World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 6.129

EXTRACTION AND APPLICATION OF SOME NATURAL FABRIC DYES FROM AKOLA REGION

Vaishali S. Patil*, Sara Tabassum Naseem Khan

Department of Botany, Shri Shivaji College of Arts Commerce & Science Akola.

***Corresponding Author: Vaishali S. Patil**
Department of Botany, Shri Shivaji College of Arts Commerce & Science Akola.

Article Received on 14/03/2023 **Article Revised on 04/04/2023** **Article Accepted on 25/04/2023**

ABSTRACT

Natural dyes are renewable source of colouring materials. They are dyes or colorants derived from plants, invertebrates, or minerals. The majority of natural dyes are vegetable dyes extracted from plant sources such as roots, berries, bark, leaves, wood and other biological sources such as fungi. Besides textiles it has application in colouration of foods, medicine and in handicraft items. In present scenario environmental consciousness of people about natural products, renewable nature of materials, less environmental damage and sustainability of the natural products has further revived the use of natural dyes in dyeing of textile materials. In synthetic dyes, the most common substrate for dye production is petroleum, which is a non-renewable source of energy. Synthesis generates a large amount of effluent which contains toxic chemicals generated as side products. These dyes also react with various other organic by products of the effluent, forming harmful aromatic complexes that result in mutations and cancers in aquatic animals. Recent studies have shown that dyes have genotoxic, cytotoxic, and mutagenic properties when exposed in greater concentrations to living organisms. They can also cause DNA fragmentations, allergies, skin irritations, and malfunctioning of various organs when acted upon by different biotic and abiotic factors due to the formation of toxic breakdown products. So there is need of significant research work to explore the potentials of natural dyes before its important application to textile substrate.

KEYWORDS: Natural fabric dyes, extraction, application.

INTRODUCTION

Dyes are coloured compounds, which are widely used in textiles, printing, rubber, cosmetics, plastics, leather industries to colour their products. Natural dyes or colorants derived from plants, invertebrates, or minerals. The majority of natural dyes are vegetable dyes from plant sources roots, berries, bark, leaves, and wood and other biological sources such as fungi. Most of the dyes are known for their medicinal properties among Ayurvedic practitioners. In India, natural dyes are being demanded not only for textile but also to be employed in food colouring, cosmetics and hair dye (Baliar Singh 2012).Some exhibited antimicrobial activity against pathogenic bacteria (Singh et al. 2005). These health beneficial features of natural dyes are dueto flavonoids, tannins and other secondary metabolites.

The discovery of man-made synthetic dyes in the mid-19th century triggered a long decline in the large-scale market for natural dyes.

There are different types of fibers i.e. Cellulose fibers e.g. cotton, linen, hemp, ramie, bamboo, rayon; Protein fibers e.g. wool, angora, mohair, cashmere, silk, soy, leather, suede etc. which require different types of dyes. They showed different level of absorption.

The purpose of the present study is to give extraction method as well as application of eco-friendly natural dyes from various plants found in Akola region.

Synthetic materials and their products are more complex; it will take a long time for decomposing and return to nature hence causes environmental pollution (Lal et al. 2011).

A survey of study of Natural dye yielding plants of Akola region have been left almost untouched. Akola is a district in vidarbha region in the state of Maharashtra in central India. Akola is located at latitude 20-7 North longitude 77.07 the east. It is at an altitude of 925 ft (282m) above sea level. It has tropical savanna climate. Annual temperature ranges from high of 48^0 C (118 f) to a low of 10^0 C (50 f). Species of Acacia, *Bauhinia*, *Emblica*, *Mangifera*, *Butea*, Cassia, Gossypium, Aegle, Annona, Punica, Lawsonia, Tectona, Curcuma, Bixa, Caesalpinia, Moringa are some common dye yielding

plants found in this region. But most of the dye yield plants had not been studied.

Although indigenous knowledge system has been practiced over the years in the past, the use of natural dyes has diminished over generations due to lack of documentation. Only 150 colouring agents, out of 2000, produced by plants are exploited for dyeing purpose (Siva 2007). There is an urgent need to explore natural sources of dyes, identify new and rediscover traditional dyeing methods, and find out more precise and specific ways of applying natural dyes to get the required shades of colour, and ensure colour fastness and examine the processes that have a potential for making natural dyes more eco-friendly and commercially important again.

The purpose of the present study is to give extraction method as well as application of eco- friendly natural dyes from various plants found in Akola region.

