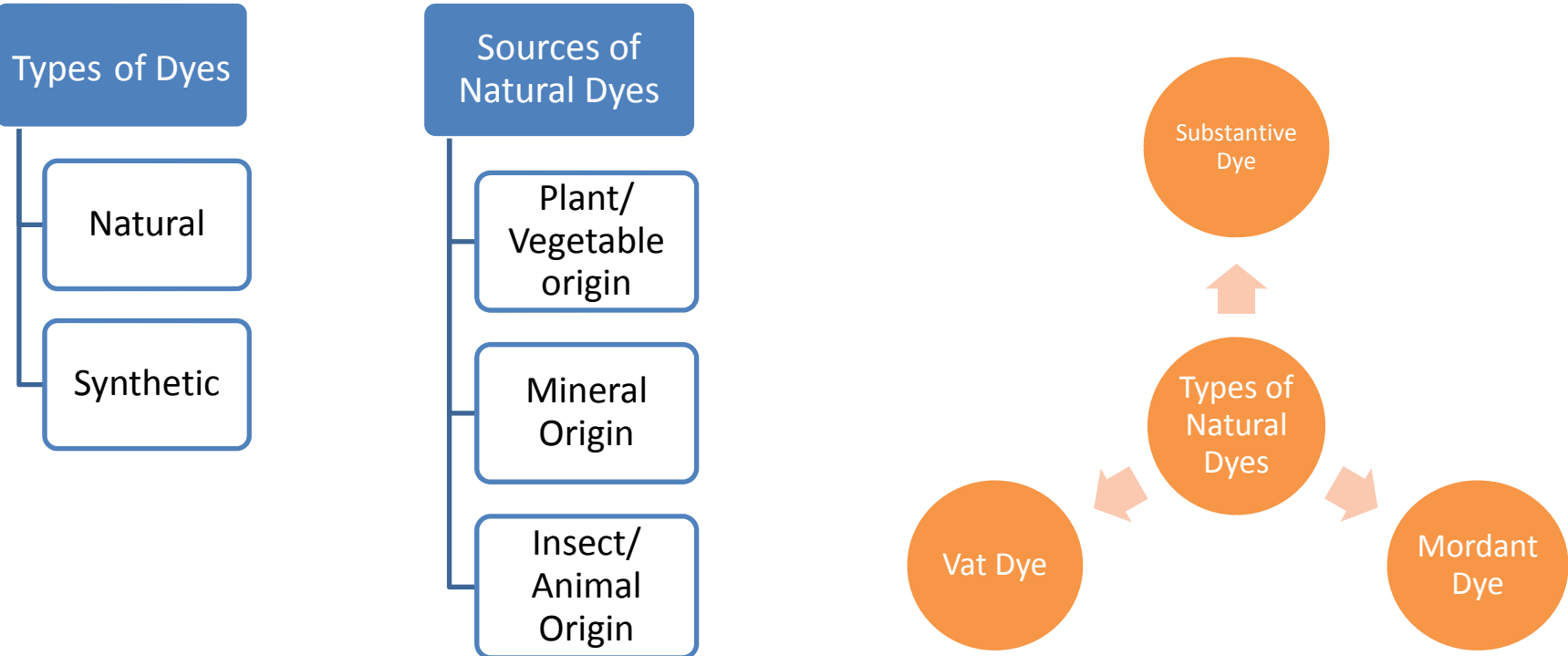


NATURAL DYEING WITH HIBISCUS ANTHOCYANIN

INTRODUCTION

Dye

It is any substance, natural or synthetic, used to color various materials. A dye can generally be described as a colored substance that has an affinity to the substrate to which it is being applied.



Classification of Natural Dyes

On the basis of Chemical Constituents	On the basis of Mineral colorants	On the basis of Applications
<ul style="list-style-type: none">•Indigoid Dyes•Anthraquinon•Alpha-Naphtha•Flavones•Dihydropyrans•Anthocyanidins•Carotenoids	<ul style="list-style-type: none">•Red color•Blue Color•Brown and Black Dye•Yellow color	<ul style="list-style-type: none">•1 Acid dyes•2 Basic dyes•3 Direct or substantive dye•4 Mordant dyes•5 Reactive dye•6 Disperse dye•7 Azoic dye

Advantages of Natural Dyes

- 1) Natural dyes have pharmacological effects and possible health benefits.
- 2) They are obtained from renewable sources.
- 3) Natural dyes cause no disposal problems, as they are biodegradable.

Dyes versus pigments

A dye binds to the substrate, but a pigment generally has no affinity for the substrate. The major difference between dyes and pigments is **solubility**. Dyes are usually soluble in water. Pigments are generally not soluble in water, oil, or other common solvents.

NATURAL PIGMENTS

Natural pigments are highly colored substances found in living organisms, (i.e either in plants or in animals are known as plants and animals pigments) Natural pigments are good for use in the shower gel, bath bombs. These pigments have good quality of bleed protectiveness in soap and these are also water dispersible. But, these pigments don't have high intensity in light.

Kinds of Natural Pigments			
Plant pigment	Carotenoid Pigments	Betalain Pigments	Anthocyanin Pigments

Anthocyanin Pigments

Greek- anthos (flower) and kyanos (blue)

These are colored pigments and these are found profusely in plant kingdom. The colors imparted by these pigments are blue, red and purple. in flower, fruit, stem, leaves and root of plants. They soluble in water and generally occur in the aqueous cell sap.

Color - Red, Purple and Blue

Source - Red Cabbage, Strawberries, Grape Skin, Blueberries, Raspberries

Color Pigments - Cyanidin, Delphinidin, Malvidin, Peonidin.

