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Production of Natural Dye from Beet Roots *(BETA VULGARIS L.)* by using different Mordants

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Abstract: ***Dyes can be derived from nature by different part of plants. Natural dyes give the color like cool, warm colors that are with unique combinations. Dyes are made from natural resources like plants, animals, and minerals tend to produce colors that wash out easily. With most natural dyes, a mordant can be used to make color more permanent. In the mordanting process the fiber of wool, cotton is treated with a solution of a metal salt (usually an aluminum, chromium, copper, iron, or tin salt). Then the fiber is dyed with natural colors.***
Metals ions which are present in the salt form strong bonds with the fiber and also with the dye, therefore holding the dye to the fiber. In this activity, we can easily extract colored compounds from plant materials; use them to dye white cloths. A small difference in the dyeing technique or the use of different mordants with the same dye can shift the colors of a wide range or create new colors, which are not easily possible with synthetic dyes. Natural dyes are usually moth proof and can replace synthetic dyes in kid garments and food stuff for safety which have allergy to synthetic dyes.
Keywords: Beetroot, Natural dye, Mordant etc.

AIM: To produce natural dye from Beetroot *(Beta vulgaris L.)*

I. INTRODUCTION

Natural dyes are synthesized from plants, animals, fruits, insects, flowers, minerals and other natural resources. Therefore natural dyes are usually called as harmless and safe for the environment. William H. Perkin discovered the 1st synthetic dye, name as mauveline, in 1856.

This gives the proper way for the manufacturing of dyes in different pigments and in large quantities. Synthetic dyes are very popular because of its lasting colour and wide range of color range and synthetic dyes have harmful effects on the environment and human beings.

Plant dyes appear a good alternative for synthetic dyes because of the health issues of many synthetic dyes. Active pigmented parts of the plants are used for dyeing. Beetroot is known for its natural red colour. This natural red colour is because of the betanin pigment found in beetroot. The characteristic feature of this vegetable is its dark skin and colored flesh.

This betanin pigment is also known as a anthocyanin antioxidant. Betanin is the main important colouring compound present in red beetroot colour. The colourin responsible for the red colour of red beet juice is a group of molecules called Betanins. This group of pigments contains the red and yellow pigment known as betacyanins and betaxanthins.

Betanin, is a red pigment of the Beetroot of the beetroot was first time isolated in 1918 by schudel. Betanin is the important main pigment compound of the red colorant extracted from Beta Vulgaris. Plant dyes are ecofriendly and environmental friendly. Many parts of plant used for making different dyes. Beetroot is easily available and used to make different coloured dyes by using different mordents.

Natural dyes are synthesized from plants material without any chemical treatment. They are obtained from different sources like flowers, leaves, fruits, bark, roots etc. They are not available and involve an extraction process. In historical era, natural colourants were usually obtained from berries, blossoms, barks and roots. They were applied to the fibre without any pretreatment of the dyes. There are certain ancient art forms like Kalmkari, which is continue to use the natural dyes. A few examples for natural dyes are as follows:

1) *Indigo:* One of the most important and popular dyes from ancient era till today. It is produced from the leaves of *Indigfera turquoise*.
2) *Madder:* The precious dye pigment that give Turkey Red Colour.

The majority of natural dyes need a mordant, which act as a dye fixing agent used as a link between dyestuff and fibre. Therefor it is helps to produce faster shades of dyes by forming an insoluble compound of mordant and dyestuff within the fibre itself. The most commonly used mordants are as follows:

a) Alum/Potassium sulphate, present in the form of white crystals is a popular and safe mordant to use.
b) Chrome/Potassium dichromate, sold in the form of light orange crystals is a popular and safe mordant, in fact it is widely used and it is sensitive to light.
c) Iron/Ferrous sulphate can be obtained as a green crystal. It is very important and one of the oldest known mordent.
d) Tin/Stannous chloride sold as off-white colored crystals, must be used carefully. It is a very important mordant for silk and cotton.

II. MATERIAL AND METHOD

A. *Material*

1) Beet root,
2) Different mordents,
3) Distilled water,
4) Wool ,
5) Thread ,
6) Mordent used,

a) Cupric acid
b) Alum
c) Ferrous sulphate
d) Zinc sulphate
e) Lead

III. EXPRIMENTAL SET UP


A. *Process Of Dye Extraction*

Take 500gm of beetroot and wash it with tap water and remove all dirt and clean it well. Cut into it small pieces around 2 to 3cm in size. Add 1000ml of distilled water into a boiling vessel and keep it on flame. This mixture boils for 2hrs till the quantity of liquid become half then turn off gas. Filter the liquid from beetroot pieces and separate the liquid and pieces and the pure dye is extracted from the beetroot.