MATERIALS AND METHODS

Extensive survey of natural dyes yielding plants in Akola region was carried out from January to March 2022 & morphological characters were studied. Plants were collected from different localities i.e. *Bixa orellana L.; Azadirachta indica A.Juss.; Nerium oleander L.; Lawsonia inermis L.; Caesalpinia sappan L.; Tagetes erecta L.; Bambusa vulgaris Schrad. Ex J.C.Wendle.; Carica papaya Linn.; Rosa chinensis L.; Bougainvillea peruviana; Curcuma longa L.; Allium cepa L.; Spinacia oleracea L.; Ocimum sanctum(Linn); Beta vulgaris L.* More than 15 plants were collected in different season. All the material was collected in polythene bags and brought in laboratories for further studies.

Dye Extraction

The collected plant materials were used for extraction of dyes. The clean samples (50g) of plant parts such as leaves, flowers, seed, rhizome and fruits were crushed and dissolved in deionized water (1litre) to obtain particular dye. These plant materials were boiled for 2 hours in a hot water bath for quick extraction. After 2 hours the total color was extracted from plant material. This solution was double filtered using filter paper and used to carry out further study.

Dyeing materials - Cotton (5×5cm), Rayon (5×5cm),Jute (5×5cm), Silk (5×5cm).

RESULT- Table showing extraction of dyes from Plant species and its effect on different fabrics.

Sr no	Name of plant with Family	Plant Parts use	Colour	Effect of natural dyes on different fabrics			
				Cotton	Jute	Rayon	Silk
1	*Bixa orellana L.* **Bixacea*e***	Seed	Orange	Excellent	Good	Very good	Poor
2	*Azadirachta indica A.Juss* **Meliaceae**	Leaves	Green	Very good	Good	Excellent	Poor
3	*Nerium oleander L.* **Apocynaceae**	Flower	Pinkish red	Very good	Excellent	Good	Poor
4	*Lawsonia inermis L.* **Lythracea*e***	Leaves	Green	Excellent	Good	Very good	Poor
5	*Caesalpinia sappan L.* **Fabaceae**	Flower	Yellow	Very good	Good	Excellent	Poor
6	*Tagetes erecta L.* **Asteracea*e***	Flower	Yellow	Excellent	Good	Very good	Poor
7	*Bambusa vulgaris Schrad. Ex J.C.Wendl.* **Poaceae**	Leaves	Light green	Excellent	Very good	Good	Poor
8	*Carica papaya Linn,* **Caricaceae**	Leaves	Green	Very good	Good	Excellent	Poor
9	*Rosa chinensis L.* **Rosaceae**	Flower	Reddish	Very good	Good	Excellent	Poor
10	*Bougainvillea peruviana ex Juss.* **Nyctaginaceae**	Flower	Brown	Very good	Good	Excellent	Poor
11	*Curcuma longa L.* **Zingiberaceae**	Rhizome	Yellow	Excellent	Very good	Good	Poor
12	*Allium cepa* L. **Amaryllidaceae**	Bulb	Brown	Excellent	Very good	Good	Poor
13	*Spinacia oleracea L.* **Amaranthaceae**	Leaves	Green	Very good	Good	Excellent	Poor
14	*Ocimum sanctum*(*Linn*) **Lamiaceae**	Powder	Brown	Very good	Excellent	Good	Poor
15	*Beta vulgaris* L. **Amaranthaceae**	Fruit	Red/pink	Excellent	Good	Very good	Poor

Photoplate-I

A) Bixa orellana

B) Seed

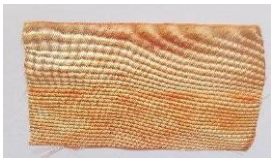
C) Extraction of Dyes

Effect of dye on

D) Cotton-excellent

Jute-Good

Rayon-very good



Silk-Poor

A) ***Azadirachta indica A juss***

B) Leaves

C) Extraction of dyes

Effect of dye

D) Cotton-Very good

Jute-Good

Rayon-Excellent

Silk-Poor

Photoplate-II

A)Nerium oleander L.

***B)*Flower**

C) Extraction of dye

Effect of dye

D) Cotton-Very good

Jute -Excellent

Rayon-Good

Silk- poor

A) Lawsonia inermis L.

B) Leaves

C) Extraction of dye

Effect of dye

D) Cotton-Excellent

Jute-Good

Rayon-Very good

Silk-Poor

Photoplate-III

A)Caesalpinia sappan L.

