

Newer Dyeing Approach with Rose Anthocyanin

INTRODUCTION

- Dyes and pigments are substances that impart color to a material. Dyes are usually soluble in water, while Pigments are generally not soluble in water. Most dyes are organic compounds, whereas pigments may be inorganic compounds. Pigments generally give brighter colors and may be dyes

Advantages of Natural Dyes

Obtained from renewable sources.

Health and safety aspects.

Biodegradable

Cost effective.

Ecofriendly.

Types of Dyes

Natural

Synthetic

Plant/
Vegetable
Sources

Sources
of Natural
Dyes

Mineral
Sources

Animal/
Insect
Sources

Classification of Natural Dyes

On the basis
of Chemical
Constituents

1. Indigoid Dyes
2. Anthraquinon
3. Alpha-Naphtha
4. Flavones
6. Anthocyanidins
7. Carotenoids

On the basis of
Mineral
Colorants

1. Red
2. Blue
3. Yellow
4. Black
5. Brown

On the basis
of Application

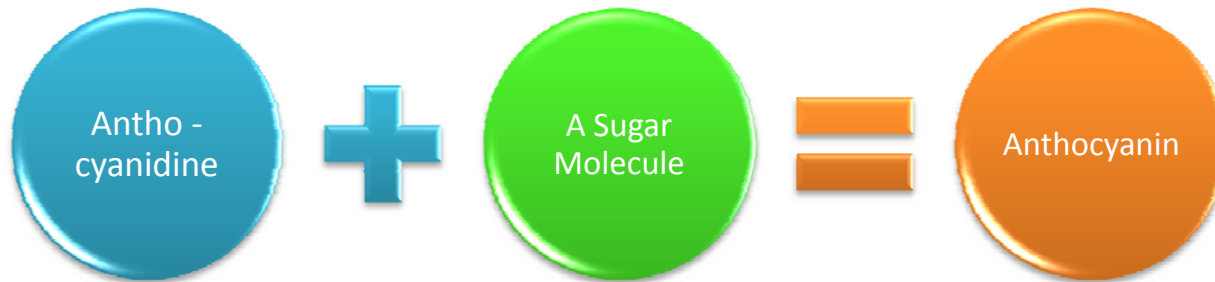
1. Substantive Dye
2. Adjective Dyes

- (1) Direct Dye
- (2) Vat Dye
- (3) Mordant Dye
- (4) Acid Dye
- (5) Basic Dye
- (6) Dispersed Dye

Anthocyanin pigment

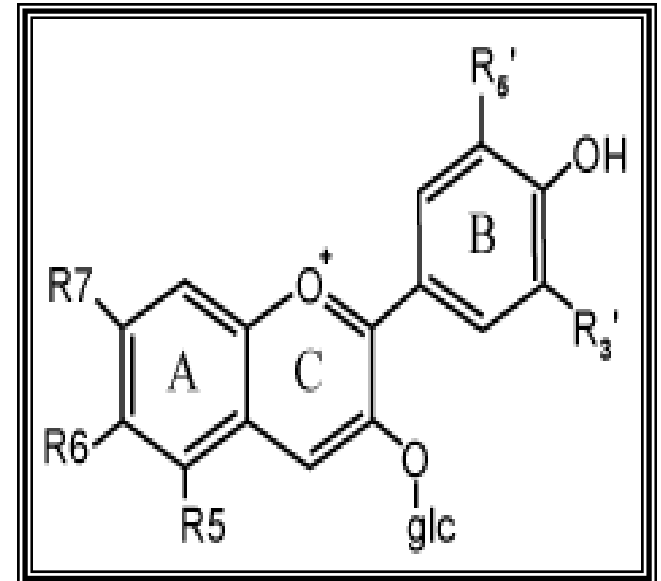
Greek: *anthos* = flower + *kyanos* = blue

It is a Natural Pigment. More than 550 different types of anthocyanins are present in fruits and flowers of plants. It is the most important pigment of plants after Chlorophyll.



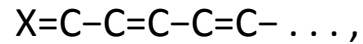
Benefits of Anthocyanin

1. Attract insects for Pollination.
2. It possesses antioxidant, anti-inflammatory, antimicrobial and anti-cancer activities.
3. Protection from UV-Vis radiation.
4. pH indicator.