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IV. MORDENT USED

A. Cupric acid
B. Alum
C. Ferrous sulphate
D. Zinc sulphate
E. Lead

Preparation Of Mordent

Sr no	Mordents	Measurements		Amount of water	Mordent observation
		I	II		
1	Cupric sulphate	1gm	4gm	10ml	light blue
2	Alum	1gm	4gm	10ml	clear liquid
3	Ferrous sulphate	1gm	4gm	10ml	yellow
4	Zinc sulphate	1gm	4gm	10ml	clear liquid
5	Lead acetate	1gm	4gm	40ml	white

At first, 0.2 grams of each of thread and woolen yarn were weighted to be dyed. Each of the weighted thread and wool were soaked in mordent dye mixture and were kept on the boiling for half an hour with constant stirring.

Mordent Dyeing Process

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Mordent or dye fixative is a substance used to set or bind dyes on fabric by forming a coordination complex in dye which then attached to the fabric

↓

Different mordents were taken in different containers

↓

Add dye 40ml in beaker/container

↓

The weighted woolen and thread deep in mordant dye mixture

↓

The temperature is increased slowly till temperature became 100^{o}C with constant stirring.

↓

The dyed wool and thread samples were then rinsed and dried in shed.

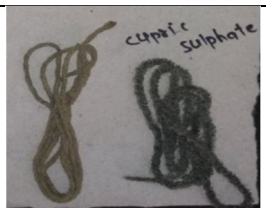
Mordent With Dye Observation

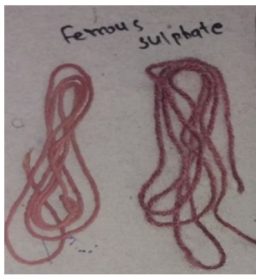
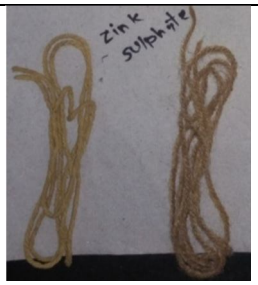
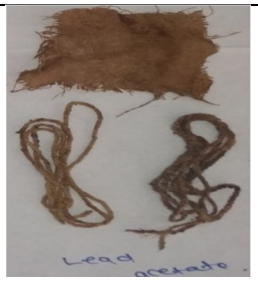
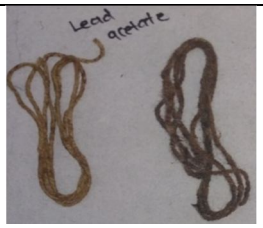
Sr no	Mordants	Volume of dye	PH	Quantity of mordant	Observation
1	Cupric sulphate	50ml	3.4 to 4	1gm	Turned dye greenish brown during heating
				4gm	Dark green
2	Alum	30ml	3.4 to 4	1gm	No color change
				4gm	Orange
3	Ferrous sulphate	50ml	4.5 to 5	1gm	Pink
				4gm	Pink
4	Lead acetate	50ml	9.5 to 10	1gm	Yellow
				4gm	Deep orange
5	Zinc sulphate	50ml	3.5 to 4	1gm	Light Orange
				4gm	Deep yellow
6	Pure dye	30ml	3 to7	-	Red