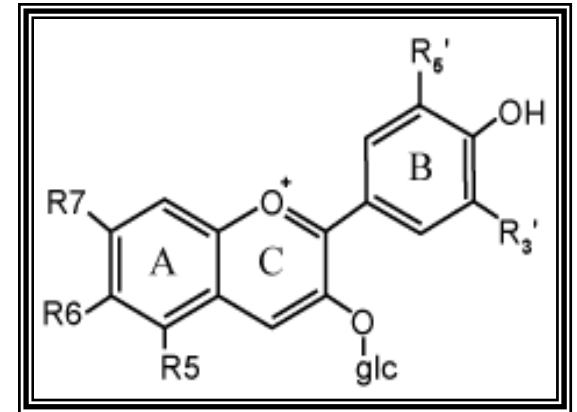
Solubility - Soluble in aqueous solutions

Stability - Each pigment has different stability . Brighter in lower pH range Becomes blue at higher pH

Other Properties - Antimicrobial Properties, Antioxidant properties , Anti-cancer properties

structure of Anthocyanin Pigments

Anthocyanins are derivatives of anthocyanidins which include pendant sugars. The common sugars found in anthocyanin are glucose, galactose and rhamnose. The different shade of the flower are due to the presence of some anthocyanin in different media (i.e. their acidic salts are red, alkali salts are blue and free anthocyanins are violet.)

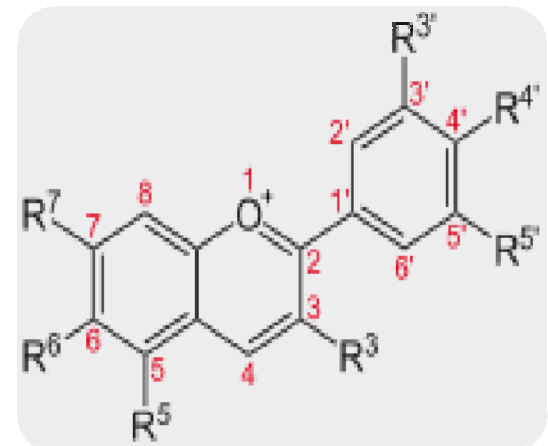


STRUCTURE OF ANTHOCYANIDIN PIGMENTS

Sugar free portion of anthocyanin



Anthocyanidin



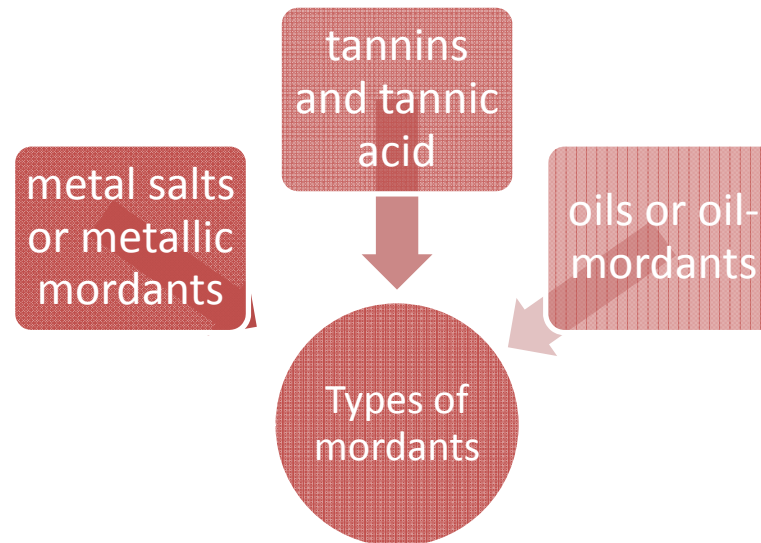
Principle of Natural Dyeing:

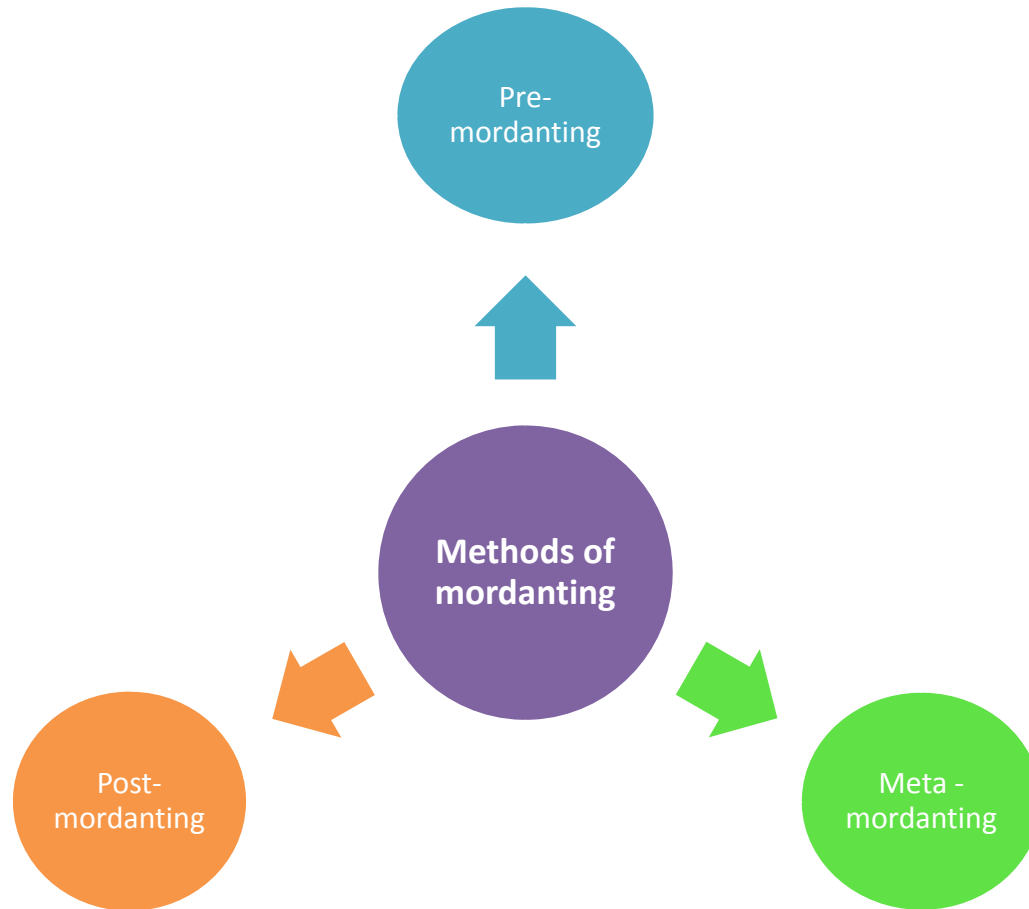
1. Most natural dyes need both a plant extract and a mineral mordant to make a permanent color.
2. The stronger the dye extract - the more plant used - the deeper the colour.
3. Mineral (metal salt) mordants are always used in the same PROPORTION.
4. TIME - TEMPERATURE - CONCENTRATION are the variables involved in any chemical reaction. Higher temperature means less time needed for dyeing, as does higher concentration of dyestuff.

