Fastness properties Assessment on Dyed fabrics

Machines used are

- **XENOSTER**
- This is used to test the light fastness of the dyed fabric.
- colour fastness to light, IS-2454-85 by xenotester;

- **WASH WHEEL**

- ***Model Make: Thermolab***
- This is used to test the washing fastness of the dyed fabric.
- colour fastness to washing, IS-687-79 by wash wheel

- **Perspirometer**

- ***Model Make: Sashmira***
- This instrument is used for the testing of perspiration fastness of the dyed fabric.
- colour fastness to perspiration, IS-971-83 by perspirometer.

- **CROCK METER:**

- ***Model Make: Ravindra Engg.***
- This instrument is used for testing the rubbing fastness of the dyed fabric
- colour fastness to rubbing, IS-766-88 by crockmeter;

Xenometer machine

Evaluation of Fastness Properties

- Evaluation of fastness properties of a dye is done by measuring washing, light, rubbing and perspiration fastness values using Wash wheel, Xenoster, Crock meter and Prespirometer respectively. Methods for evaluating these properties are as follows:

- **Fastness to washing (IS 765:79)**

- A 10 x 4 cm swatch of the dyed fabric is taken and is sandwiched between two adjacent fabrics and stitched. The sample and the adjacent fabric were washed together. Five different types of washing are specified as different washing methods.

- The solution should be preheated to the required temperature of washing. The liquor ratio should be 1: 50. After soaping treatment, the specimen is removed, rinse twice in cold water and then in cold running tap water. Squeezed and dried in air at a temperature not exceeding 60°C. the value is evaluated with the help of grey scales.

Washing Fastness Tester

Wash fastness

- The color fastness of textile material is determined by way of mechanical hesitation of a specimen of textile with the piece of specified adjacent fabrics in Standard Soap Solution followed by rinsing and drying. Thereafter, the change in color of specimen and stains of the adjacent fabrics are assessed with standard grey scale.

Features of Washing Fastness Tester:

- It is fabricated out of quality stainless steel.
- Possess electric heater to heat water in water bath.
- The microprocessor based programmer is provided for temperature control.
- Buzzer to indicate the completion of the process cycle or step.

Fastness evaluation

Fastness to light (IS: 2454:1985)

- After processing, comparison in the change in color of the specimen with the changes that have occurred in the standard pattern under suitable illumination is carried out to determine the fastness of light.

Fastness to rubbing (IS 766:88)

The test is quite sensitive and for getting consistent result, it is necessary to use standard crockmeter cloth, maintain uniform pressure for applying rubbing strokes and number of strokes. Besides, for wet rubbing, % moisture on the crock-cloth has to be kept to uniform level. For ISO-105 x 12 test method, rubbing cloth that has been wetted with water, has to be squeezed to contain its own weight of water.

For AATCC 116-1995 methods, wet pick up is to be maintained between 65 ± 5% by squeezing the wet crockmeter cloth using a AATCC blotting paper. Any variation in the moisture content can lead to deviation in the rating. With high amount of moisture i.e.., wet pick up, ratings will be lower. Degree of staining is visually assessed using Grey scale for change of colour with grade of 1-5 where rating of 5 signify negligible change and 1 maximum change.

Crockmeter is used for testing the transference of color from the surface of one material to another by either wet or dry rubbing.

Crockmeter

Fastness to perspiration

Fastness to perspiration

- The fastness of colored fabric with reference to alkaline and acidic perspiration was evaluated. For the alkaline (pH-8) and acidic (pH-5.5) liquors were prepared and the composite specimens were dipped in acidic and alkaline solution separately for 30 minutes. Good and uniform penetration of the solution was ensured. The liquor was poured off and the excess water and air bubbles, if any were removed by passing the specimens in between two glass rods. Composite specimens were then placed between glass/acrylic plates with a pressure of 12 kpa perspirometer. The perspirometer was kept for four hours at a temperature of 37 ($\pm 2^0$C). Afterwards, the fabrics were removed, separated and dried in air below 60°C. The values were rated as per the grey scale. The details of the values assigned for these properties are:

- 5 = Negligible (Excellent)
- 4 = Slightly changed (Good)
- 3 = Noticeable changed (Fairly good)
- 2 = Considerably changed (Fair)
- 1 = Much changed (Poor)