B) Flower

C) Extraction of dye

Effect of dye

D)Cotton-Very good

Jute-Good

Rayon-Excellent

Silk-poor

A)Tagetes erecta .L

B) Flower

C) Extraction of dye

Effect of dye

D)Cotton-very good

Jute-good

Rayon-Excellent

Silk-Poor

Photoplate-IV

A)Bambusa vulgaris L.

B)Leaves

C) Extraction of dye

Effect of dye

D)Cotton- Excellent

Jute-Very good

Rayon-Good

Silk-poor

A)Carica papaya Linn,

B) Leaves

C) Extraction of dye

Effect of dye

D) Cotton-Very good

Jute-Good

Ra yon-Excellent

Si lk-Poor

Photoplate-V

A)Rosa chinensis L.

B) Flower

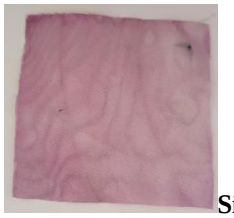
C) Extraction of dye

Effect of dye

D) Cotton-Goodz

Jut e-Very good

Ra yon-Excellent



Silk-Poor

A) Bougainvillea peruviana ex Juss.

B) Flower

C) Extraction of dye

Effect of dye

D) Cotton-Very good

Jute-Good

Rayon-Excellent

Silk-Poor

Photoplate-VI

A)Curcuma longa L.

B) Rhizome

C) Extraction of dye

Effect on dye

Cotton-Excellent

Jute- Very good

Rayon-Good

Silk-Poor

A) *Allium cepa L.*

***B)* Bulb**

C) Extraction of dye

Effect of dye

D)Cotton-Excellent

Jute-Very good

Rayon-Good

Silk-Poor

Photoplate-VII

A)Spinacia oleracea L.

Leaves

C) Extraction of dye

Effect on dye

D) Cotton-Very good

Jute- Good

Rayon-Excellent

Silk-Poor

A) Beta vulgaris L.

Rhizome

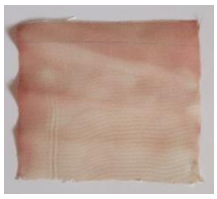
C)) Extraction of dye

Effect of dye

D) Cotton-Excellent

Jute-Good

Rayon-Very good



Silk-Poor

Photoplate-VIII

A) *Ocimum sanctum Linn.*

B) Leaves

C)Extraction of dyes

Effect of dye

D) Cotton- Very good

Jute- Excellent

Rayon- Good

Silk- Poor

DISCUSSIONS

Natural dyes are considered fugitive even though one finds many fabrics dyed with natural dyes. In Museums, where in the cloth has retained its original colors throughout the centuries of exposure. In *Lawsonia inermis* and *Bambusa vulgaris* there are "fugitive" compounds, which are not true dyes. Extraction of orange color dye extracted from *Bixa orellana* shows excellent effect on cotton while it shows poor on silk. (See photo plate I C&D) Green color dye extracted from *Azadirachta indica* shows excellent effect on cotton while it shows poor on silk. (See photoplate I C&D) Pinkish red color dye extracted from *Nerium oleander* shows excellent effect on cotton while it shows poor on silk. (See photo plate II C&D) Green colour dye extracted from *Lawsonia inermis* shows excellent effect on cotton while it shows poor on silk. (See photoplate II C&D) Yellow colour dye extracted from *Caesalpinia sappan* shows excellent effect on cotton while it shows poor on silk. (See photoplate III C&D) Yellow colour dye extracted from *Tagetes erecta* shows excellent effect on cotton while it shows poor on silk. (See photoplate III C&D) Light green colour dye extracted from *Bambusa vulgaris* shows excellent effect on cotton while it shows poor on silk. (See photoplate IV C&D) Green colour dye extracted from *Carica papaya* shows excellent effect on cotton while it shows poor on silk. (See photoplate IV C&D) Reddish colour dye extracted from *Rosa chinensis* showsexcellent effect on cotton while it shows poor on silk. (See photo plate V C&D)