Mordants

Mordants are those compounds which bind the natural dyes to the fabrics and prevent the color from either fading with exposure to light or washing out. Hence mordant is a chemical which enables the fabric to take up the color of the dye.

Metallic salts, tannins and oils are also used as mordants. Generally cotton mordanted with these mordants. These mordants impart affinity for basic dye.





REVIEW OF LITERATURE

This literature review constitute 102 references from 1868 to 2009 , which is based on Natural dyeing by using Anthocyanin from various natural sources. This review also focus on the effect of mordants on natural fibers (i.e. colorfastness and washing fastness). The production and stability of anthocyanin is activated by antioxidant and U-V radiation. Some latest literature survey are given below-

Shahina Waheed, Amina Alam (2006) explained the effect of mordants on color shade and color fastness of silk dyed with Kikar and Madder barks. The silk fabric was dyed with aqueous extract of Kikar bark (*Acacia arabica* [*A. nilotica*]) and Madder bark (*Rubia cordifolia*) by using various metal sulfates as mordants.

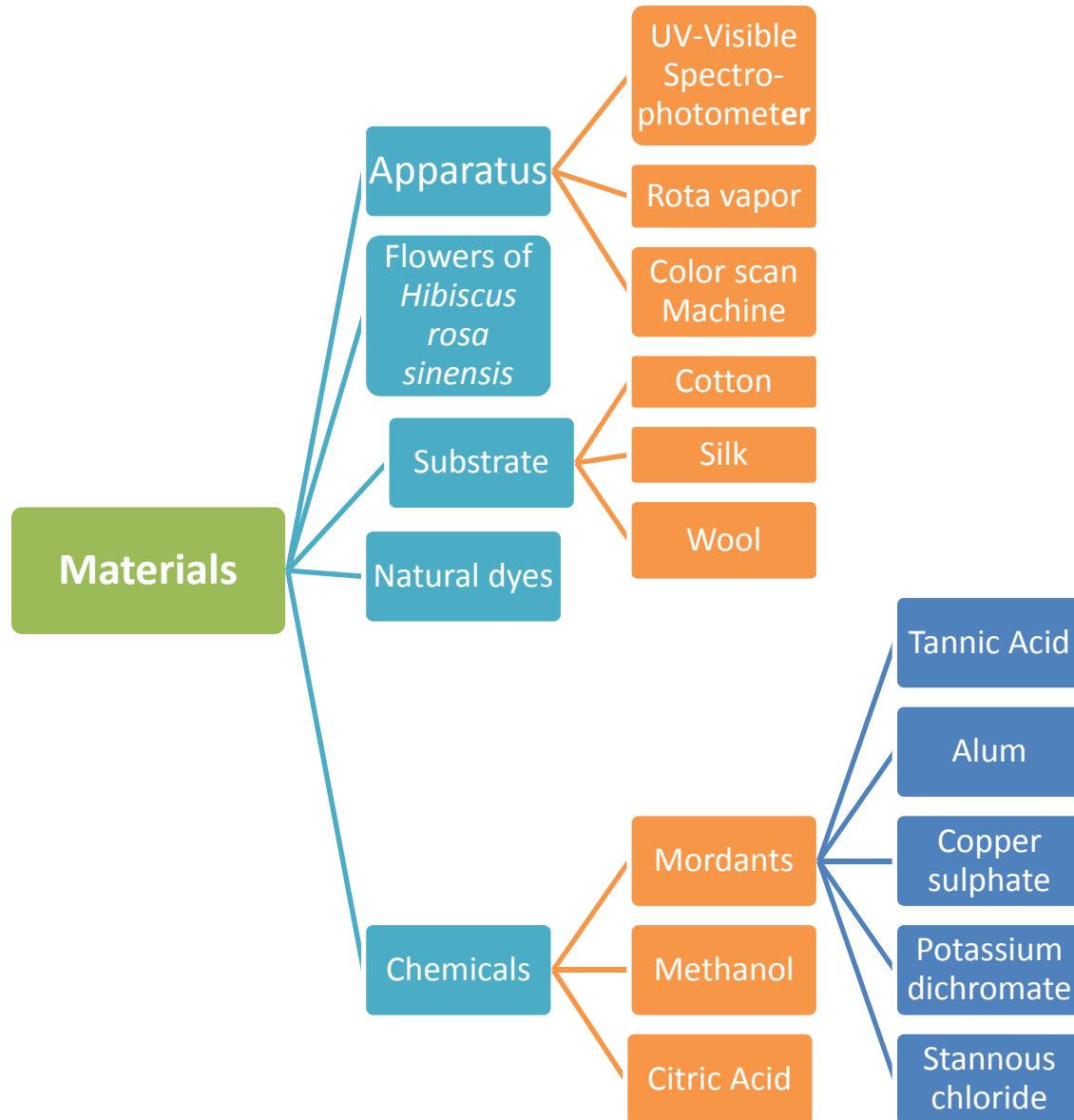
❖ Yoshiumi Kohno, Reina Kinoshita, Shuji Ikoma, et al. (June 2009) gave stabilization of natural anthocyanin by intercalation into montmorillonite.