Perspiration Tester - Perspirometer

Color Scan Machine

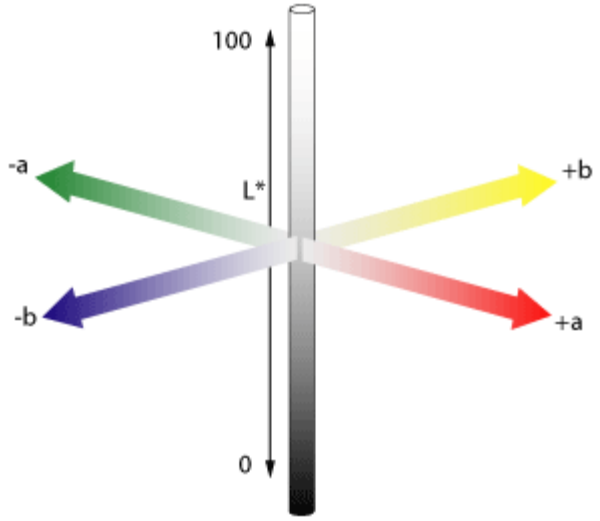
- Color models are used to classify colors and to qualify them according to such attributes as hue, saturation, chroma, lightness, or brightness. They are further used for matching colors and are valuable resources for anyone working with color in any medium. CIELAB uses Cartesian coordinates to calculate a color in a color space.

- The CIE color models are highly influential systems for measuring color and distinguishing between colors. The a* axis runs from left to right. A color measurement movement in the +a direction depicts a shift toward red. Along the b* axis, +b movement represents a shift toward yellow. The center L* axis shows L = 0 black

- or total absorption) at the bottom. At the center of this plane is neutral or gray.

An organization called CIE (Commission Internationale de l'Eclairage) determined standard values that are used worldwide to measure color.

The values used by CIE are called L*, a* and b* and the color measurement method is called CIELAB. L* represents the difference between light (where L*=100) and dark (where L*=0). A* represents the difference between green (-a*) and red (+a*), and b* represents the difference between yellow (+b*) and blue (-b*). Using this system any color corresponds to a place on the graph shown in Figure in the next slide. Variables of L*, a*, b* or E* are represented as delta L*, delta a*, delta b* or delta E*, where delta E* = delta (delta L^{*2}+delta a^{*2}+delta b^{*2}). It represents the magnitude of the difference in color, but does not indicate the direction of the color difference.



CIELAB coordinate system

Color characteristics

- **Color characteristics:** At present, a combination of laboratory dyeing and CIELa*b* coordinates was found to be suitable to establish an experimental basis for standardization of plant material. CIELa*b* colorimetric system was used to determine the color measurement on fabric. Coloration was determined using a Color Scan Machine (Premier Color Scan) color difference photometer which recorded the spectrum of reflected light and converted it into a set of color coordinates (L, a and b values).

- With the help of color scan machine CIELa*b* values can be calculated through reflectance. The color coordinates are:

- L→ Whether the sample is light or dark [*L* = 0 (black) to *L* = 100 (white)]

- a*→ if the sample is red (+a) or green (-a) [, −*a* (greenness) to +*a* (redness)]

- b*→ if the sample is yellow (+b) or blue (-b) [−*b* (blueness) to +*b* (yellowness)]


PREMIER COLORSCAN
SpectraScan
5 1 0 0 +

CIELAB

- In the CIELAB system, a color is represented by three numbers, which specify its position in the three-dimensional volume. The first number, the L value, defines how light or dark a color is. The “a” and “b” tell us about the “color.” Because colors are specified in terms of numbers, it is easy to go one step further and describe the difference between two colors with a numerical value. This difference, expressed as the numerical difference between the two CIELAB numbers, is called Delta E (^{3}E).

- The most sophisticated color-measurement instrument is a photometer. A photometer measures the spectrum of a sample, reporting the reflectance or transmittance at regular intervals. The spectrum is the most complete description of a color, and it can be used to calculate all other metrics, including density and CIELAB.

Evaluation of L, a* and b*

- After dyeing color strength and fastness studies were carried out to have an idea about the dye uptake on the fabric. For color specification the C I E system is used.

- The basis of all color measurement work is the C I E system of color specification introduced in 1931 by the Commission International de I' Ecclairage.

- The x, y, and z tri-stimulus values specify a color viewed by the C I E standard observer which is depicted as L, a* and b* values by CIELAB equation.