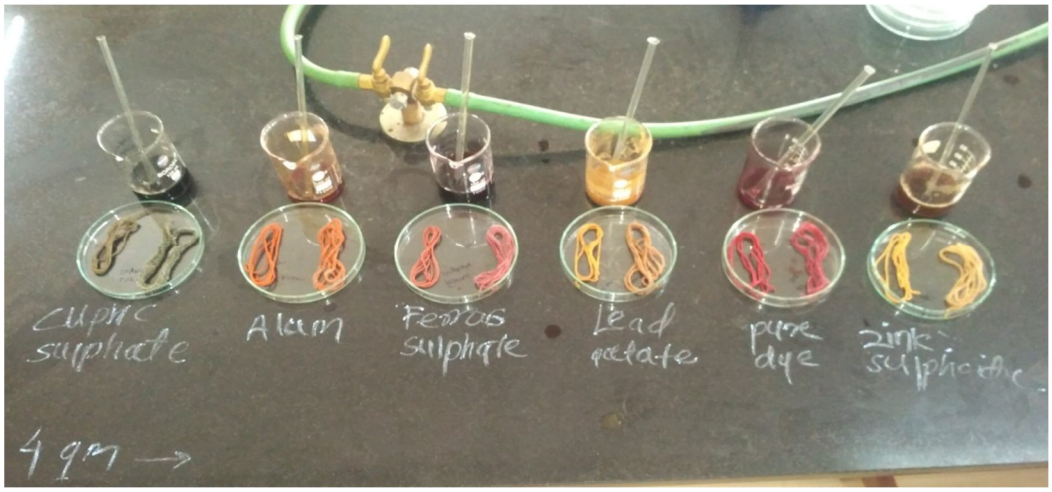
Colour of wool and thread after mordant-dye process:

Sr no	Mordants	Wt.	Wool	Thread
1	Cupric sulphate	1gm	Bronze green	Silver Grey Green
2	Cupric sulphate	4gm	Resend Green	Olive Green
3	Alum	1gm	Seal Brown	Spice Brown
4	Alum	4gm	Dark Brown	Tan
5	Ferrous sulphate	1gm	Maroca	Wine red
6	Ferrous sulphate	4gm	Red Grape	Pink
7	Zinc sulphate	1gm	Khaki Drab	Khaki Drab
8	Zinc sulphate	4gm	Peach	Medium Brown
9	Lead acetate	1gm	Bronze	Dark Bronze
10	Lead acetate	4gm	Bronze	Dark Bronze
11	Pure dye	-	Red	Red wine

Comparison Of Shades Of Different Dye

Sr no	Mordants	Wt.	Wool	Thread	
1	Cupric sulphate	1gm	Bronze green	Silver Grey Green	
2	Cupric sulphate	4gm	Resend Green	Olive Green	
3	Alum	1gm	Seal Brown	Spice Brown	
4	Alum	4gm	Dark Brown	Tan	
5	Ferrous sulphate	1gm	Maroca	Wine red	

6	Ferrous sulphate	4gm	Red Grape	Pink	
7	Zinc sulphate	1gm	Khaki Drab	Khaki Drab	
8	Zinc sulphate	4gm	Peach	Medium Brown	
9	Lead acetate	1gm	Bronze	Dark Bronze	
10	Lead acetate	4gm	Bronze	Dark Bronze	
11	Pure dye		Red	Red wine	



V. ADVANTAGES OF NATURAL DYE

A. Low Environmental Impact – Because they are come from natural resources and natural dyes are not harmful to the environment. Natural dyes are biodegradable that's why don't cause environmental pollution.
B. Renewable – Natural dyes are obtained from renewable sources that can be harmless to the environment.
C. Color pay-off – If you want a soft hue or soothing shade, natural dyes can us to help achieve that look.
D. Safe – Some natural dyes like carmine found in lipsticks, will not cause any harm or health problems when ingested.
E. Some of its components are anti-allergens hence it prove safe for skin contact and are mostly non-hazardous to human health.
F. Natural dyes bleed out but do not stain other fabrics.
G. Natural dyes can produce a wide range of different colors by mix and match system and combination.
H. Natural dyes produce bright lovely colors and variety of shades.

VI. RESULT

The different shades observed with using different mordants at specific time. The color is also depend on how much mordant is used which gives light to dark shades of color. Khalida Tasneem*and Hage Maria used different mordents gives color shade as spring bud, pastel orange, copper, earth yellow etc and by using beetroot as a natural dye we used mordant's gives silver grey green, olive green, spice brown, tan, pink, khaki Drab, Red wine, Dark Bronze etc.

Different ranges of colors are formed by using different mordants. It also gives such colors which are rarely present in synthetic dye, which are hard produce such unique color

VII. CONCLUSION

We used beetroot in only foods stuff but here it is observed that beet root can also be used as natural due as it contain beta cynine which gives red colour. The different techniques are used and compared with other color chart. It gives soft, bright, warm colors. Thread and wool is highly receptive towards mordant and their differences in the colour. Wool and thread for observed after adding the same mordants. Wool is soft than thread so it is absorbs dye easily than thread. Natural dye is compared with other synthetic dyes; natural dyes are more suitable for those who have allergy for synthetic colors.