Extraction of brown colour dye extracted from *Boughainvillea peruviana* shows excellent effect on cotton while it shows poor on silk. (See photoplate V C&D) Extraction of yellow colour dye from *Curcuma longa* shows excellent effect on cotton while it shows poor on silk. (See photo plate VI C&D) Extraction of brown colour dye from *Allium cepa* shows excellent effect on cotton while it shows poor on silk. (See photoplate VI C&D) Extraction of green colour dye extracted from Spinacia oleracea shows excellent effect on cotton while it shows poor on silk. (See photoplate VII C&D) Extraction of brown colour dye extracted

from *Ocimum sanctum* shows excellent effect on cotton while it shows poor on silk. (See photoplate VIII A&B) Extraction of red or pink colour dye extracted from *Beta vulgaris L.* shows excellent effect on cotton while it shows poor on silk. (See photoplate VII C&D)

There is a wrong perception regarding fastness properties of natural dyes that the dyes don't have required fastness property. That is one of the reasons industries doesn't use natural and consumers also don't want to use those dyes. We have seen that most of the dyes used for dyeing fabric had a good score on fastness test. It has been seen that using mordant also affects the color strength and fastness. Use of natural and synthetic mordant both have different effect on dyed fabrics. So, to take natural dyes for industrial use we both industries and consumers have to step forward to make more and more use of natural dyes instead of synthetic ones.

From above table it show that on silk effect of natural dyes is poor while excellent on cotton, rayon on jute reason its show good to moderate effect.

CONCLUSION

All synthetic dyes are not harmful, for example, fiber-reactive dyes are dyes that form covalent bond to the fibers like cotton, rayon, and soy. But most of the synthetic dyes tend to remain quite stable to common oxidation and reduction processes as per their designing and so are very difficult to remove from textile industry effluents. They are full of by-products that are directly or indirectly proven health hazards. Synthetic dyes based effluents can cause a serious hazard to the water stream and environment due to their synthetic origin and complex molecular structures, which decrease their ability to biodegrade. Many carcinogenic and allergic synthetic dyes are banned now. Many dyes, though not banned yet, may not be completely safe. Most synthetic dyes are not biodegradable; they accumulate on lands and in river causing ecological problems. The toxicity of a dye considers the structure of the dye rather than the dyeing process.

Heavy metals containing dyes and cancer-producing dyes cause high impact and are objectionable. Dyes that cause allergic reactions are not considered as low impact on nature. Acute toxicity involves oral ingestion and inhalation; the main problems of acute toxicity with textile dyes are skin irritation and skin sensitization, caused mainly by reactive dyes for cotton and viscose Cationic dyes can cause increased in heart rate, shock, vomiting, cyanosis, jaundice, quadriplegia, heinz body formation and tissue necrosis in humans.

Natural dyes are biodegradable without the use of any oxidant or reluctant. Hazardous compounds have not been detected in the natural dye degraded by-products. It is possible that natural dyes completely degrade under natural conditions. These dyes are mostly eco-friendly, biodegradable, less toxic, less allergenic. By using natural dyes we can help in preserving the environment and lowering human dependence on harmful products i.e. use of synthetic dyes. These dyes provide higher UV absorption in the fabrics which fully protect our skin from the sun's harmful rays. But discovery of man-made synthetic dyes in the mid-19th century triggered a long decline in the large-scale market for natural dyes. More attention should be given to natural dyes because they can be easily extracted from plants, invertebrates, or minerals which are easily available in nature. By using natural dyes rather than synthetic dyes, we are able to be closely connected to nature and recognize the importance it plays in all of our lives.

