

Extraction of natural dye from *Cascabela thevetia* L. flowers for cotton fabric colouration

¹Mayur Prajapati, ²Nainesh Modi

¹Research Scholar, ²Associate Professor

^{1,2}Department of Botany, Bioinformatics and Climate Change Impacts Management,

School of sciences, Gujarat University, Navrangpura, Ahmedabad-380009

E-mail – ¹mayur.prajapati1807@gmail.com, ²nrmodi@gujaratuniversity.ac.in

Corresponding E-mail address -nrmodi@gujaratuniversity.ac.in

Abstract: Natural dyes are used for coloring of fabric like wool, silk and cotton. Recently, many commercial dyers have started using natural dyes to overcome the environmental mutilation caused by artificial dyes. In the present study experiment was carried out to extraction of natural dye from flower of *Cascabela thevetia* belongs to apocynaceae family. *Cascabela thevetia* commonly known as yellow oleander and flower is like trumpet structure and yellow in colour. The cotton fabric was dyed with both aqueous and methanolic dye using various mordants. Dyeing was performed through pre-mordanting, simultaneous mordanting and post mordanting. The dyed samples were tested for their colour fastness to washing properties in which they have good result.

Key Words: *Cascabela thevetia*, Natural dye, Mordents, Cotton fabric

1. INTRODUCTION:

A dye is a coloured substance that chemically bonds to the substrate to which it is being applied. Natural dyes are used for colouring of food materials, leather and fibres like wool, silk and cotton. The use of environmental-friendly natural dyes on textiles have become a matter of significant importance due to the increased environmental consciousness in order to avoid some harmful synthetic dyes (Samanta *et al.*,2009). Natural dyes of comprise those colourants that are obtained from animal or vegetable matter without chemical processing (Adeel *et al.*, 2009). Roots, leaves, bark, flower and fruits are major source for natural dyes from plants. *Cascabela thevetia* L. is a Small evergreen plant species of shrub or small tree belonging to the family Apocynaceae. Common names are be-still tree, captain cook tree, dicky plant, foreigner's tree, lucky nut, mexican oleander, still tree, yellow oleander, currant-tree. It is a large spreading shrub usually 2.5-3.5m tall. Leaves are spirally arranged along the stem (Kanthal *et al.*, 2018). It is a native of tropical America; especially Mexico and West Indies, but has a naturalized in tropical regions worldwide (Ibiyemi *et al.*, 2002). It is a small tree, the leaves are green, and the colour of the flowers is yellow or orange yellow it shows like trumpet structure. Flowers have odourless; fruits are deep green or black colour. Fruit size is largely it contains milky sap substance which is called Thevetin. Leaves are present waxy coating to reduce the water loss of the plant. When plant turned to aged condition stem change colour greenish to grey (Kumar *et al.*,2017). The objective of this study is to extract the natural dye from flowers of *Cascabela thevetia* and dyeing the cotton fabric with this dyewith help of various mordants.

2. MATERIALS:

2.1. Source of plant material:

The flowers of *C. thevetia* was collected from the garden of Lalbhai Dalpatbhai College of Engineering, Ahmedabad, Gujarat, India. Fresh flowers of *C. thevetia* were used for this experiment.

2.2. Textile material:

100% pure 1meter cotton fabric was purchased from Shri Mohan Vikas Mandal, Dudheshwar, Ahmedabad.

2.3 Chemical used:

Sodium carbonate, Sodium sulphate, Tween 80, Sodium chloride, mordants were used which are Alum, copper sulphate and ferrous sulphate and solvents for dye extraction are Distilled Water and Methanol

3. METHOD:

3.1. Dye extraction:

The fresh petals of flower were soaked in distilled water and methanol and heated in a beaker kept over a water bath for 2 hours to facilitate quick extraction. Then it was filtered and the filtrate was collected in a separate beaker. The filtrate was concentrated up to high viscous state. This extract is used for dyeing cotton fabric (Chandra *et al.*,2012).



Figure 1. *Cascabela thevetia* plant and flower



Figure 2 Dye of flower

3.2. Scouring of Cotton Fabric:

Cotton cloth scouring was achieved by washing it in a solution containing 0.5g / lit sodium carbonate and 2g / lit non-ionic detergent (Tween 80) at 50°C for 25 minutes, maintaining the liquor ratio content at 1:40. The scoured fabric was cleaned vigorously with tap water and then dried at room temperature. The scoured fabric was soaked for 30 min before dyeing or mordanting in clean water.

