	44	92.6	0.34	0.79-	47.61	66.95	23.47
Red032	57	67	39	92.6	0.34	0.79-	48.24	65.62	19.15
Rubine Red	64	72	6	92.6	0.34	0.79-	38.6	64.84	5.20
Rhodamine Red	54	71	13-	92.6	0.34	0.79-	49.16	60.99	-
Purple	48	65	42-	92.6	0.34	0.79-	44.77	47.72	-
Violet	34	34	53-	92.6	0.34	0.79-	34.20	17.70	-
Blue072	23	31	72-	92.6	0.34	0.79-	28.18	13.08	-
Reflex Blue	24	19	62-	92.6	0.34	0.79-	25.63	1.13	-
Process Blue	50	31-	51-	92.6	0.34	0.79-	40.97	-	-
Green	62	69-	2	92.6	0.34	0.79-	53.31	-	0.71
Black	25	2	3	92.6	0.34	0.79-	20.9	0.71	1.66

The results of research:

1 - There is a difference in color measurements depending on the type of surface finishing of glossy paper and matt.
2 - Measurement differentials are increased with uncoated paper.

The recommendations of research:

1 - Using of the printed color guides, and increasing the tolerance of color difference sepically in matt coated paper.
2 - Interested of studies and research related to this field and follow up the updates of the new annual colors in guides.

The references of research:

1. Kipphan Helmtt *HAND BOOK OF PRINT MEDIA* U.S.A Springer.2001
2. F .Hird Kenneth *OFFSET LITHOGRAPHIC TECHNOLOGY* U.S.A Good heart -
3. Willcox company. 2000 ,
4. Leach R .H .*THE PRINTING INK MANUAL* - fourth edition U.S.A Springer.1989
5. L .Green wald Martin and C .Luttrapp John *GRAPHIC DESIGN - PRODUCTION TECHNOLOGY* U.S.A Prentice-Hall. 2001
6. Parr Andrew *INDUSTRIAL CONTROL HANDBOOK* - Industrial Press ,Inc. 2008 –