❖ Stephanie Jolly (Feb 2009) proposed that Red Anthocyanin Pigments in Cabbage turn Color with Changes in pH. Red cabbage juice contains anthocyanin pigments that change color when mixed with alkaline or acidic ingredients

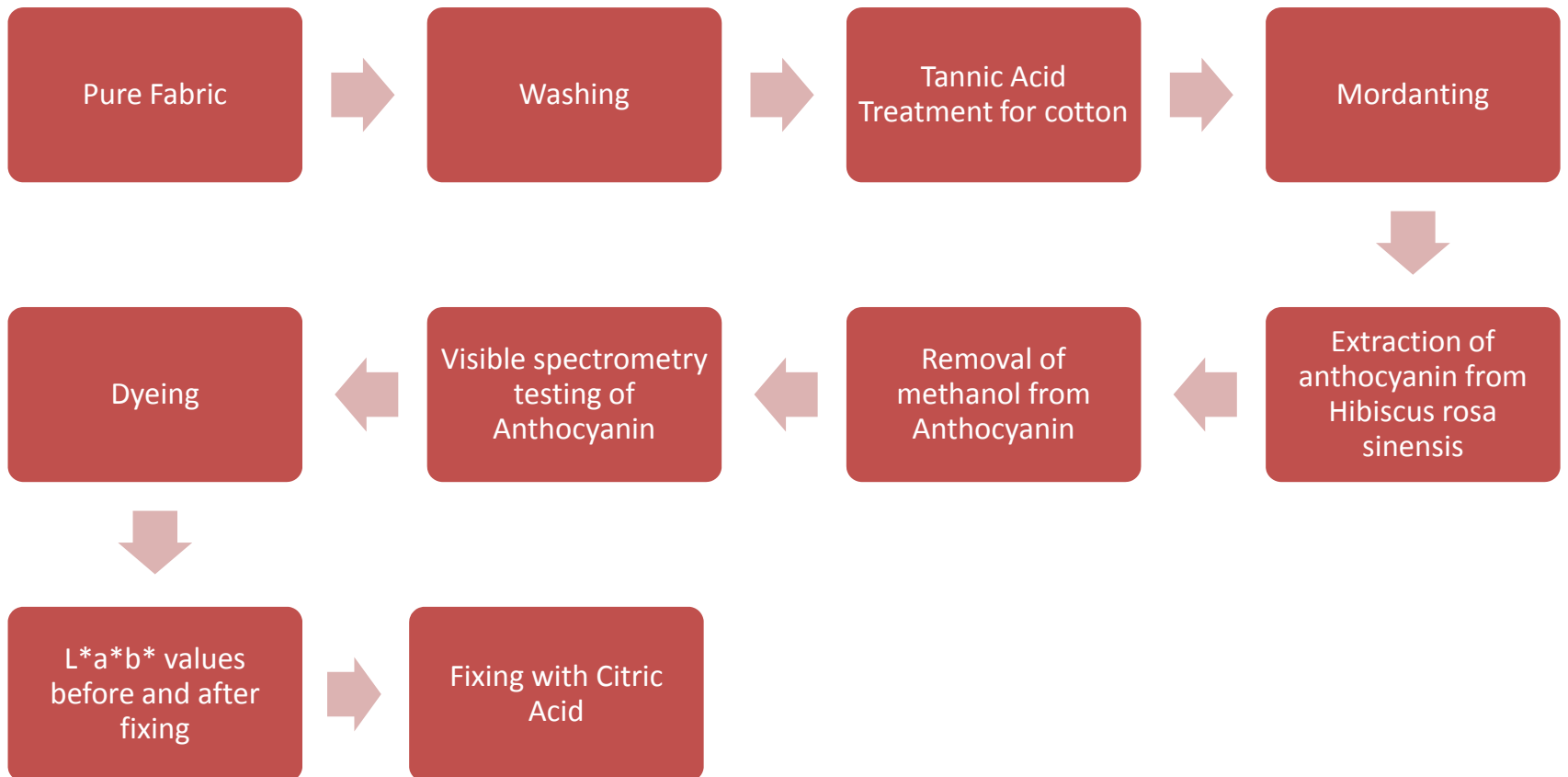
❖ Hill D.J (1998) told about the future for natural dyes. The current status of the natural dye industry and potential market for textile dyed with natural dyed

Rakhi Shanker and Padma S. Vankar (May 2006) proposed on dyeing cotton, wool and silk with *Hibiscus mutabilis* (Gulzuba) Cotton rose/ belongs to family Malvaceae produces natural dye which has been used for dyeing textiles

Materials and method



Method



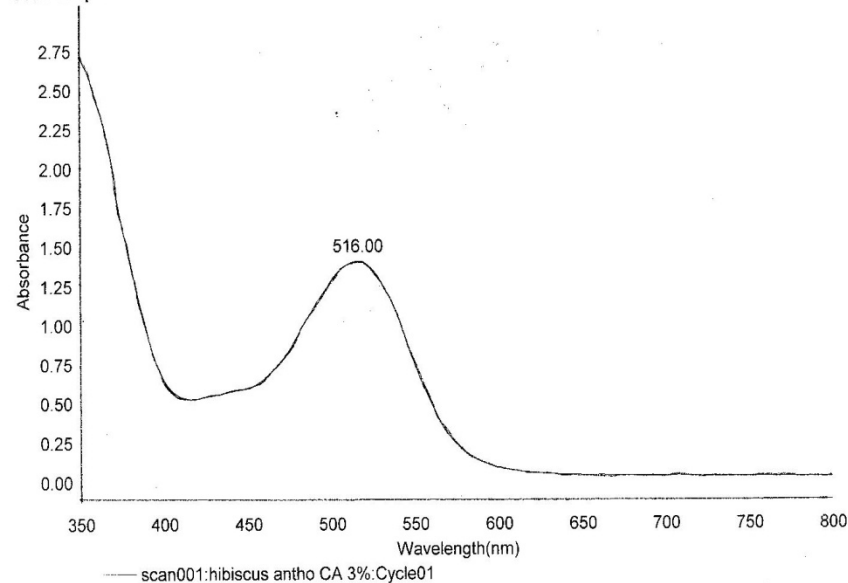
Result and discussion

Identification of Extracted Methanolic solution of Anthocyanin pigment by Visible Spectroscopy

THERMO ELECTRON ~ VISIONpro SOFTWARE V4.10

Operator Name (None Entered) Date of Report 3/6/2009
Department (None Entered) Time of Report 3:23:20PM
Organization (None Entered)
Information (None Entered)

Scan Graph



Results Table - scan001,hibiscus antho CA 3%,Cycle01

nm	A	Peak Pick Method
516.00	1.404	Find 8 Peaks Above 0.0000 A
		Start Wavelength 350.00 nm
		Stop Wavelength 800.00 nm
		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 actual color (Band I) depends on the number and position of hydroxyl and methoxyl groups.