Dye Structure and Color

Dyes contain sequences of conjugated double bonds:

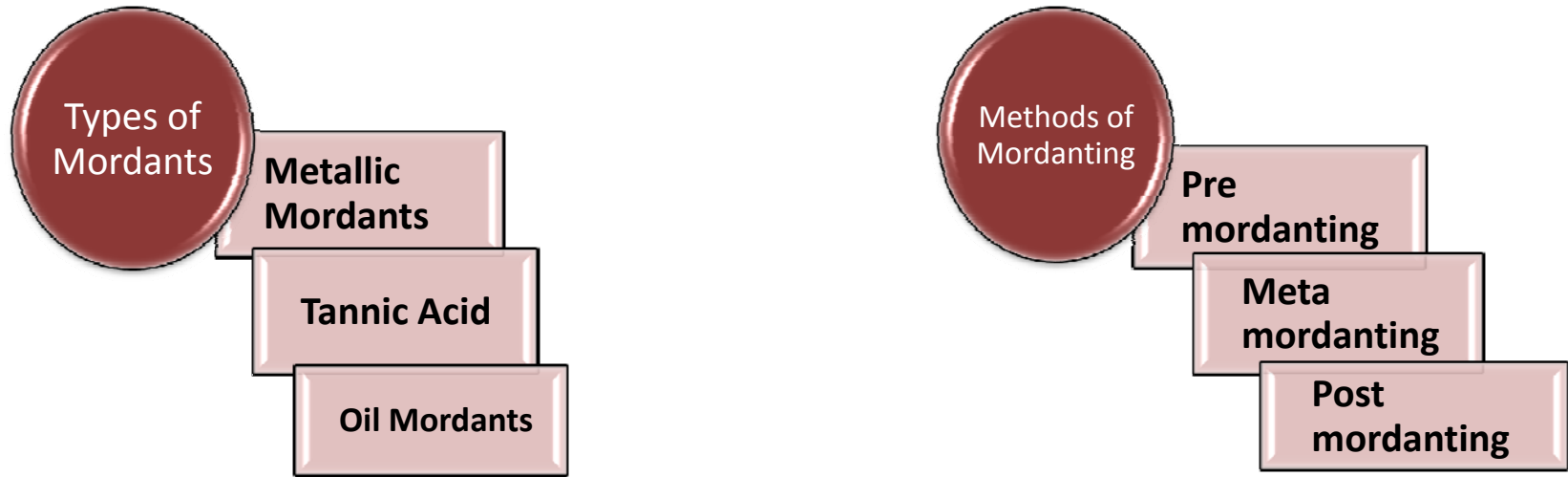


Where X is carbon, oxygen or nitrogen

Dyes contained conjugated systems of benzene rings bearing simple unsaturated groups (e.g., $-\text{NO}_2$, $-\text{N}=\text{N}-$, $-\text{C}=\text{O}$), called **chromophores**, and polar groups (e.g., $-\text{NH}_2$, $-\text{OH}$), named **auxochromes**. These Chromophore and Auxochrome are responsible for the color of dye.

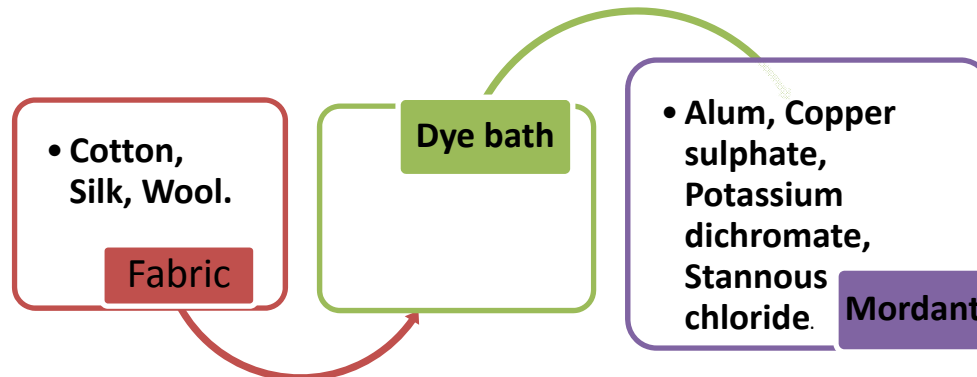
Mordants

Mordant bind the natural dyes to the fabrics by the chemical reaction between the dye and the fiber.



