

# Colour Strength and Washing Fastness Properties of Cotton Fabric Dyed With Kasunda Flower Extract



Govardhana Rao Chilukoti, B. Venkatesh, Md. Vaseem Chavhan, M. Siva Jagadish Kumar

**Abstract:** Colouration of textile materials is most important step in whole chemical processing of textiles department. There are various sources of obtain colours/dyes for the application. Natural dyes are the one of the emerging area in the field of dyeing of textile materials due to their eco-friendly in nature. In the present study the kasunda flower powder is used as a dye along with the mordants, which improves the dye up take and colour strength. The kasunda flower powder and natural mordants were applied in different concentrations to cotton fabrics and measured the colour strength in terms of K/S and washing fastness properties.

**Index Terms:** Kasunda, K/S, Mordants

## I. INTRODUCTION

Dyeing of cotton fabrics from natural extracts is very important in terms of environmental and human skin. There are many sources of natural dyes, where the colorants will extract such as plants, vegetables and animal based. The synthetic dyes are lead in textile industry due to more availability and cheap cost [1]. The synthetic dyes produce dangerous by-products, some of which possess carcinogenic intermediates. Hence, it is essential to control the effluent generation rather than treating it [2][3].

Kasunda is a plant as an Indian name and botanical name of this family was *Cassia* [4]. Generally this plant species used in ayurvedic or pharma industries due to rich sources of medicinal components[5]. These plant leaves can be used as an antibiotic in injure areas of body parts for external usage [6][7].

This plant is producing flowers of color yellow, also used to apply the color to natural fabrics. Young-H Lee and Han - Do Kim were studied on dyeing of natural fabrics with cassia

seeds with different mordants. The dyed samples was tested their color strength and fastness properties [8][9][10].

In the present research, our aim is to study the color and washing properties of kasunda flower powder of altered concentrations with a variety of mordants.

## II. MATERIAL AND METHOD

### Materials

The bleached cotton fabric of plain weave was procured from market. The kasunda flowers were collected, dried in hot air oven at 105<sup>0</sup>C up to the flowers become dried and made a powder. Kasunda flower powder was directly used for dyeing as per the concentration required. Also, for improving the colour strength in the present study have used natural mordants such as Myrabola, Amla and Pomegranate.



**Fig 1: a) Myrabola, b) Amla and c) Pomegranate rind powder**



**Fig 2: Kasunda flower Dye powder preparation steps a) kasunda flower, b) dried flowers & c) kasunda powder**

### Methodology

Three different concentrations of kasunda flower dye powder were selected for the study i.e. 2%, 5% and 8%. Cotton fabrics were treated with mordants of pre-mordanting techniques at a temperature of 80<sup>0</sup>C in Infa-red beaker dyeing machine for one hour. After mordanting, the fabric swatches subjected for dyeing with combinations produced from statistical software.

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**Design of experiment**

A total eighteen treatment combinations are created according to Taguchi orthogonal array design with mixed level design of L18 experimentation shown in table1.

For the present study two factors with mixed levels are selected to prepare treatment combinations shown in table2.

**Table 1: Taguchi orthogonal array design of L18 and Treatment combinations**

L18 Design			Treatment Combinations		
Sl. No.	A	B	Sample Code	Mordant type/combination	Dye conc. (%)
1	1	1	M2	M	2
2	1	2	M5	M	5
3	1	3	M8	M	8
4	2	1	A2	A	2
5	2	2	A5	A	5
6	2	3	A8	A	8
7	3	1	P2	P	2
8	3	2	P5	P	5
9	3	3	P8	P	8
10	4	1	MA2	M+A	2
11	4	2	MA5	M+A	5
12	4	3	MA8	M+A	8
13	5	1	MP2	M+P	2
14	5	2	MP5	M+P	5
15	5	3	MP8	M+P	8
16	6	1	AP2	A+P	2
17	6	2	AP5	A+P	5
18	6	3	AP8	A+P	8

**Table 2: Factors and levels chosen for study**

Factors	Mordant type and combinations	Dye Concentration (%)
1	Myrabola (1)	2 (1)
2	Amla (2)	5 (2)
3	Pomegranate (3)	8 (3)
4	M+A (4)	
5	M+P (5)	
6	A+P (6)	

**Evaluation of colour strength and washing fastness**

The dyed fabric samples are subjected to evaluate the colour strength in terms of K/S using a Spectrophotometer of premier colour scan SS5100H. Also treated swatches are measured their washing fastness property using Laundro-meter as per the AATCC- 61- 2010 [11] [12].