VIII. DISCUSSION

This study contains the different pure color range like wine red, bronze, tan, olive green. Some unique colors are also observed which are rarely produced synthetically like khaki drab and spice brown. The results from the isolation of natural dye from beet root and its application on wool and thread with different mordant's at different temperatures (khalida Tasneem and Hage Maria.) gives the different color shades by using different mordant's it shows the Varity of colors can produced naturally. It gives the pastel orange and spring bud is unique color range from plant origin material so we can produce the lots of different colors from beetroot.

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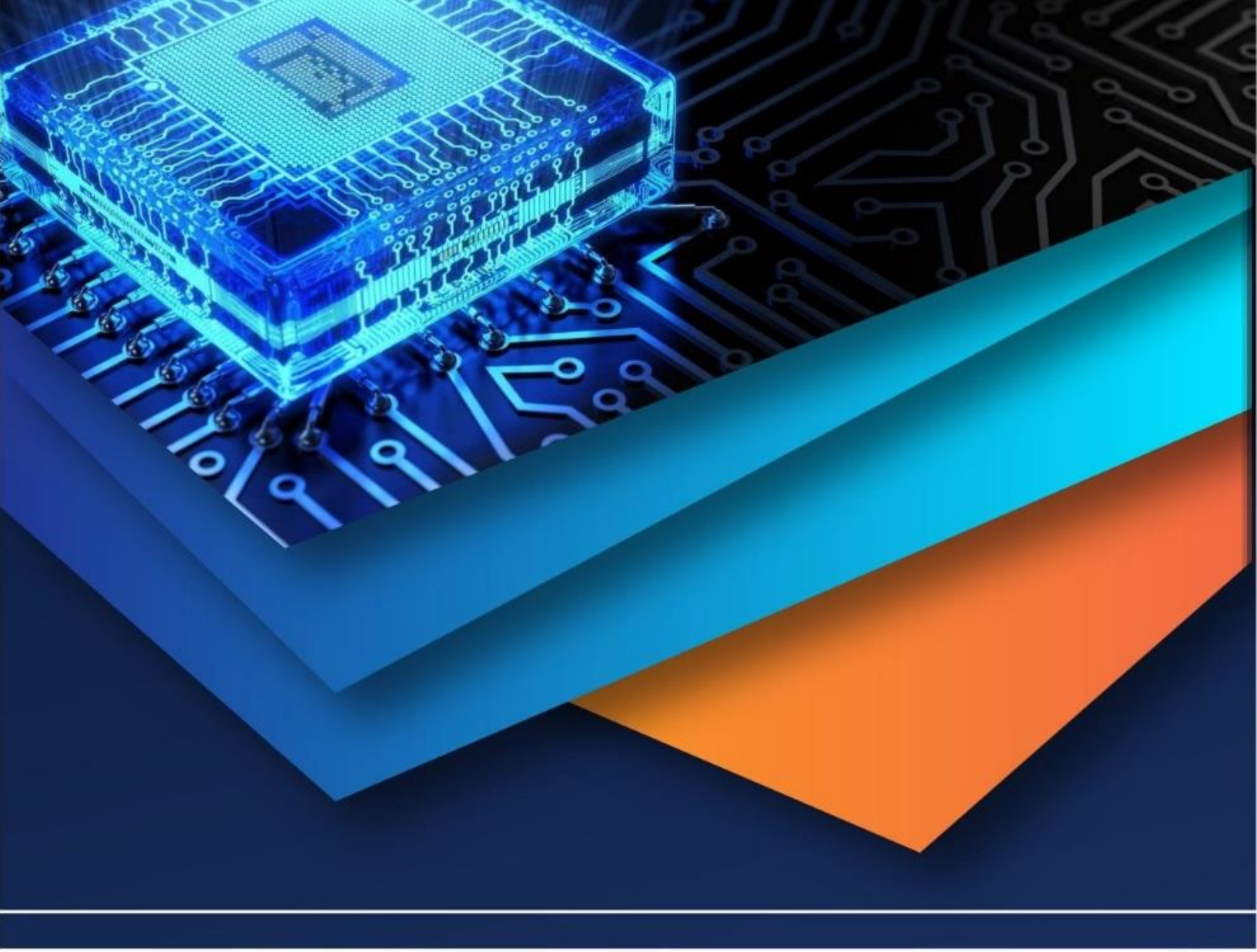

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