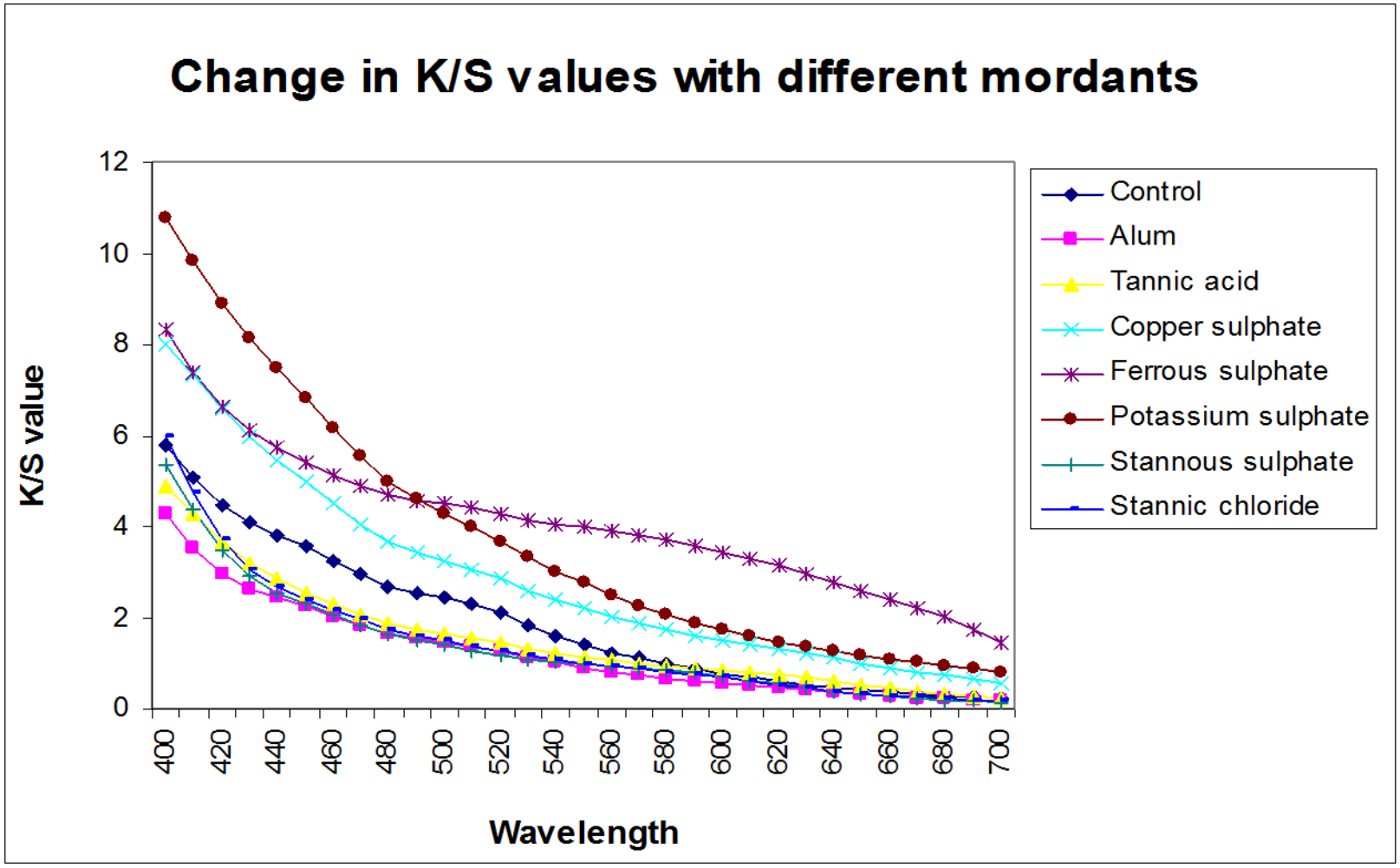
- The L, a* and b* values form the three perpendicular axes of the color space. In this work CIE Lab values have been measured by Premier color scan machine SpectraScan 5100+.

