

Computer Color Matching System (CCMS)



CCMS (Computer Color Matching System) is a system that **measures** the **reflectivity of a target color** with a Spectro-colorimeter and **calculates the blending ratio of primary color** which are **registered in a computer** in advance to **reproduce** the color. Since the results of the prepared color can be kept in the computer, customers can meet **repeated orders swiftly**, **not just calculating** blending recipes. The system also has a function for **controlling color quality** such as **calculation of color difference** and **control of shipment lots**.

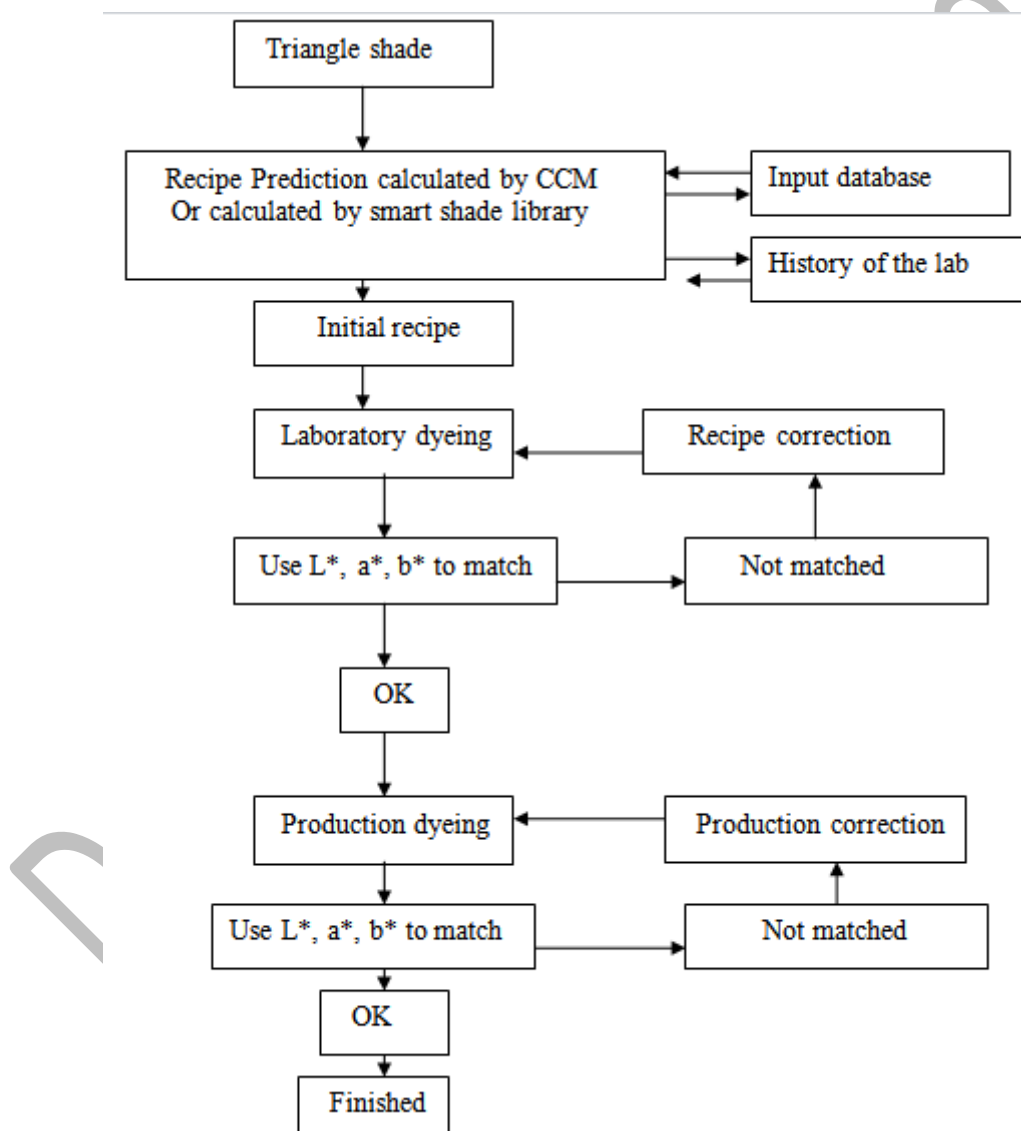
Functions of CCMS

- **Color match prediction.**
- **Color difference calculation.**
- **Determine metamerism.**
- **Pass/Fail option.**
- **Color fastness rating.**
- **Cost Comparison.**
- **Strength evaluation of dyes.**
- **Whiteness indices.**
- **Reflectance curve and K/S curve.**
- **Production of Shade library.**
- **Color strength**