Dyeing

The dyeing process involves three factors -

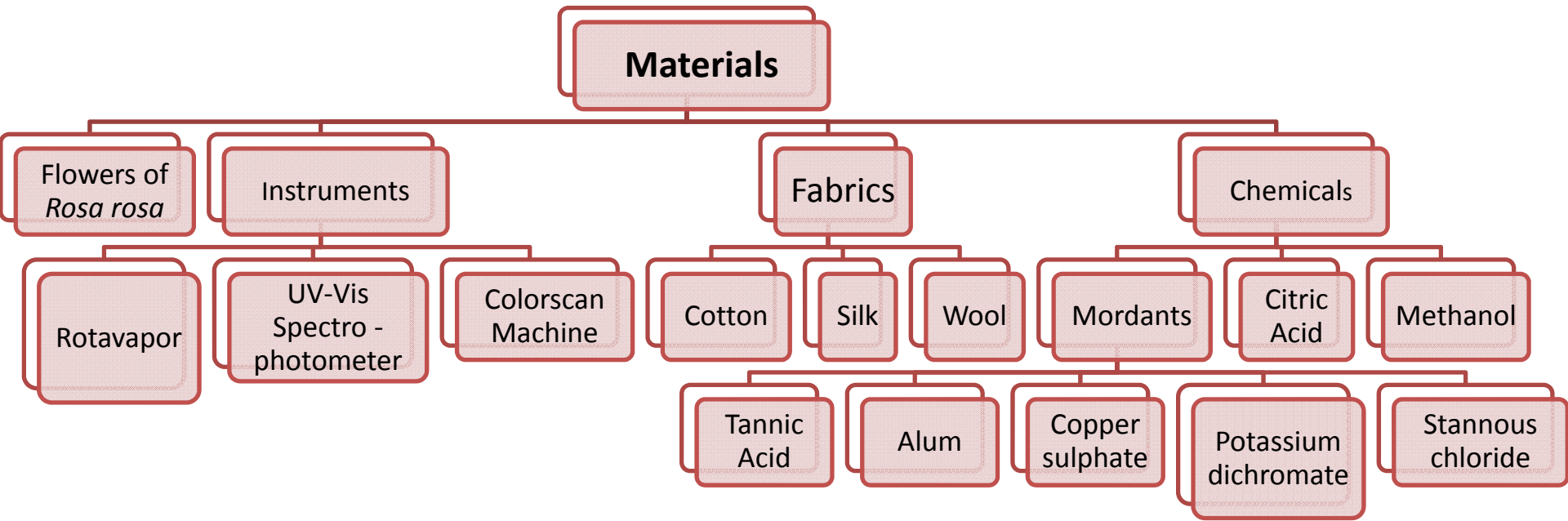


REVIEW OF LITERATURE

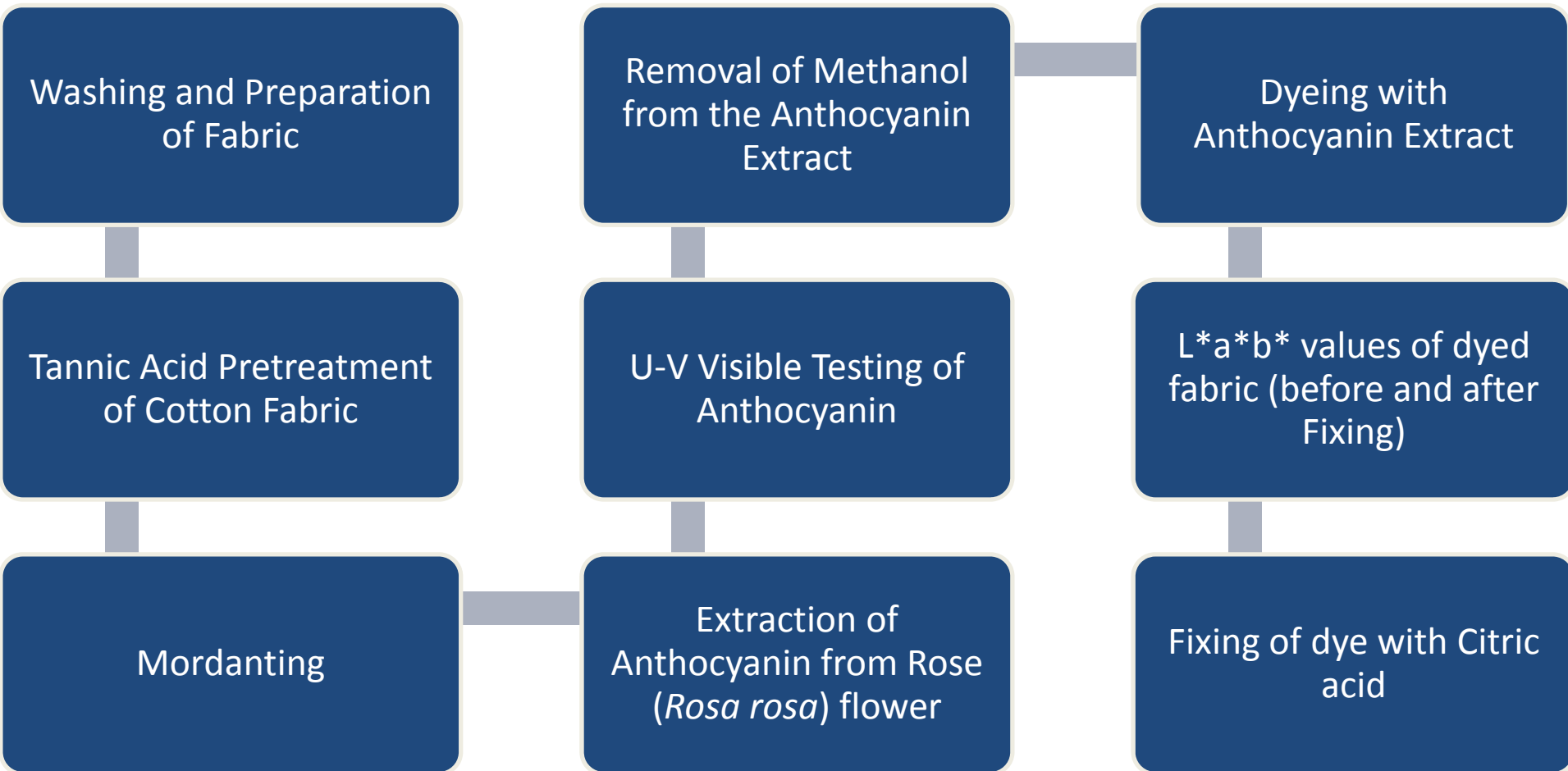
The literature review on my dissertation topic constitute about 95 references, which consider about Natural dyeing, it's benefits, it's future, Anthocyanin pigment, it's advantages, it's extraction from flowers and many more about anthocyanin pigment. Few references are given here-

