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The Variation of Color Shade & Color Density in the Different Printing Flexible Substrate by Using Spectrophotometer

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Abstract: In this paper is attempted to know Printing on flexible substrate in which different value of color shade & Color density in different flexible substrate. Spectrophotometer color measuring device for improve print quality and performance on various grade of different Flexible Substrate i.e. PET, BOPP, CPP, and N. POLY. It is used in all printing process. It is best quality of color shade improve by this Spectrophotometer. The purpose of this study is to study of various identifying color shade evolution, color density evaluation, it's measuring by spectrophotometer and to knowing of the Spectrophotometer on working of color difference at the flexible printing substrate. Identify of spectrophotometer evaluation of print surface. In this paper in main result, the color shade matching & color density were vary on different flexible substrate i.e. BOPP, PET, CPP and Natural Poly. It may be finding color variation in Color Shade and Color density from job card to job Sample.

Key words: Spectrophotometer, Additive color, Subtractive color, color Systems, CMC, Gloss, & Flexible substrate.

I. INTRODUCTION

Spectrophotometers are color measurement devices used to capture and evaluate color. As part of a color control program, brand owners and designers use them to specify and communicate color, and manufacturers use them to monitor color accuracy throughout production. Spectrophotometers can measure just about anything, including liquids, plastics, paper, metal and fabrics, and help ensure that color remains consistent from conception to delivery. A spectrophotometer measures spectral data the amount of light energy reflected from an object at several intervals along the visible spectrum, which are interpreted in the form of spectral data.

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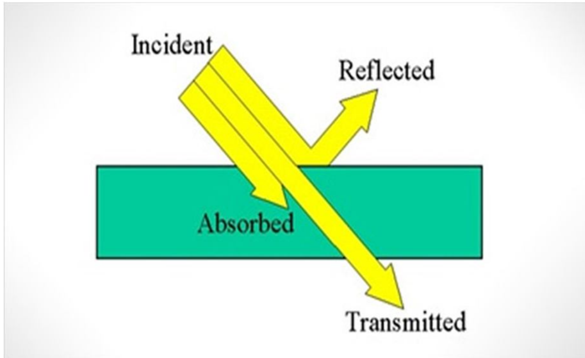
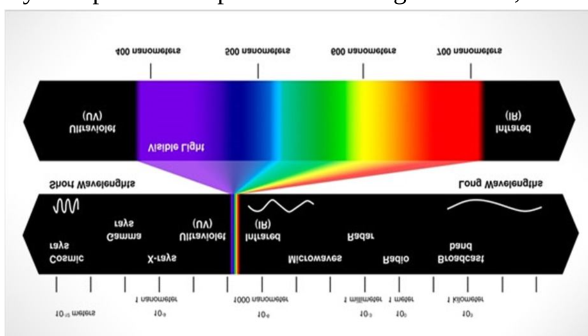


A second principle of spectrophotometer is that every substance absorbs or transmits certain wavelengths of radiant energy but not other wavelengths. For example, chlorophyll always absorbs red and violet light, while it transmits yellow, green, and blue wavelengths. In recent years spectrophotometer are applicable to many printing industrial problems involving the quantitative determination of compounds that are colored or that react to form a colored.

A. *Color Shade*

Color is the visual effect that is caused by the spectral composition of the light emitted, transmitted, or reflected by objects.

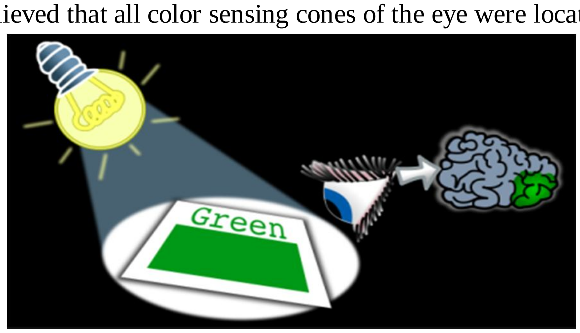


When a beam of white light passing through a prism, disperses the light so that we can see how our eyes respond to each individual wavelength.