The broad peak of Anthocyanin Pigment was observed at **516 nm** wavelength which indicate that anthocyanin pigment fall in visible region with the absorbance **1.404** (as shown in figure)

Yield of Anthocyanin Pigment - 5.195 %

Including moisture

**Cotton Dyeing from Anthocyanin Extracted from
Hibiscus rosa sinensis using various Mordants**



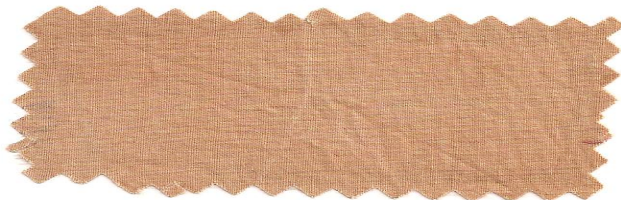
Controlled Tannic Acid
treatment



Alum



Copper sulphate



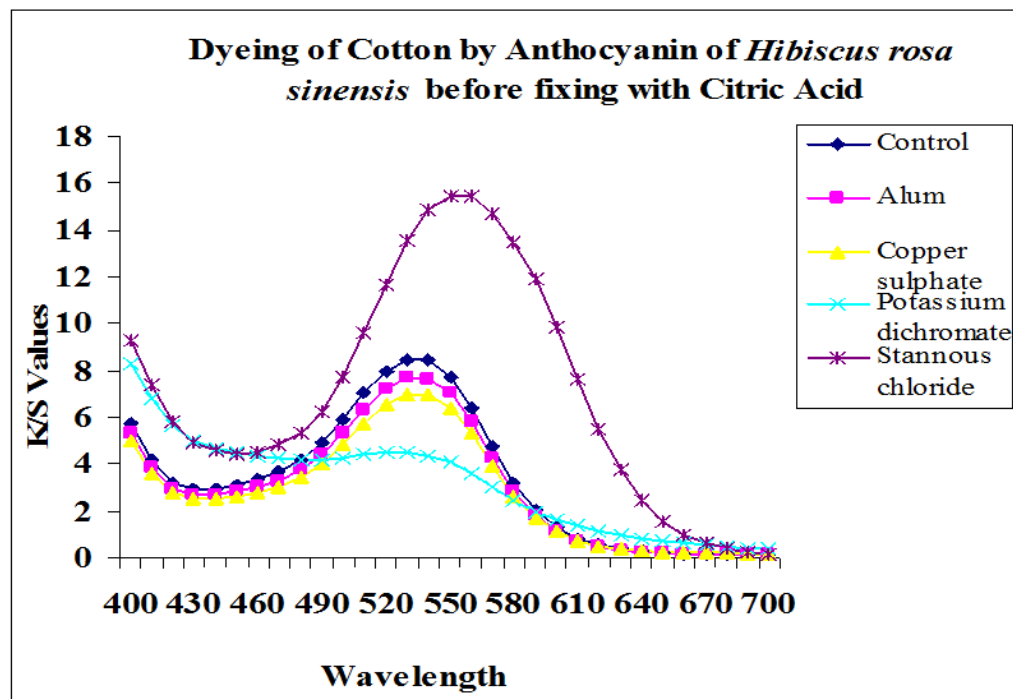
Potassium dichromate



Stannous chloride

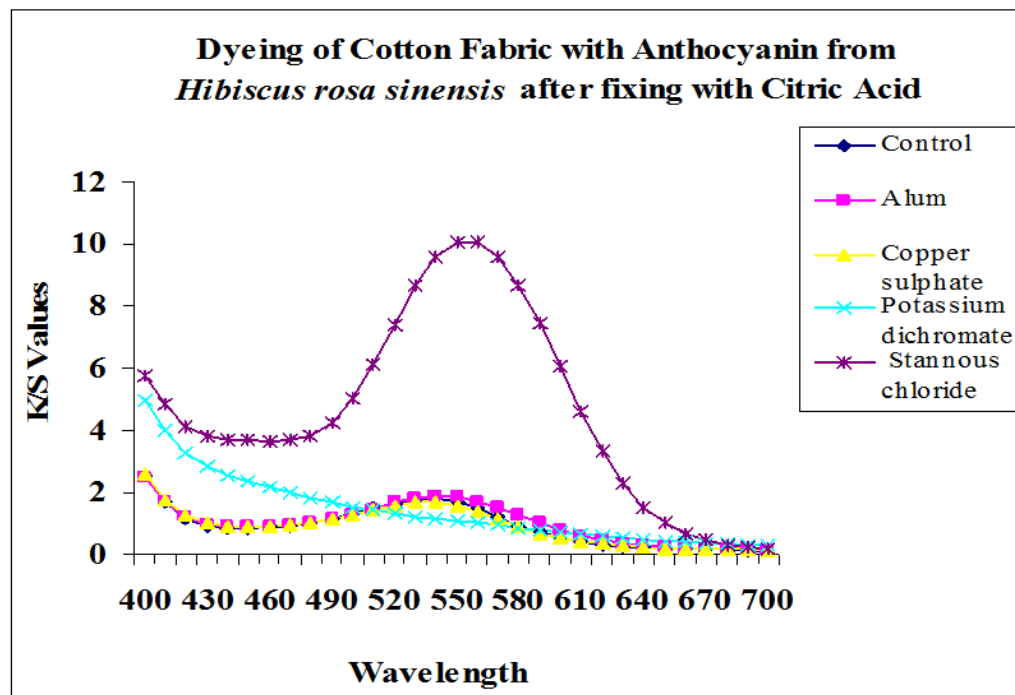
L* a*b* values for Cotton dyed by Anthocyanin of *Hibiscus rosa sinensis* before fixing with Citric Acid

Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	41.977	40.230	2.725	40.322	3.873	100	66.6939
Alum	41.971	40.116	2.715	40.208	3.870	90.854	60.5941
Copper sulphate	40.535	38.290	2.114	38.348	3.159	83.470	55.6693
Potassium dichromate	41.986	19.505	12.259	23.038	32.137	93.239	62.1848
Stannous chloride	37.344	19.512	-16.298	25.423	320.145	223.796	149.2585