- In 1930 one of the first chemists to analyze natural dyestuffs was French chemist **Pfister**, who used a micro chemical analysis.
- Dr. Conrad Hans Eugster (1990) gave an article on the Chemistry of Rose Pigments and presented a survey of the pigments found in the flowers and fruits of old and modern varieties of roses.
- David Hershey (2001) told the specific function of anthocyanin in plants. Anthocyanins are flavonoids. A major function of anthocyanins is to provide color to most flowers and fruits. The colors can help attract pollinating animals to flowers and animals that will help disperse seeds.
- Yoshiumi Kohno, Reina Kinoshita, Shuji Ikoma, Keiko Yoda et al.(2009) proposed the stabilization of natural anthocyanin by intercalation into montmorillonite.
- Lawrence W. J. C., Price J. R. suggested that the principal flower coloring matters are the anthocyanins, anthoxanthins and carotenoids.

MATERIALS AND METHODS



Method



RESULTS AND DISCUSSION

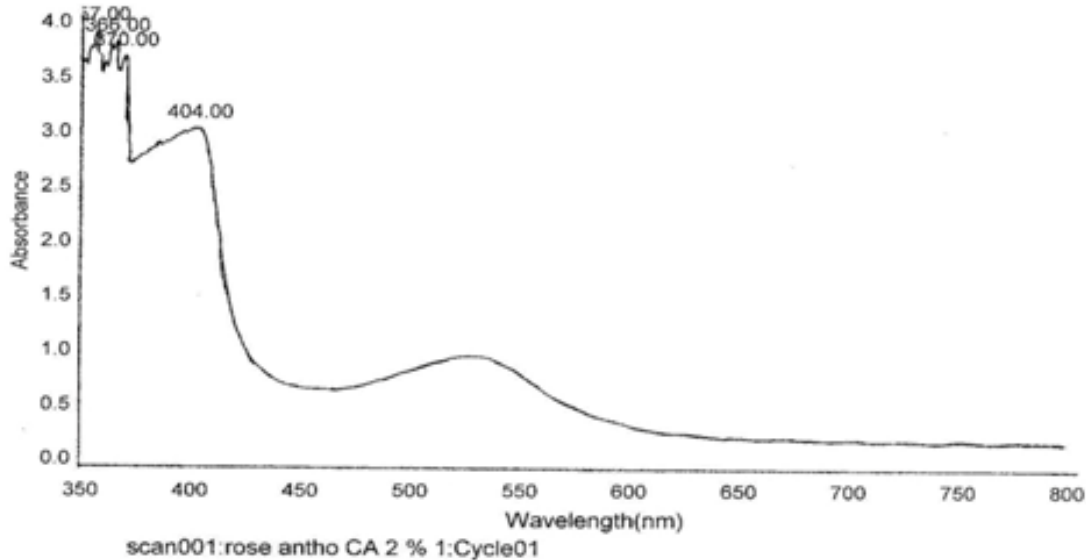
Absorption Band and Visible Spectra of Anthocyanin extracted from *Rosa rosa*

THERMO ELECTRON ~ VISIONpro SOFTWARE V4.10

Operator Name (None Entered)
Department (None Entered)
Organization (None Entered)
Information (None Entered)

Date of Report 3/6/2009
Time of Report 3:22:28PM

Scan Graph



Results Table - scan001,rose antho CA 2 % 1,Cycle01

nm	A	Peak Pick Method
357.00	3.921	Find 8 Peaks Above 0.0000 A
366.00	3.824	Start Wavelength 350.00 nm
370.00	3.690	Stop Wavelength 800.00 nm
404.00	3.035	Sort By Wavelength
Sensitivity	Auto	

The Anthocyanin are characterized by two absorption bands-
Band I- 475-560 nm (Visible region)
Band II- 275-280 nm (UV region)

The broad peak of absorbance was observed at **wavelength 526 nm** with the **absorbance 0.942** as shown in figure

Yield of Anthocyanin Pigment - 4.074 %.