B. *Color Perception*

Color perception involves

1) A light source normally emits light that appear to be white,
2) An Object modifies light colorants such as pigments or dye in the objects, selectively absorbs some wavelength of the incident light while reflecting or transmitting other. The amount of reflected or transmitting light at each wavelength can be quantified. This is a spectral curve of the objects color characteristics.
3) A receiver normally an eye (observer):- In 1931, Wright and guild published 2dgree standard observer function based on their experimental. This was called as 2dgree observer because of the hole through which color were imaged, allowed a 2degree field of view. During the time it was believed that all color sensing cones of the eye were located within 2 degree are fovea.



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The light falls on the objects, part of it is absorbed the remaining is reflected back to receiver and the combined effect shows the color.

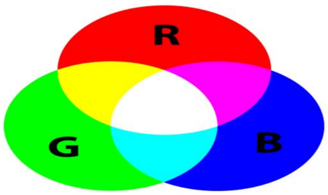
We have two different theories for understanding of color perception,

1st we have a light source, an objects and a receiver. Light falls on the objects part of it is absorbed by the objects, rest is reflected back and sensed, to perceive the color, this is subtractive method.

2nd we have two or more light sources and the light sources itself are missing certain wavelength, is perceived by receiver as color.

C. Additive Color Method

Primaries additive are red, green and blue light



D. Subtractive Color Method

Cyan magenta and yellow as a primary subtractive colors'.

If the object absorbs all light, there is nothing to be reflected by the object and hence it appears black.

E. Color Measurement System

The CIE (International commission on Illumination), is the body responsible for international recommendation for photometry and colorimetric

The CIE color system utilizes three coordinates to locate a color in a color space. These color spaces include:-

1) CIE XYZ
2) CIE L*a*b*
3) CIE L*C*h*

To obtain these values, we must understand how they are calculated.

Where a color is expressed in CIE L*a*b*

L* defines the light or darkness, a* defines redness (+a*); greenness (-a*) and b*defines yellowness (+b*); blueness (-b*).

The difference in color between two specimens can represent by their distance apart in color space. It is generally expressed in the terms of

Δ E, L*a*b*, where **Δ** in this case signifies difference in E' i.e. total color difference.

The CIE L*C*h*, it is defines as the location of color coordinates rather than rectangular coordinates

F. CMC (Color Measurement Committee)

CMC is a modification of CIELAB developed by the colorants measurements of the society of dyers and colorists. Color difference calculated using the CMC method are believed to correlate better with visual assessment than color difference calculated using other instrument systems.

An average observes will observe: Hue difference first, Chroma difference second and Light difference last

G. Gloss

Gloss effect are based on the interaction of light which the physical properties of the sample surface. Gloss is measured using a gloss meter which directs a light at a specific angle to the surface and simultaneously measurement the amount of reflection.

II. RESEARCH OBJECTIVE

Every research work has to be focused on certain parameter & their consequence, accordingly various aspects related with these parameters is to be studies from time to time. Hence this study is based on the following objective:-

To study of various identifying color shade evolution, color density evaluation, its measuring by spectrophotometer.
To evaluate of spectrophotometer for shade color, color density and its comparison.
To knowing of the spectrophotometer on working of color difference at the flexible printing substrate.

III. RESEARCH METHODOLOGY

In this study research work was of experimental based work. The using of some kind of flexible printing substrate i.e. BOPP, CPP, PET, POLY Natural, etc. the printing work was carried out in "Aero Plast Pvt. Ltd" in Bahadurgarh. The color shade and color density of different sample were measured with the help of spectrophotometer. Print quality factor, color shade, color density and its color comparison with in different system. The entire data are analyzed with suitable statically tools and techniques i.e. bar graphs, charts and table.

IV. DATA COLLECTION AND ANALYSIS

For the flexible printing substrate the print by rotogravure and flexo printing process in which color shade, color density measuring by spectrophotometer. The machine was run 80 percent of the rated speed (18000IPH) after make ready, 5 sample cut reel in out feed roll print without any stop. After every sample to check by spectrophotometer, First of all mix the ink color sample and master sample properly. Take a drawdown of fresh ink with bar coater number no.1 on suitable substrate. Check the value of draw down by X-Ritespectrodensitometer.