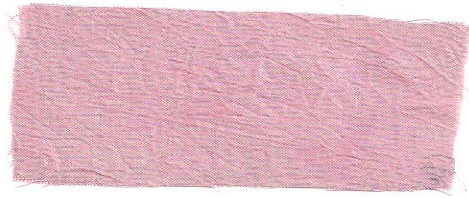


L* a*b* values for Cotton dyed by Anthocyanin of *Hibiscus rosa sinensis* after fixing with Citric Acid

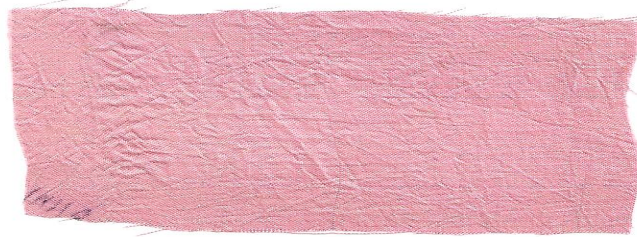
Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	39.420	25.990	-0.045	25.990	359.901	26.233	17.4956
Alum	38.339	21.490	-4.130	21.883	349.126	29.148	19.4397
Copper sulphate	39.616	24.127	1.733	24.189	4.107	26.183	17.4626
Potassium dichromate	44.894	8.501	20.498	22.191	67.448	40.539	27.0372
Stannous chloride	37.711	18.418	-11.851	21.901	327.254	149.351	99.6082



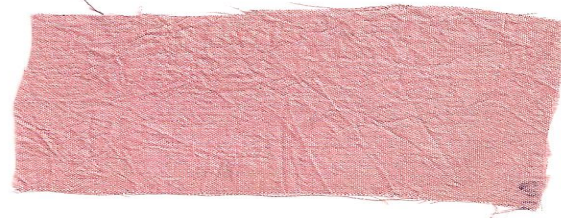
**Dyeing of Silk from Anthocyanin Dye Extracted
from *Hibiscus rosa sinensis* using various
Mordants**



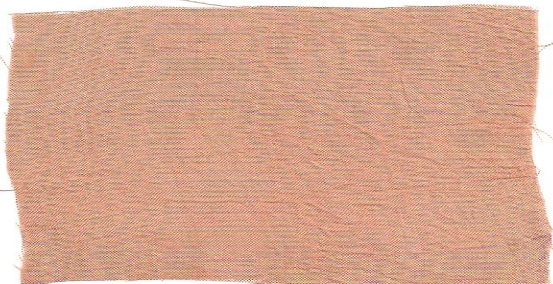
Controlled (washed)