Results obtained by using Colorscan Machine

Table- 1. L*a*b* values for Cotton fabric dyed with Anthocyanin of *Rosa rosa* before fixing with Citric Acid

Mordants	L*	a*	b*	C	H	Color %	K/S values
Controlled	41.553	24.166	1.844	24.236	4.362	100	60.6401
Alum	41.631	23.763	1.601	23.817	3.853	83.484	50.6245
Copper sulphate	41.786	22.734	3.941	23.073	9.831	120.925	73.3293
Potassium dichromate	42.574	23.380	6.293	24.212	15.059	97.898	59.3653
Stannous chloride	40.508	22.795	-2.808	2.967	352.98	218.361	132.4141

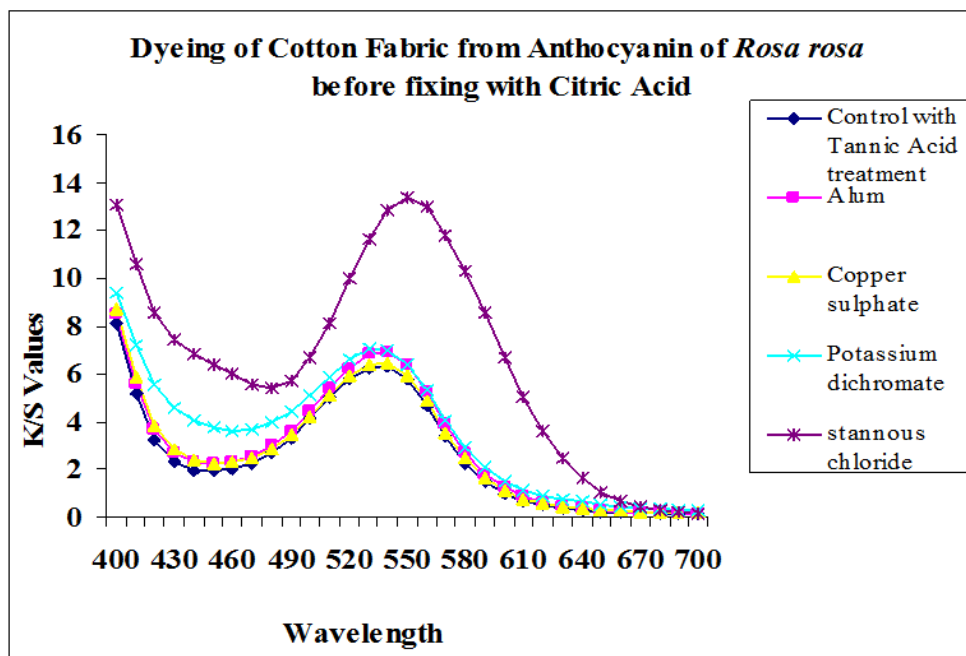
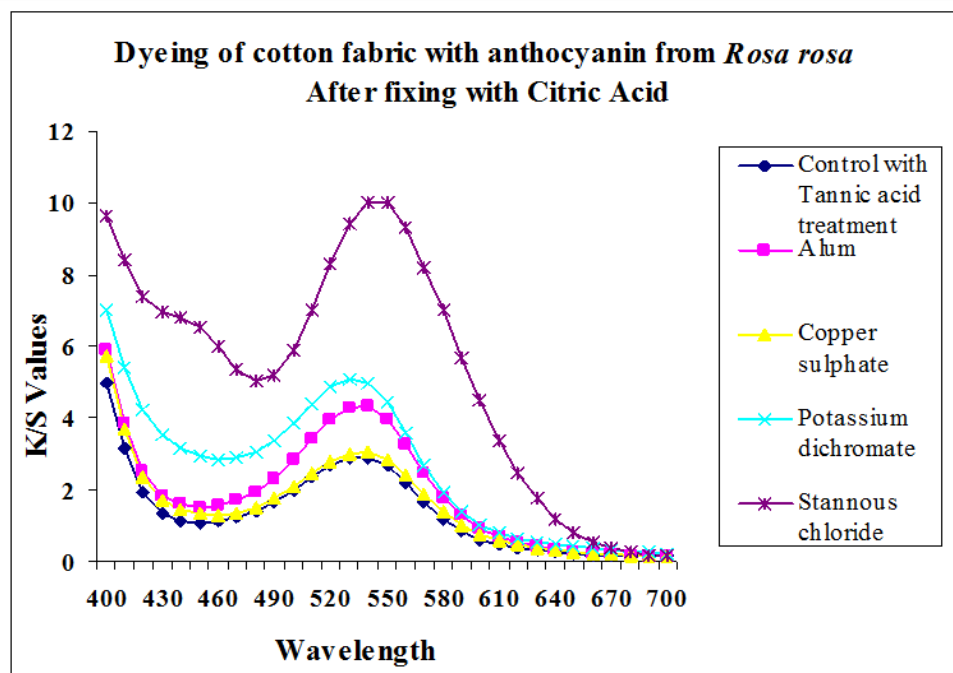


Table- 2. L*a*b* values for Cotton fabric dyed with Anthocyanin of *Rosa rosa* after fixing with Citric Acid

Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	44.004	7.609	5.851	9.598	37.544	22.452	13.6148
Alum	43.645	9.862	5.377	11.214	28.409	25.401	15.4033
Copper sulphate	43.975	13.861	7.901	15.955	29.672	31.118	18.8700
Potassium dichromate	44.891	12.105	12.207	17.191	45.22	36.328	22.0293
Stannous chloride	41.726	20.939	4.322	21.380	11.658	215.70	130.8014



**Dyeing of Cotton from Anthocyanin
Extracted From *Rosa rosa* using Various Mordants**



Controlled Tannic Acid
treatment



Alum



Copper sulphate



Potassium dichromate



Stannous chloride

**Table-3. L*a*b* values for silk fabric dyed with Anthocyanin
of *Rosa rosa* before fixing with Citric Acid**

Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	45.641	37.491	-0.941	37.503	358.563	100	48.5124
Alum	45.177	35.580	-1.567	35.614	357.479	113.067	54.8515
Copper sulphate	45.605	35.137	0.581	35.142	0.947	108.467	52.6197
Potassium dichromate	45.772	29.279	5.588	29.807	10.801	139.638	67.7418
Stannous chloride	43.515	18.853	-4.724	19.436	345.939	283.310	137.4406

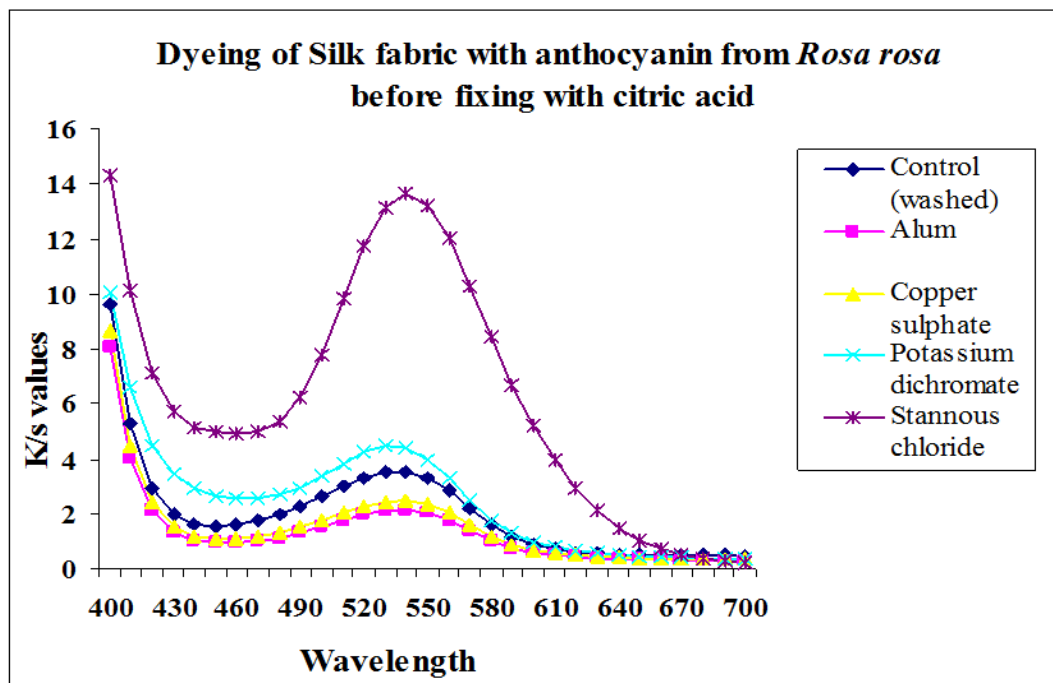
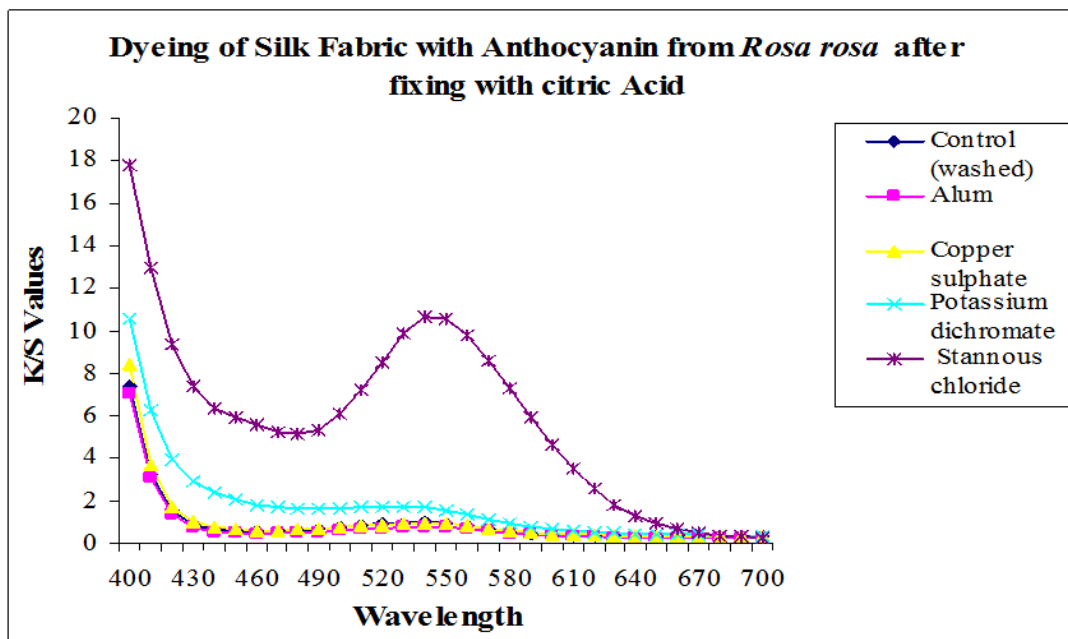