3.2. Dyeing Procedure:

The cotton samples were dyed with dye extract keeping M:L ratio as 1:20. Dyeing was carried out at 80°C and continued for 1 hour.

3.3. Mordanting:

The wetted-out cotton samples were entered into dye baths containing required amount of dye extract and water. After 10 minutes, required amount of sodium carbonate and sodium chloride were added. The dyeing was carried out for 1 hour at 60 °C. The dye samples were dried in air without washing to make them ready for pre-, simultaneous and post-mordanting using different metallic salts.

3.3.1. Pre-mordanting:

Scoured cotton samples were further mordanted prior to dyeing using 1gm of the chemical mordants, such as Alum, Copper sulphate and Ferrous sulphate at 60°C for 30 minutes with material-to-liquor ratio of 1:20. The samples treated with metal salts were dyed with the both dye extract (Kumaresan *et al.*,2011).

3.3.2. Simultaneous-mordanting:

Scoured cotton samples were treated with both dye extract and metal salts simultaneously, using 1gm of the chemical mordants, such as Alum, Copper sulphate and Ferrous sulphate at 60°C for 30 minutes with material-to-liquor ratio of 1:20 (Kumaresan *et al.*,2011).

3.3.3. Post-mordanting:

Scoured cotton samples were dyed with dye extract. The wetted-out cotton samples were entered into different dye bath containing required amount of dye extract and water. After 10 minutes required amount of sodium sulphate was added. After 20 minutes required amount of sodium chloride was added. The dyeing was carried out for 1 hour at 50°C. The dyed samples were taken out. Squeezed and used for treatment with metal salts process without washing. The dyed cotton samples were treated with different metal salts using 1gm of the chemicals mordants, such as Alum, Copper sulphate and Ferrous sulphate at 60°C for 30 minutes with material-to-liquor ratio of 1:20 (Kumaresan *et al.*,2011).

3.3.4. Fastness Tests:

The dyed material has been checked for wash fastness. Normally the colour speed is measured either by loss of colour depth in the initial samples or by staining scale. Wash fastness test was analysed at Ahmedabad Textile Industry's Research Association (ATIRA). Test method was ISO 105 C10 Test:1, (40°C)

4. RESULT AND DISCUSSION:

Various shades of yellow have been obtained from the dye derived from the *C. thevetia* flowers. Such shades are obtained from a single dye using different mordants such as alum, copper sulphate and ferrous sulphate. Mordants are very important for colour on the fabric. The different mordants used have offered differing shades. Specific colour shades were obtained from pre-, simultaneous and post-mordanting, as seen in Fig.3 and Fig.4. It was observed that, in three ways, the dye take was found to be fine. Some mordants are light sensitive so the mordanted cotton cloth was immediately used for dyeing. Colour fastness to washing test was performed on all cotton sample at ATIRA. Alum and ferrous sulphate gave good result on the test. Copper sulphate gave good result in only post mordanting with methanolic dye. As compare to distilled water dye, methanolic dye gave good result on cotton fabric. In this study the staining of

dyed cotton was also checked by putting various fabric with dyed cotton. The various fabrics were Acetate, Cotton, Nylon, Polyester, Acrylic and Wool. Dye does not attach with another fabric during washing test.

Table 1: Fastness Properties for Cotton Fabric Dyed with *Cascabela thevetia*

Name of Mordant	Method of Mordanting	Name of Solvent	
		Distilled water	Methanol
Alum	Pre-mordanting	1	1
	Simultaneous-mordanting	1	2
	Post-mordanting	1	1
Copper sulphate	Pre-mordanting	1	1
	Simultaneous-mordanting	1	1
	Post-mordanting	1	3
Ferrous sulphate	Pre-mordanting	1	1
	Simultaneous-mordanting	2	1
	Post-mordanting	2	2

Table 2: Staining on adjacent for Distilled water (solvent):