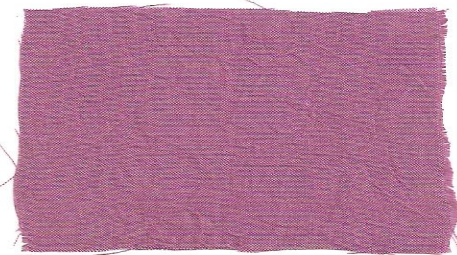
Alum



Copper sulphate



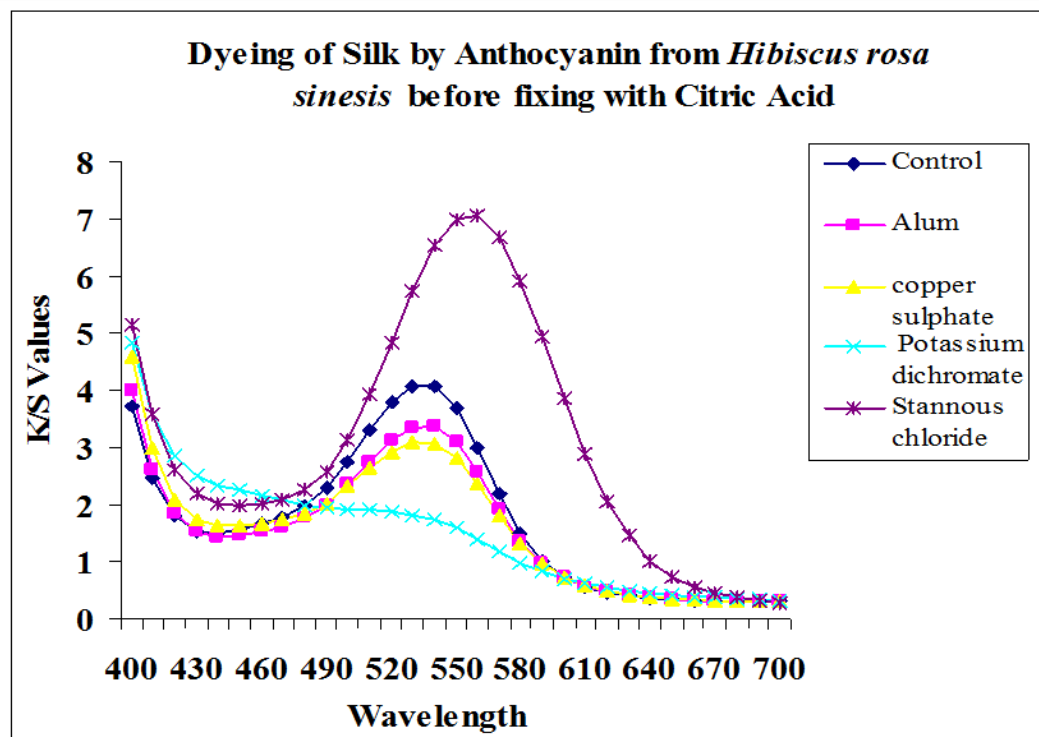
Potassium dichromate



Stannous chloride

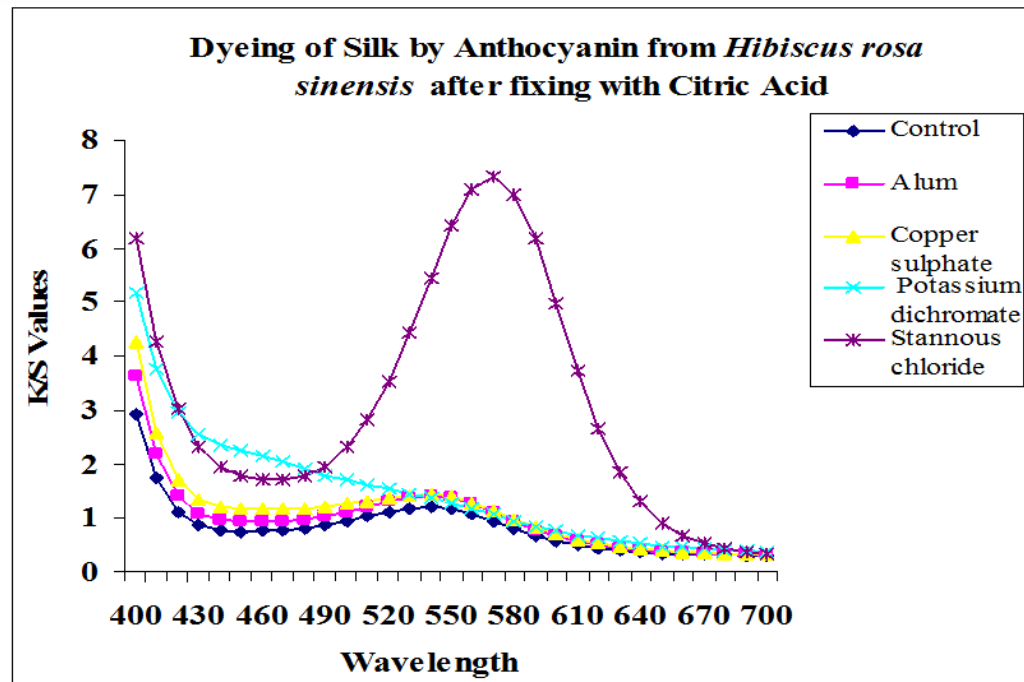
L* a*b* values for silk dyed by Anthocyanin of *Hibiscus rosa sinensis* before fixing with Citric Acid

Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	46.318	29.48	0.576	29.486	1.119	100	33.0538
Alum	46.537	29.841	1.237	29.869	2.373	91.864	29.6050
Copper sulphate	46.411	27.96	1.998	28.031	4.086	95.276	29.9003
Potassium dichromate	46.577	20.291	5.702	21.077	15.69	75.814	28.5089
Stannous chloride	44.295	19.248	-9.383	21.413	334.022	171.707	64.3137

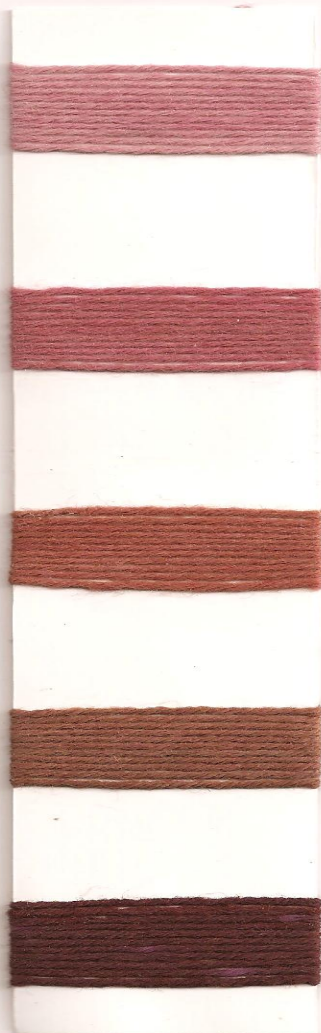


L* a*b* values for silk dyed by Anthocyanin of *Hibiscus rosa sinensis* after fixing with Citric Acid

Mordants	L*	a*	b*	C	H	Color %	K/S values
Control	45.522	26.017	-0.649	26.025	358.572	40.329	14.6310
Alum	44.521	21.516	-4.64	22.011	347.835	44.81	17.5277
Copper sulphate	45.763	24.115	1.236	24.147	2.933	40.254	19.7643
Potassium dichromate	51.298	7.98	20.871	22.345	69.048	62.323	27.4247
Stannous chloride	45.248	8.035	-8.057	11.379	314.94	150.139	65.4133



**Dyeing of Wool from Anthocyanin Dye Extracted
from *Hibiscus rosa sinensis* using various
Mordants**



Controlled (washed)