Table-4. L*a*b* values for silk fabric dyed with Anthocyanin of *Rosa rosa* after fixing with Citric Acid

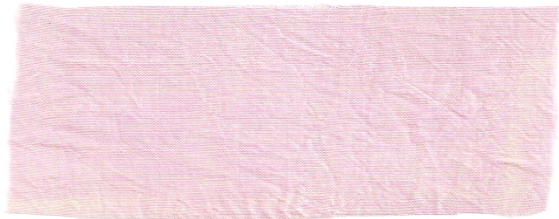
Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	44.804	31.215	-0.654	31.222	358.800	51.623	25.0437
Alum	44.581	31.804	-1.757	31.852	356.839	74.217	36.0046
Copper sulphate	44.734	27.997	0.435	28.000	0.890	58.657	28.4558
Potassium dichromate	46.266	29.076	7.826	30.111	15.058	102.380	49.6671
Stannous chloride	44.345	20.189	1.198	20.225	3.395	229.395	111.2850



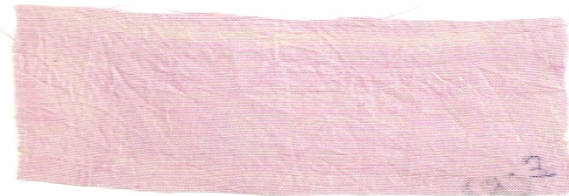
Dyeing of Silk from Anthocyanin
Extracted From *Rosa rosa* using Various Mordants



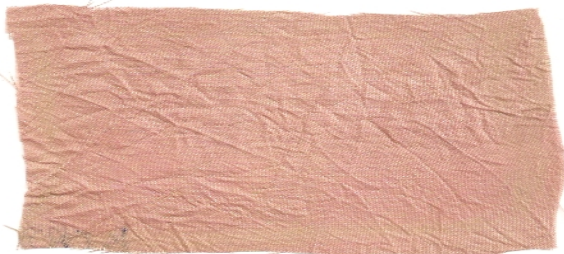
Controlled (washed)



Alum



Copper sulphate



Potassium dichromate



Stannous chloride

Table-6. L*a*b* values for Wool fabric dyed with Anthocyanin of *Rosa rosa* before fixing with Citric Acid

Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	38.791	28.085	2.531	28.199	5.147	100	75.7111
Alum	38.935	25.902	3.612	26.153	7.935	84.040	63.6276
Copper sulphate	38.663	22.590	3.727	22.895	9.365	89.550	67.7994
Potassium dichromate	39.175	15.578	8.809	17.896	29.475	185.550	140.4820
Stannous chloride	37.015	14.508	-1.306	14.567	354.858	293.855	222.4810

