“Technological Upgradation done at FEAT laboratory for Dyeing with Natural dyes”.

NATURAL DYES OF INDIA

- Indigoid dyes
- Anthraquinone dyes
- Alpha-Napthaquinones dyes
- Flavones dyes
- Dihydropyrans dyes
- Anthocyanidinsdyes
- Carotenoids dyes

NATURAL DYES

- Natural dyes have a certain appeal to the consumer.
- The United States imports some 3500 tons/year of natural dyes, representing 0.4% of its dye market.
- After many decades in which little or no natural dye research took place,technical interest is being rekindled.

LIST OF NATURAL DYES SCREENED IN FEAT LABORATORY

Sappan wood, Bougainvillea, Lac, Balsam, Tulsi, Canna, Cineraria,Cosmos, Tessu, Pomergranate, Cassia, Tectona, Babool and Eucalyptus

NEWER TECHNIQUE FOR DYE EXTRACTION USED BY US:

1. Sonicator
2. Supercritical fluid extraction

SONICATOR AS EFFICIENT DYE EXTRACTOR.

- Utilization of ultrasound energy for extraction of dye from plants source.
- The sonicator used is of 20kHz frequency which suitable for inducing cavitation
- Cavitation which causes formation and collapse of microbubbles is very effective in dye extraction of air sensitive substrates.
- The microbubbles which are unstable slowly grow in the process of oscillation, finally implode generating momentary localized high pressure & temperature, thus helping in extraction.

ACCLERATED SUPERITICAL EXTRACTION

- With increasing frequency, industry is utilizing supercritical fluids to extract and purify biological active compounds,flavors,fragrances, and essential oils from both plant and animal sources.

- This extraction process consists of contacting the supercritical fluid and natural product in an extraction vessel at a high pressure, where the solubility of the desired product is appreciable in the supercritical fluid.

SUPERCRITICAL FLUID EXTRACTION (SFE) FOR THE EXTRACTION OF NATURAL DYES.

- CO_2 is used as bulk extraction media with Ethyl Acetate entrains.
- Extraction cared out for Eucalyptus bark and Tulsi leaves.

GLOBAL SCENARIO

- Indian textile industry has potential for 25% of total export of the country
- Collapse of soviet market has resulted the us and European union to depend on India
- They are demanding eco-friendly textiles.
- Indian textile industry has to reorient its activity to meet the requirement of the imparting countries.

TECHNOLOGY UPGRADATION

Effective and efficient exploitation of new technology will keep us in competitiveness with the world. Utilization of Ultrasound energy for dyeing cotton with natural dyes is a definitive improvement in dyeing process.

LIMITATIONS OF NATURAL DYES

- Lack of standardization.
- High cost of Dyeing.
- Their easy and ready availability.
- Their pastel shades.

THE PROBLEMS ASSOCIATED WITH EXPLORATION OF NEVER SOURCES FOR NATURAL DYES ARE:

- Poor R & D on dyeing techniques and dye extraction methodologies.
- Lack of facilities to access latest technologies and market information.

ADVANTAGES OF NATURAL DYES

- They are obtained from renewable resources.
- No health hazards, sometimes they act as health care as in the case of Tulsi.
- Practically no or mild chemical reactions are involved in their preparation.
- No disposal problem; biodegradable.
- They are harmonized with nature.

SPECTRUM OF COLOURS FROM NATURAL DYES

- Red coloured Dye: Sappan wood, Lac
- Yellow coloured Dye : Bougainvillea,Marigold, Eucalyptus
- Blue coloured Dye : Indigo
- Black coloured Dye : Lac
- Brown coloured Dye: Sappan, Balsam
- Green coloured Dye: Canna, Tulsi
- Orange/Peach coloured Dye: Balsam,Bougainvillea

NEWER TECHNIQUES IN DYEING

1. Sonicator dyeing

2. Microwave dyeing

SONICATOR DYEING

In sonicator type of dyeing when all the is added at the onset to the dye bath,the dye uptake is most rapid at the beginning and then slows down as the process continues.

Due to higher dye uptake the effluent is fairly clear thus least amount of dye discharge.

DYE UPTAKE BY ULTRASOUND MECHANISM

- Cavitation, The formation and collapse of microbubbles is responsible for the effect.
- Unstable microbubbles affect chemical reactions as a result of momentary localized pressure and temperature.
- Combined effect of cavitation, compression and rarefaction cause better dye uptake.