Measurement of Color Strength

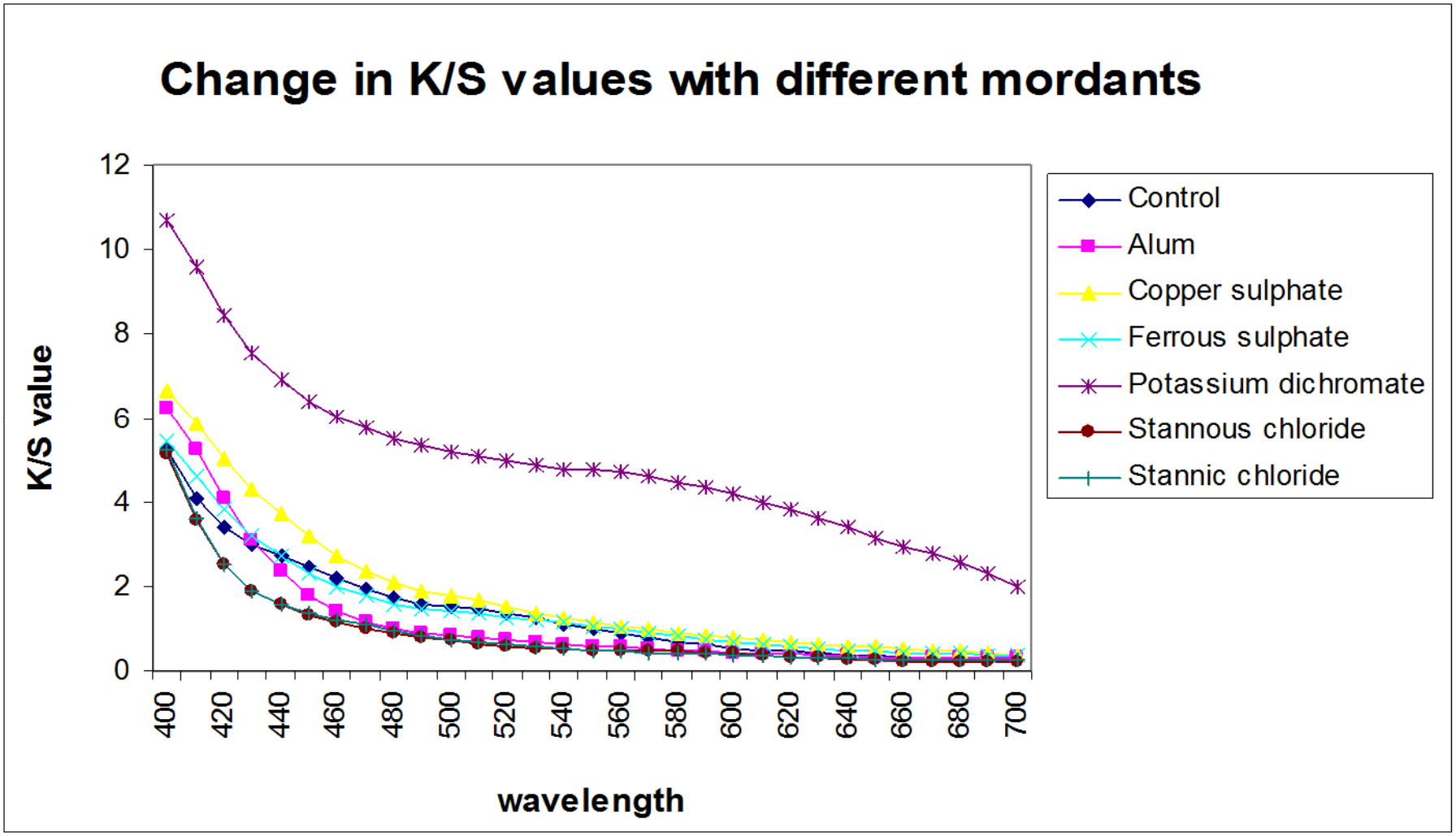
- The color yield of both dyed and mordanted samples were evaluated by light reflectance measurements using Premier Colorscan machine.
- The color strength (K/S value) was assessed using the Kubelka-Munk equation

$$K/S = (1-R)2/2R$$

- Where K is the sorption coefficient, R is the reflectance of the dyed fabric and S is the scattering coefficient.
- The CIELab values were determined for all the samples investigated here.



Changes in K/S values for cotton samples,
The best values are obtained with ferrous sulphate and the order of reactivity is Fe> Cr > Cu >> Al >Sn (IV) > Sn (II) for cotton samples as shown in figure



Changes in K/S values for silk samples,
The best values are obtained with ferrous sulphate and the order of reactivity is Fe> Cr > Cu >> Al >Sn (IV) > Sn (II) for silk samples as shown in figure

Pre-mordanting	Color obtained	L*	a*	b*	C	δE	K/S
Control		54.817	13.25	24.94	28.24	--	37.61
Alum	Khaki brown	53.338	5.51	20.30	21.04	9.14	29.65
Ferrous sulphate	Greenish brown	49.259	2.60	8.40	8.79	20.43	77.70
Stannous chloride	Camel brown	54.287	7.17	22.47	23.52	6.57	26.05
Copper sulphate	Brown	53.399	7.18	20.98	21.17	7.38	55.98
Potassium dichromate	Brown	54.347	8.62	23.52	25.05	4.85	73.37
Stannic chloride	Almond brown	54.567	8.10	23.21	24.59	5.43	27.19