The data collected from these Five samples are represented below

Table of different surface of L*a*b* color value:

PET	L, a, b value	Master	Sample 1.	Sample 2.	Sample 3.	Sample 4.	Sample 5.
	L*	81.89	82.34	81.56	80.96	81.12	81.76
	a*	-0.96	-0.71	-0.93	-0.45	-0.91	-0.74
	b*	107.87	106.72	107.23	107.88	107.55	106.79
BOPP	L*	71.79	65.10	66.79	70.12	72.16	70.19
	a*	-01.23	-0.21	-0.35	-0.29	-0.39	-0.27
	b*	104.55	101.35	102.66	101.45	104.17	103.82
CPP	L*	76.12	78.23	75.66	76.18	77.10	76.35
	a*	-0.85	-0.42	-0.68	-0.75	-0.75	-0.56
	b*	111.29	109.15	112.13	108.76	110.56	111.15
N. POLY	L*	11.15	10.19	12.09	11.18	12.33	11.18
	a*	-06.10	-05.17	-06.13	-05.29	-06.45	-04.22
	b*	-05.25	-04.56	-03.67	-06.37	-03.44	-05.29

These above reading values of flexible printing substrate by using of spectrophotometer evaluation in ink color shade, color density range value and color comparison to be calculated.

The main purpose of the CIELAB color space was to determine as accurately as possible the magnitude of perceptual color difference between a standard color and a sample. The color difference between two measured colors can be expressed as their difference (Δ) in lightness (ΔL* = L*1 – L*2), redness-greenness (Δa* = a*1 – a*2), and blueness-yellowness (Δb* = b*1 – b*2). These provide the difference in the lightness and each of the chromatic dimensions independently of each other.

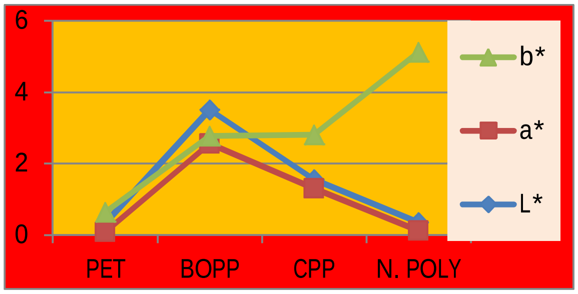
The Total color difference ΔE* is the same as the ΔE* in the CIE LAB scale,

$$\Delta E_{ab}^{*} = \sqrt{(L_2^{*} - L_1^{*})^2 + (a_2^{*} - a_1^{*})^2 + (b_2^{*} - b_1^{*})^2}$$

Table: (a) Calculation of ΔE a*b* total Color Difference:

PET	L, a, b value	Diff. 1.	Diff. 2.	Diff. 3.	Diff. 4.	Diff. 5.
	L*	-0.45	0.33	0.93	0.77	0.13
	a*	-0.25	-0.03	-0.51	-0.05	-0.22
	b*	01.08	0.64	-0.01	0.32	0.08
BOPP	L*	06.60	05.00	01.67	-0.65	01.60
	a*	-01.02	-0.88	-0.94	0.84	-0.96
	b*	03.20	01.89	03.10	0.38	0.73
CPP	L*	-02.11	04.66	-0.06	-0.98	-0.17
	a*	-0.43	-0.17	-0.10	-0.10	-0.29
	b*	02.14	-0.16	02.53	0.73	0.14
N. POLY	L*	0.96	-0.94	-0.03	-0.18	-0.03
	a*	-0.93	0.03	-0.81	0.35	-01.88
	b*	-0.69	-01.58	01.12	-01.81	0.04

Figure: (b) the chart of color shade and color density variation:



V. RESULT

By this study, we find out that are evaluation of color shade, color density range and color comparison on difference flexible printing substrate by using of spectrophotometer. It is found that if PET of L* lightness when +a* is redness (+a*) and+ b* will yellowness. Other substrate compare values of this L* is darkness and a* is same with the PET and b* will blueness (-b*). There are Natural POLY and BOPP on print shade color range value of ΔCIE will same because they are very opaque nature substrate and matt finish type substrate, very less required due to PET and CPP. Other than Natural poly and PET of CIE value in (+ b*) is yellowness according to this study of color shade on applying on flexible substrate. This main point of view this paper was evaluation of color shade, color density, it depend on the difference surface substrate.

VI. CONCLUSION

The color Shade matching & color density were varying on different flexible substrate i.e. BOPP, PET, CPP and Natural Poly. It may be finding color variation in Color Shade and Color density from job card to job Sample. Different Color shade variation in Different flexible printing substrates and while applying on same ink ratio.

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