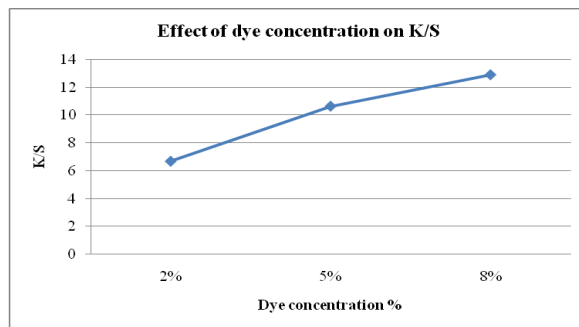
**III. RESULT AND DISCUSSION**

The 100% cotton fabrics samples were dyed with three different concentrations of kasunda flower powder as a natural dye. The dyed samples are measured their colour strength and is shown in table3.

**Table 3: Results for cotton fabrics treated only with kasunda flower powder**

Dye conc. (%)	L*	a*	b*	K/S
2%	77.679	-1.502	20.45	6.701
5%	78.284	-0.635	22.218	10.65

8%	78.869	-0.465	23.608	12.908
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**Fig 3: Effect of dye concentration on colour strength K/S**

Kasunda flower powder has taken directly for dyeing of cotton samples with different concentrations. Three different concentration (i.e. 2, 5, & 8%), 2% indicates that two grams of dye powder was mixed with 100ml of water. The result shows that in figure3, as increase in dye concentration was improved the colour strength.

**Table 4: Colour strength K/S, L\*, a\*, and b\* and Washing fastness of dyed fabrics**

Sample Code	Dye conc. (%)	L*	a*	b*	K/S	Washing Fastness
M2	2	70.98	1.12	21.14	8.49	3-4
M5	5	71.15	1.60	21.58	9.57	3
M8	8	71.73	1.49	22.85	10.10	3
A2	2	69.23	1.84	16.63	11.46	3
A5	5	69.99	2.16	18.86	14.57	3-4
A8	8	69.76	1.86	18.06	12.03	3
P2	2	70.65	2.39	20.50	14.25	3-4
P5	5	70.95	2.18	21.28	12.92	3
P8	8	70.64	2.09	20.38	12.47	4
MA2	2	67.71	2.01	19.48	12.47	3
MA5	5	67.21	2.10	18.38	13.71	3
MA8	8	68.10	2.77	21.01	17.93	4
MP2	2	68.52	2.67	21.81	14.02	3-4
MP5	5	68.85	2.33	22.45	13.87	4
MP8	8	68.42	2.67	21.71	14.07	3-4
AP2	2	67.61	2.37	19.70	13.51	3
AP5	5	67.89	2.65	20.35	14.71	3
AP8	8	67.67	2.41	19.69	14.58	3-4

**Effect of dye concentration on K/S:**

Dyeing of cotton fabrics using kasunda flower powder as a coloring substance. Fabrics were dyed with varying concentrations such as 2, 5 and 8 percentages, then dyed fabrics subjected for testing of their color strength in terms of K / S. Out of three concentrations 8 percent claimed more color strength and 2 percent has low in fig3.



Pre-mordanted and dyed cotton fabrics with various mordants and their combinations also studied color strength. In which, the combinations like A+P and M+A was got highest color strength shown in fig3.