Sr. no	Name of Mordant	Staining on adjacent					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
1	Alum						
	Pre-mordanting	4	4	4	4	4	5
	Simultaneous-mordanting	4	4	4	4	4	5
	Post-mordanting	5	5	4	5	4	5
2	Copper sulphate						
	Pre-mordanting	4	5	5	5	5	5
	Simultaneous-mordanting	5	5	5	5	5	5
	Post-mordanting	4	5	4	4	4	4
3	Ferrous sulphate						
	Pre-mordanting	4	5	4	4	4	5
	Simultaneous-mordanting	4	5	5	4	5	4
	Post-mordanting	4	3	4	5	4	5

Table 3: Staining on adjacent for Methanol (solvent):

Sr. no	Name of Mordant	Staining on adjacent					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
1	Alum						
	Pre-mordanting	4	4	4	5	5	5
	Simultaneous-mordanting	4	4	4	5	4	5
	Post-mordanting	4	4	4	5	5	4
2	Copper sulphate						
	Pre-mordanting	5	5	5	5	5	4
	Simultaneous-mordanting	4	5	4	5	5	5
	Post-mordanting	5	5	4	4	4	4
3	Ferrous sulphate						
	Pre-mordanting	5	4	4	4	5	5
	Simultaneous-mordanting	4	4	5	5	4	4
	Post-mordanting	5	4	4	5	5	4



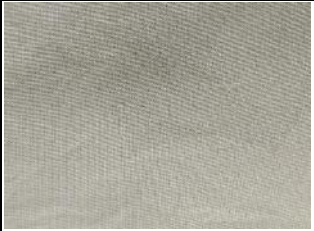






Name of Mordant	Pre-mordanting	Simultaneous-mordanting	Post-mordanting
Alum			
Copper sulphate			
Ferrous sulphate			

Figure 3. Showing a dyed cotton with Distilled water dye










Name of Mordant	Pre-mordanting	Simultaneous-mordanting	Post-mordanting
Alum			
Copper sulphate			
Ferrous sulphate			

Figure 4. Showing a dyed cotton with Methanolic dye

4. CONCLUSION:

The present work basically focusing on environmental-friendly natural dye. The flowers of *Cascabela thevetia* can be used as a good source for cotton dyeing. The whole process of dye extraction and dyeing of cotton is ecologically safe. Various shades of colour can be achieved with different chemical mordants. Cotton treatment with mordants for pre, post and simultaneous mordanting method are effective. The washing fastness of all samples are quite good. Natural dye is a better option than synthetic colour for textile industry as it is eco-friendly and has a good consistency with fabric.

REFERENCES:

1. Samanta, A. K., & Agarwal, P. (2009). Application of natural dyes on textiles.
2. Adeel, S., Ali, S., Bhatti, I. A., & Zsila, F. (2009). Dyeing of cotton fabric using pomegranate (*Punica granatum*) aqueous extract. *Asian Journal of Chemistry*, 21(5), 3493.
3. Kanthal, L. K., Suryakrishna, K., & Madhav, N. S. Evaluation of Cytotoxic, Anthelmintic and Antioxidant Studies of *Cascabela thevetia*.
4. Ibiyemi, S. A., Fadipe, V. O., Akinremi, O. O., & Bako, S. S. (2002). Variation in oil composition of *Thevetia peruviana* Juss' yellow oleander'fruit seeds. *Journal of Applied Sciences and Environmental Management*, 6(2), 61-65.
5. Kumar, A. (2017). Chronological Review on Phytochemical, Antioxidant, Antimicrobial and Clinical studies on Biodiesel Yielding Good Luck Tree (*Thevetia peruviana*). *International Journal of Pure & Applied Bioscience*, 5(6), 1499–1514. doi: 10.18782/2320-7051.2894
6. Chandra, M. S., Thiripura, S., Senthil, K. R., & Thiyagarajan, A. (2012). Dyeing of Cotton with Natural Dye Obtained from Flower of *Tecoma stans*. *Universal Journal of Environmental Research & Technology*, 2(1).
7. Kumaresan, M., Palanisamy, P. N., & Kumar, P. E. (2011). Dyeing of Cotton and Silk Fabrics Using Flower of *Spathodea Campanulata*: Effects of Mordanting and Colour Fastness Properties. *J. Basic. Appl. Sci. Res*, 1(8), 933-941.