RFERENCE

1. Ali S, Hussain T, Nawaz R. "Optimization of alkaline extraction of natural dye from Henna leaves and its dyeing on cotton by exhaust method". Journal of Cleaner Production., 2009; 17: 61-66.
2. Baliar singh S, Panda AK, Jena J, Das T, Das NB. Exploring sustainable technique on natural dye extraction from native plants for textile: Identification of colorants, colorimetric analysis of dyed yarns and their antimicrobial evaluation. J Clean Prod, 2012; 37: 257-264.
3. Cristea G. Y., and Vilarem S. J: Ultrasound assisted enhancement in natural dye extraction from Beetroot for industrial applications and natural dyeing of leather, Ultrason. Sonochem., 2003; 16(6): 782-789.
4. D .Das. et al. Dyeing of wool and silk with *Bixa orellana* Indian J. Fibre Text. Res., 2007.
5. D Jothi. "Extraction of Natural Dyes from African Marigold Flower (Tagetes ereecta L) For Textile Coloration". AUTEX Research Journal, 2008; 8: 49-53.
6. Haji A. Antibacterial dyeing of wool with natural cationic dye using metal mordants. Mater Sci (Medžiagotyra), 2011; 18: 1392-1320.
7. Iqbal J, Bhatti IA, Adeel S. Effect of UV radiation on Dyeing of cotton fabric with extracts of henna leaves,Indian Journal of Fibre and Textile Research., 2008; 33: 157-162.
8. Kapoor, V. P.; Katiyar, K.; Pushpangadan, P.; Singh, N.,(2009) "Development of Natural Dye Based Sindoor", Natural Product Radiance, 2008; 7(1): 22-29.
9. Kaur, V., "Dyeing of Cotton with Tea as a Natural Dye", International Journal of Engineering Innovation & Research, 2015; 4(1): 184-187.
10. Kumaresan M, Palanisamy P N and Kumar P E: Application of Eco-friendly Natural dye obtained From flower of Spathodea campanulata on silk using combinationof mordants, Eur J Sci Res., 2011; 52(3): 306-312.
11. Lal C, Sharma MC, Shakyawar DB, Raja ASM, Sharma KK, Pareek PK. Natural dye constituents from rind of Punica granatum and its application on Pashmina fabrics. Arch Appl Sci Res., 2011; 3: 350-357.
12. M.L. Gulrajani, D. Gupta, S.R. Maulik Studies on

dyeing with natural dyes Part 1- Dyeing of annatto on nylon and polyester Indian, 2005.
13. Maxia A, Meli F, Gaviano C, Picciau R, Martis BD, Kasture S, Kasture V. Dye plants: Natural resources from traditional botanical knowledge of Sardinia Island, Italy. Indian J Tradit Know, 2013; 12: 651-656.
14. Mohan r, Geetha N, Jennifer DH, Sivakumar V. "Studies on Natural Dye (Pelargonidin) Extraction from Onion Peel and Application in Dyeing of Leather". International Journal of Recent Engineering Science (IJRES)., 2020; 7: 14-22.
15. Mozumder, S.; Majumder, S.M.M.H., "Comparison Between Cotton and Silk Fabric Dyed With Turmeric Natural Colorant", Daffodil International Journal of Science and Technology, 2016; 11(2): 73-79.
16. Nilani, P.; Duraisamy, B.; Dhamodaran, P.; Kasthuribai, N.; Semwol. A. and Suresh, B., A Study on The Effect of Marigold Flower Dye With Natural Mordant on Selected Fibers", Journal of Pharmacy Research, 2008; 1(2): 175-181.
17. Nurunnesa; Hossain, M. A. and Rahman, M. M., "Extraction Of Natural Dye Collected from Outer Skin of Onion and its Application on Silk Fabric", Global Journal of Researches in Engineering: J General Engineering, 2018; 18(3).
18. Patil, D. B.; Patil, K. N.; Gaikwad, P. V.; Patil, P. J.; Shewale, U. L. and Bhamburdekar, S. B., "Extraction of Natural Dye From Rose Flower for Dyeing Cotton Fabrics", International Journal for Innovative Research in Multidisciplinary Filed, 2016; 2(8): 135-137.
19. S. Ali, T. Hussain, R. Nawaz Optimization of alkaline extraction of natural dye from Henna leaves and its dyeing on cotton by exhaust methodJ Clean Prod, 2009; 17: 61- 66.
20. Sharma A, Laldaihzovi J. "Colouration of cotton fabric with Marigold flower and onion peel". Asian Dyer., 2018; 15: 45-48.
21. Singh R, Jain A, Panwar S, Gupta D, Khare SK. Antimicrobial activity of some natural dyes. Dyes Pigm, 2005; 66: 99-102.
22. Siva, R. Status of Natural Dyes and Dye-Yielding Plants in India. Current Science, 2007; 92: 916-925.
23. Umbreen S, Ali S, Hussain T, Nawaz R. "Dyeing Properties of Natural Dyes Extracted from Turmeric and their Comparison with Reactive Dyeing". Research Journal of Textile and Apparel., 2016; 12: 1-11.
24. V. Sivakumar et al. Ultrasound assisted enhancement in natural dye extraction from beetroot for industrial applications and natural dyeing of leather Ultrasonics So no chemistry, 2016.
25. Zubairu, A. and Mashelia, Y. M., "Effects of Selected Mordants on the Application of Natural Dye from Onion Skin (Allium cepa)", Science and Technology, 2015; 5(2): 26-32.