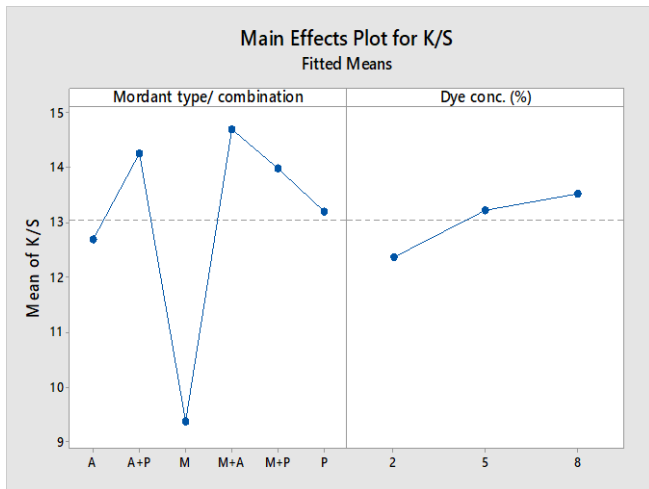


Fig 3: Main effects plot for K/S of dyed samples

**Effect of mordants and dye concentrations on K/S:**

In fig4 it is clearly observed that in interaction plots for K/S, the combination of M+A with kasunda flower 8% concentration shows significant results color strength. Also in the combination of A+P with 5 as well as 8% concentrations were clearly shows the more color strength. The samples treated with the combination of two mordants have well dye uptake because of the reaction between the fabric and mordants creates the fabric become more dyeable and improves dye uptake.

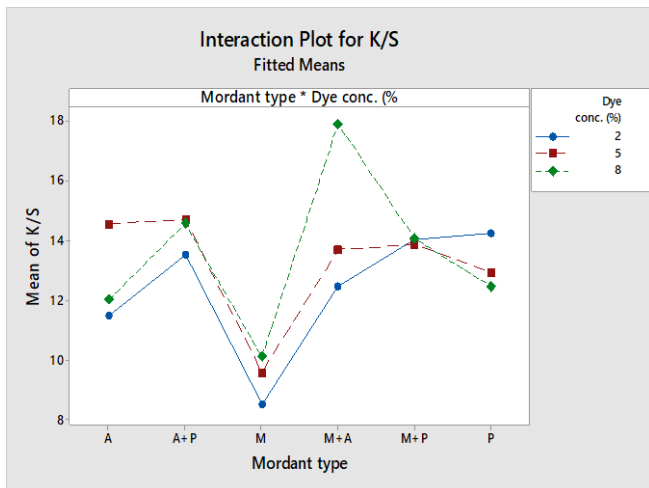


Fig 4: Interaction plot for colour strength in terms of K/S

Further the samples were evaluated their lightness values in terms of L\* and observed in fig5. It is evident that lowest color strength samples were having higher lightness values.

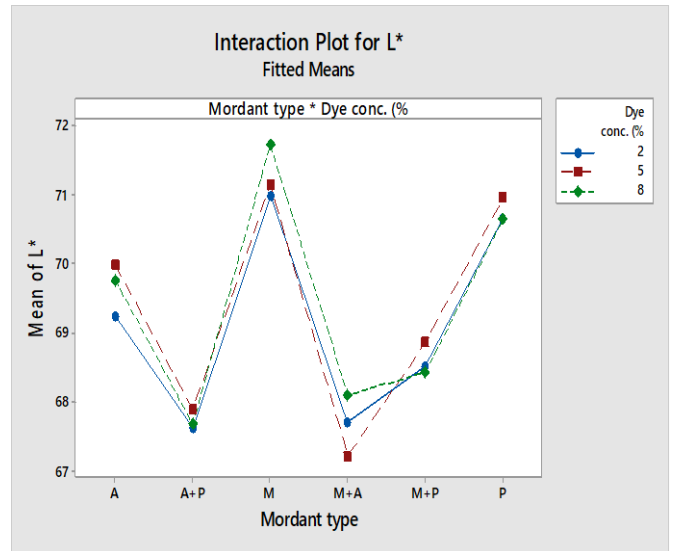
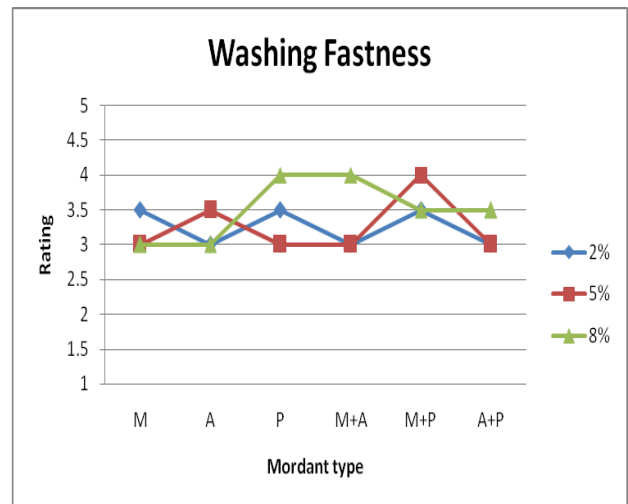


Fig 5: Interaction plot for L\*

**Effect of dye concentration & mordants on washing fastness:**

There are different methods for measuring the fastness properties of dyed cloths. Here the treated samples were subjected to measure the washing fastness and according to the standards rating was given to them and shown in table4. From the test results it was found that the fabrics treated with P, M+A and M+P of dye concentrations 5% & 8% was observed to be more fastness towards washing (fig6).