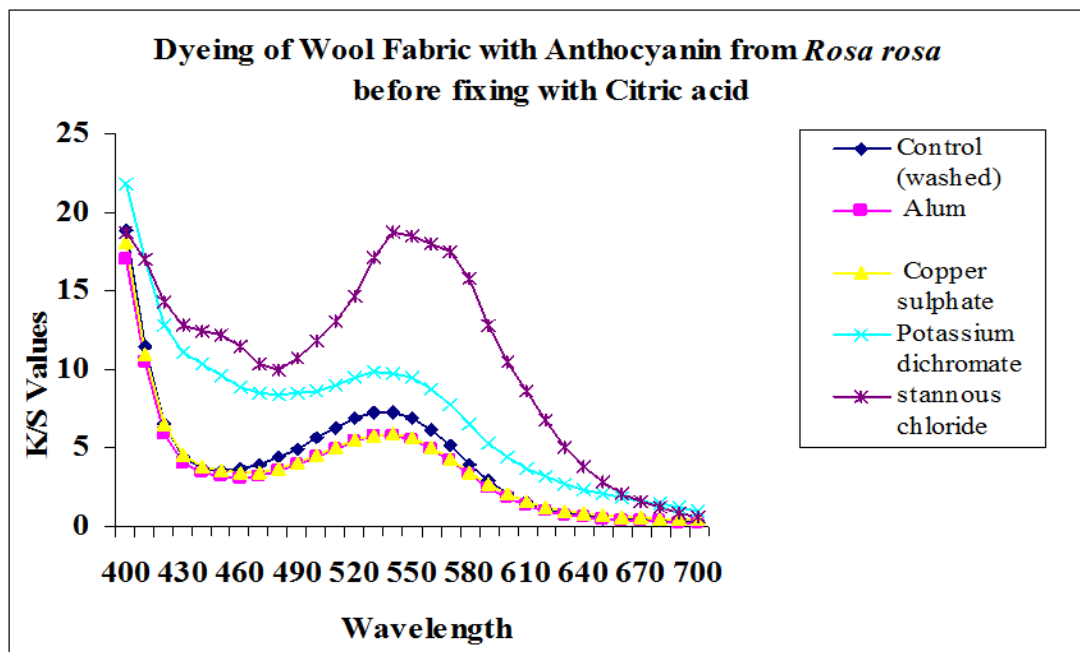
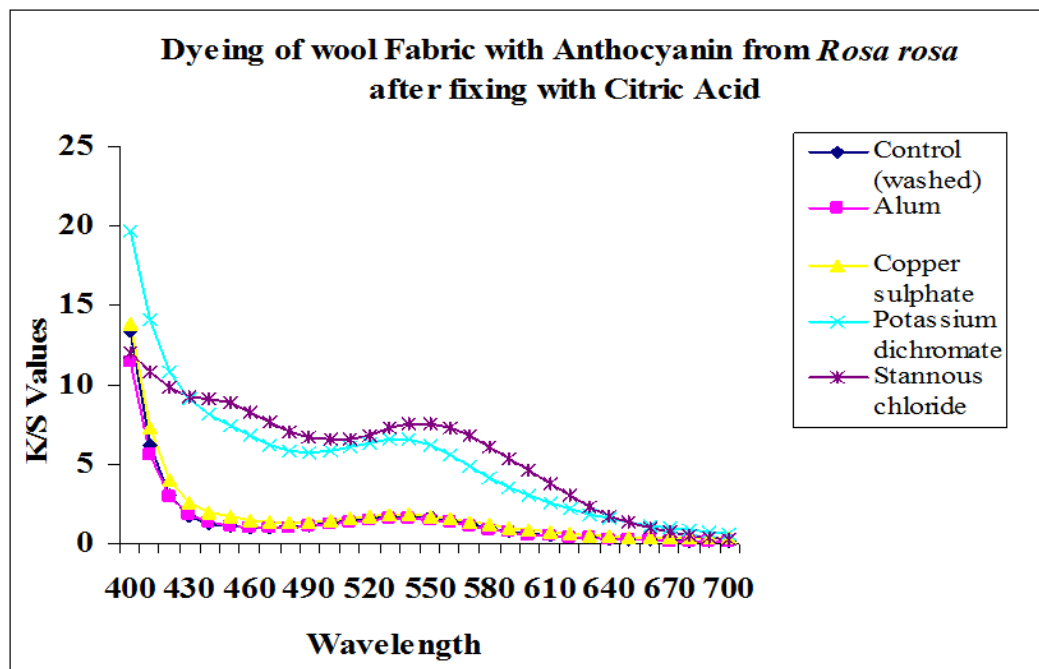


Table-6. L*a*b* values for wool fabric dyed with Anthocyanin of *Rosa rosa* after fixing with Citric Acid

Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	40.101	19.749	5.227	20.429	14.819	29.436	22.2861
Alum	40.643	19.680	7.789	21.165	21.584	27.515	20.8819
Copper sulphate	40.675	13.273	9.276	16.193	34.934	37.283	28.2276
Potassium dichromate	40.405	14.894	12.275	19.300	39.478	133.856	101.3441
Stannous chloride	39.356	13.112	9.600	16.251	16.195	157.624	119.3388



**Dyeing of wool from Anthocyanin
Extracted from *Rosa rosa* using Various Mordants**



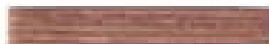
Controlled(washed)



Alum



Pottassium dichromate



Copper sulphate



Stannous chloride

Comparison of K/S values

In each type of fabric K/S value is decreased after fixing with citric Acid. Wool give the best results among the three types of fabrics used in this study.

Effects of Mordants on K/S values

In **Cotton**, the order of K/s values after fixing was -



In **Silk**, the order of K/s values after fixing was -



In **Wool**, the order of K/s values after fixing was-



conclusion

Anthocyanin pigment was extracted from the petals of *Rosa rosa* and by using it pure natural fabric was dyed. Better results were obtained with few particular mordants but the best results were obtained with stannous chloride mordant with good washing fastness.

Due to their non-toxic properties, low pollution and less side effects, there is increasing awareness among people towards natural dyes. Most of the flowers contain anthocyanin pigment and it can very well be used as dye material giving primarily different shades of red.

The wash fastness of metal-complex dyes is due to-

- the ability of dye molecules to associate into large aggregates in the fiber.
- Intermolecular Hydrogen-bonding