Alum

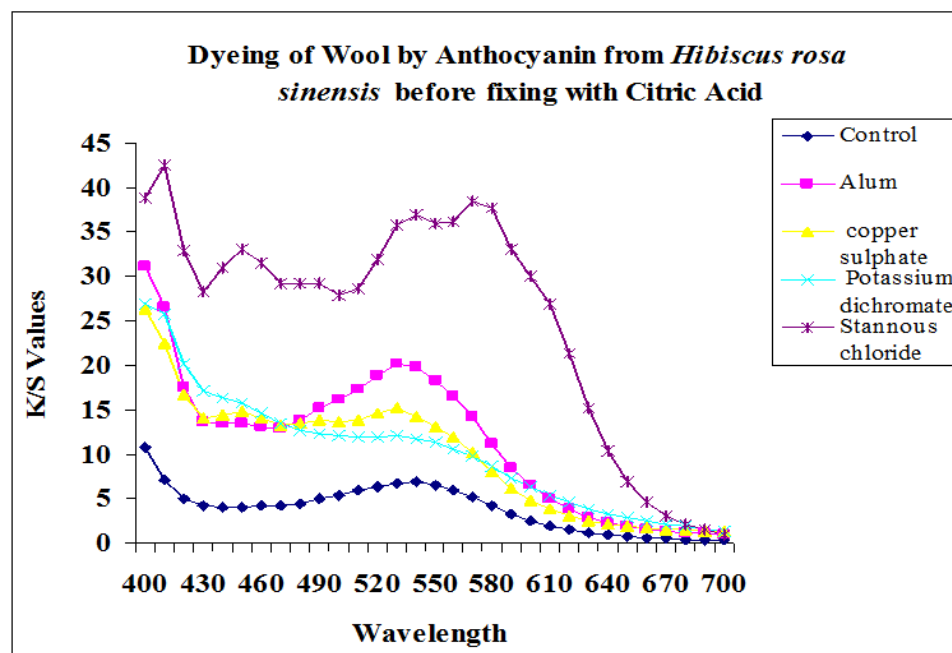
Copper sulphate

Potassium dichromate

Stannous chloride

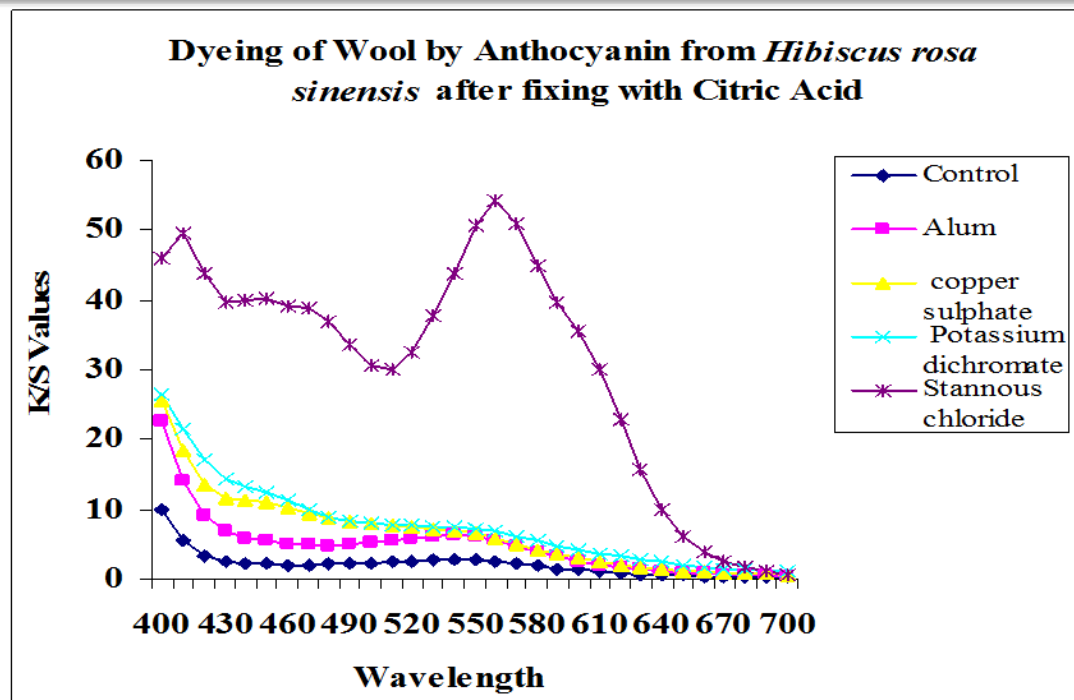
L* a*b* values for wool dyed by Anthocyanin of *Hibiscus rosa sinensis* before fixing with Citric Acid

Mordants	L*	a*	b*	C	H	Color %	K/S values
Controlled	37.957	23.886	2.04	23.973	4.88	100	74.9314
Alum	38.935	24.77	5.706	25.419	12.967	298.585	223.7335
Copper sulphate	40.472	22.316	12.404	25.432	29.055	260.679	195.3306
Potassium dichromate	40.467	12.878	12.985	18.288	45.219	270.091	202.3826
Stannous chloride	37.421	9.896	0.927	9.939	5.349	718.225	538.175



L* a*b* values for wool dyed by Anthocyanin of *Hibiscus rosa sinensis* after fixing with Citric Acid

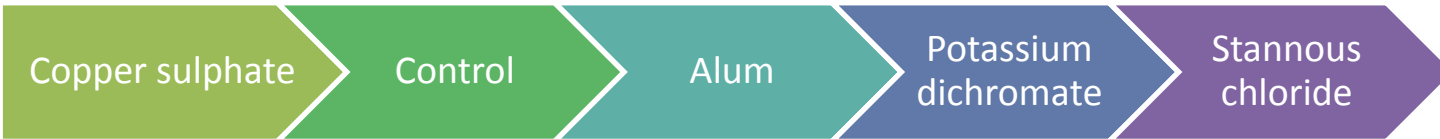
Mordants	L*	a*	b*	C	H	Color %	K/S values
Controlled	38.666	17.47	5.196	18.226	16.557	48.17	36.0947
Alum	40.002	19.119	9.119	21.82	25.489	114.174	85.5523
Copper sulphate	42.759	17.555	19.226	26.035	47.582	169.182	126.7705
Potassium dichromate	42.06	10.814	17.031	20.174	57.563	196.454	147.2058
Stannous chloride	38.254	10.515	2.916	10.912	15.493	889.6	666.655



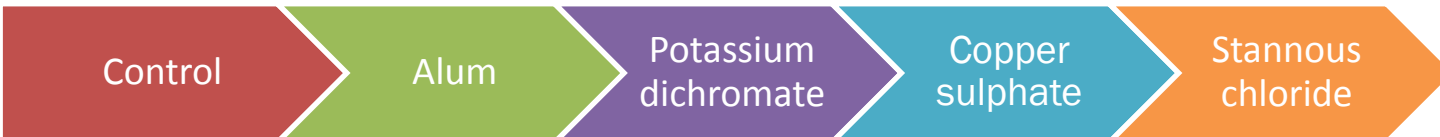
The K/S values Of Different Fabrics

The mordant activity of the four cases for different fabrics after fixing possess following sequences:

In cotton-



In Silk-



In Wool-



conclusion

The large- scale production of textile dyed with anthocyanin dye is a new concept of the textile industry. Anthocyanin extract of *Hibiscus rosa sinensis* flowers yield shades with good fastness properties. and it is also clear from this study that anthocyanin pigment can very well be used as dye material giving primarily different shades of red.

The best color was obtained with stannous chloride and it gave good washing fastness also in terms of K/S values. This better shade with Tin may also due to stable complex formation between anthocyanin and tin. The development of shade and fixation of natural dyes on natural fibers depends on the use of mordants.

As the washing fastness was considerably good in anthocyanin dyed fabric (cotton, silk, wool). It can be future color for consumers. The dye has good scope in the commercial dyeing of cotton, silk for garment industry and wool for carpet industry.