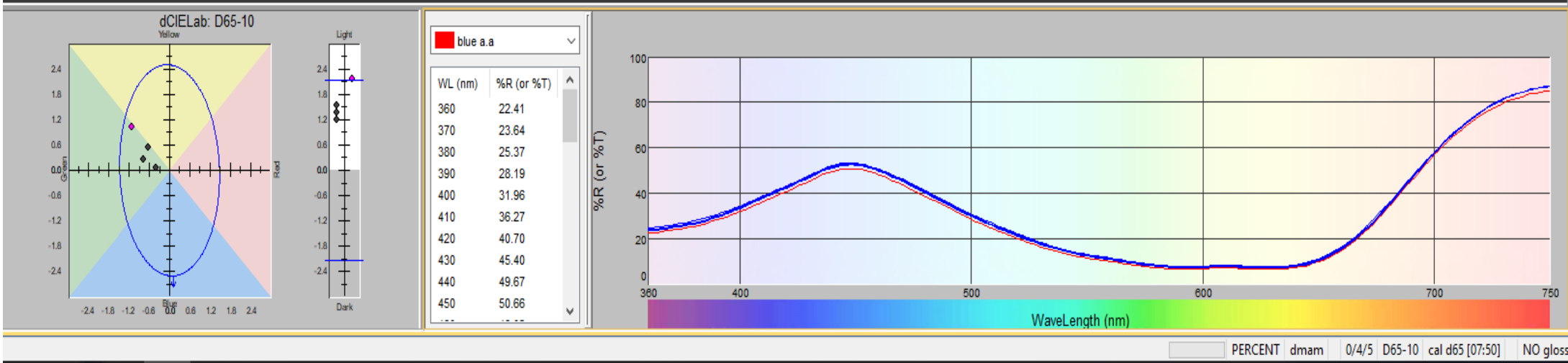
Required belongings for CCMS

- **Color measurement Instrument (Spectrophotometers).**
- **Reflectance (R%)** from a mixture of Dyes or Pigments applied in a specific way.
- Optical model of color vision to closeness of the color matching (CIE L^*A^*B).
- Personal Computer

Flow Chart of Color Matching Process with Spectrophotometer



Trial Name	ill-obs	DL*	Da*	Db*	DC*	DH*	DEcmc	P/F DEcmc	MI-(1,2)
✖ blue 1	D65-10	2.14 L	-1.11 G	1.02 Y	-1.05 D	-1.08 G	1.33	Failed	0.66
	A -10	2.23 L	-0.47 G	1.13 Y	-0.99 D	-0.72 G	1.27		
	F02-10 (C...	2.24 L	-0.97 G	1.24 Y	-1.27 D	-0.92 G	1.36		
✔ blue 1	D65-10	1.34 L	-0.63 G	0.54 Y	-0.57 D	-0.60 G	0.80	Passed	0.34
	A -10	1.39 L	-0.30 G	0.62 Y	-0.53 D	-0.43 G	0.78		
	F02-10 (C...	1.41 L	-0.56 G	0.69 Y	-0.71 D	-0.53 G	0.83		
✔ blue 2	D65-10	1.51 L	-0.76 G	0.26 Y	-0.28 D	-0.75 G	0.89	Passed	0.17
	A -10	1.51 L	-0.58 G	0.23 Y	-0.09 D	-0.62 G	0.85		
	F02-10 (C...	1.53 L	-0.64 G	0.29 Y	-0.32 D	-0.63 G	0.88		
✔ blue 3	D65-10	1.18 L	-0.40 G	0.06 Y	-0.08 D	-0.39 G	0.63	Passed	0.04
	A -10	1.18 L	-0.35 G	0.06 Y	0.02	-0.36 G	0.64		
	F02-10 (C...	1.21 L	-0.34 G	0.11 Y	-0.12 D	-0.33 G	0.65		



Kubelka-Munk Theory

In the context of color science, "**Kubelka-Munk theory**" refers to a method used to **quantify the color strength** of a material, typically expressed as a "**K/S**" value, which is calculated **based on the material's reflectance** and derived from the Kubelka-Munk equation as following:

$$\frac{K}{S} = \frac{(1 - R)^2}{2R}$$

Where,

R = reflectance

K = absorption

S = scattering co-efficient

A Higher K/S Value Indicates A Stronger Color Intensity

Relation between Color Strength and Reflectance

Sample	Reflectance (R)	K/S
Undyed	0.827	0.0181
Dyed with 0.1% shade	0.31	0.7676
Dyed with 0.5% shade	0.106	3.770

Comparison between visual & instrumental color control

Sl. No.	Color control	Visual	Instrumental
01.	Decision	Uncertain	Certain
02.	Reproducibility	Bad	Good
03.	Faulty decisions	More	Few
04.	Compatibility of various tests	-----	Good
05.	Tolerance limits	Indefinable	Definable
06.	Communication (suppliers/customers)	Bad	Good