Fi Fig 6: Washing fastness rating for dyed fabrics

**IV. CONCLUSION**

Cotton fabrics were dyed with kasunda flower powder using mordant combinations. The mordant combination of myrabolan and amla pre-mordanted samples with eight percent dye concentrated fabrics found to have good color strength i.e. K/S of 17.93. washing fastness of treated samples were also measured and it was observed that mordanted samples of pomegranate rind, Myrobolon and amla shows good washing fastness property compared with other treatments. And in the rating scale 3-4 was observed.

## REFERENCES

1. A. K. Samanta and P. Agarwal, "Application of natural dyes on textiles," *Indian J. Fibre Text. Res.*, vol. 34, no. December, pp. 384–399, 2009.
2. G. Suresh, R. Venkata Nadh, N. Srinivasu, and K. Kaushal, "Novel coumarin isoxazoline derivatives: Synthesis and study of antibacterial activities," *Synth. Commun.*, vol. 46, no. 24, pp. 1972–1980, 2016.
3. H. B. Singh, *Handbook of natural dyes and pigments*. 2014.
4. M. Ali, "Ayurvedic drugs in unani materia medica," *Anc. Sci. Life*, vol. 9, no. 4, pp. 191–201, 1990.
5. S. M. SUBRAHMANYA, M. P. Madhan, and V. R., "Simple and Validated Ultraviolet Spectrophotometric Method for the Estimation of Febuxostat in Bulk and Pharmaceutical Dosage Forms," *Orient. J. Chem.*, vol. 5, no. 6, pp. 235–240, 2013.
6. V. Madhuri, K and V. P. K., "Microbial exopolysaccharides: variety and potential applications," *Microb. Prod. Biopolym. Polym. Precursors Appl. Perspect.*, pp. 229–54.
7. N. Satyanarayana, P. Ramesh Kumar, V. Madhusudhanrao, B. Nageswararao, and M. Venkateswarlu, "Enhanced electrochemical performance of carbon-coated LiMPO<sub>4</sub> (M = Co and Ni) nanoparticles as cathodes for high-voltage lithium-ion battery," *J. solid state Electrochem.*, pp. 1–9, 2016.
8. K. Hariprasad, N. Naresh, B. Nageswara Rao, M. Venkateswarlu, and N. Satyanarayana, "Preparation of LiMn<sub>2</sub>O<sub>4</sub> nanorods and nanoparticles for lithium-ion battery applications," *Mater. Today Proc.*, vol. 3, no. 10, pp. 4040–4045, 2016.
9. D. Narsimulu, B. Nageswara Rao, M. Venkateswarlu, E. Srinadhu, and N. Satyanarayana, "Electrical and electrochemical studies of nanocrystalline mesoporous MgFe<sub>2</sub>O<sub>4</sub> as anode material for lithium battery applications," *Ceram. Int.*, vol. 42, no. 15, pp. 16789–16797, 2016.
10. Y. H. Lee and H. Do Kim, "Dyeing properties and colour fastness of cotton and silk fabrics dyed with Cassia tora L. extract," *Fibers Polym.*, vol. 5, no. 4, pp. 303–308, 2004.
11. C. Govardhana Rao, B. Venkatesh, and Y. Bhuvaneshwari, "Study on color strength of cotton fabrics dyed with tecoma stans flower extract," *Text. Trends*, vol. 8, no. November, pp. 29–32, 2018.
12. C. Govardhana Rao, B. Venkatesh, and V. Sai Chandana, "Optimisation of Dyeing and Mordanting Parameters on Cotton Fabrics Treated With Allium Cepa as a Natural Dye Source," *J. Text. Assoc.*, vol. 79, no. Jan-Feb, pp. 333–339, 2019.

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