THE ULTRASONIC WAVES ARE:

- Longitudinal waves-particles oscillates in a direction parallel to the direction of propagation of waves.

- Transverse or shearing waves-direction of the particles oscillates in a direction perpendicular to the direction of wave propagation.

CAVITATION EFFECT

- Occurs at a temperature of 45-50°C
- Useful cavitation frequencies are in the range of 5-50kHz
- Helps in breaking up of the dye aggregates
- Accelerates the rate if diffusion of dye inside the fabric.

MICROWAVE DYEING

1. Model used is microwave digestive system M D S (mls 1200)
2. Aqueous solution /Methanolic solution of the dye is taken in microwave vessel (teflon)
3. Dyeing time 5 to 10 min.
4. Dyeing uptake is fairly good

MORDANTING

1. Pre mordanting : Fabric treated with mordant before dyeing.

2. Post mordanting : Fabric treated with mordant after dyeing

3. Simultaneous mordanting : Simultaneous mordanting and dyeing

SIMULTANEOUS MORDANTING

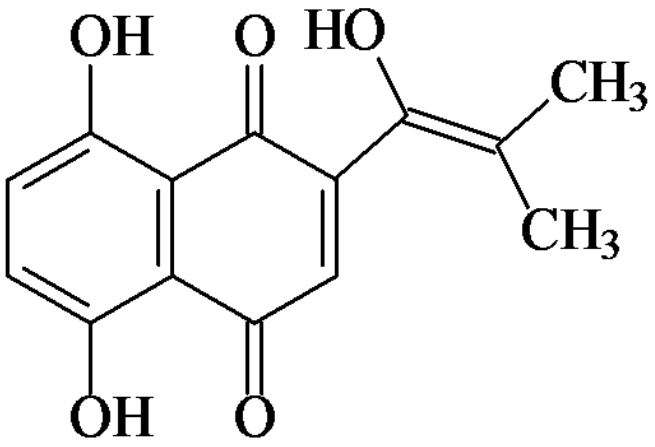
In the case of simultaneous mordanting the final exhaustion of the dye and the rate of dyeing can be controlled by adding.

The dye transfer was thus maintained at a uniform rate. Sonicator provides constant rate of dye transfer.

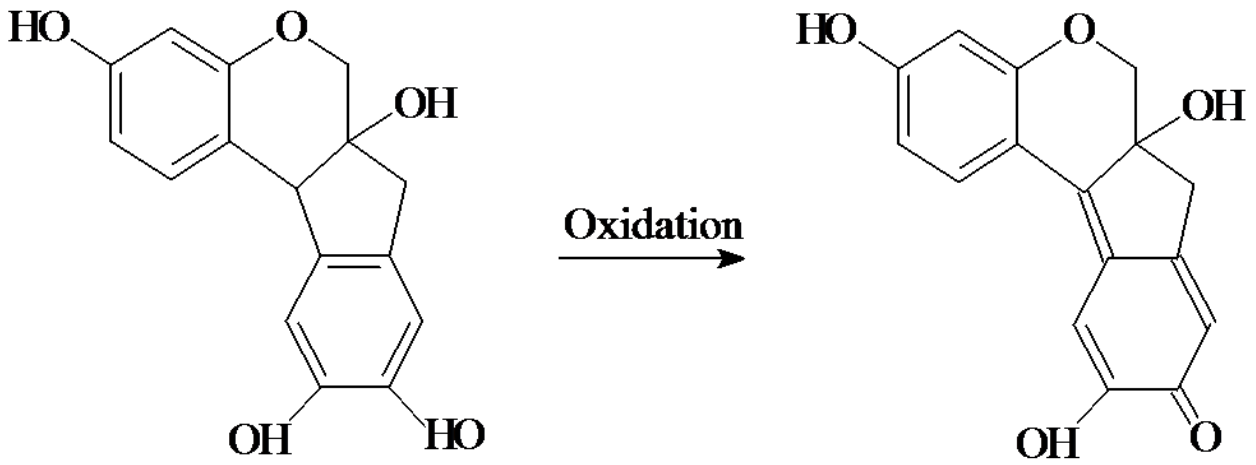
RESULT WITH MORDANT-STANNIC CHLORIDE & DYES USED ARE SHOWN IN THE NEXT FEW SLIDES:

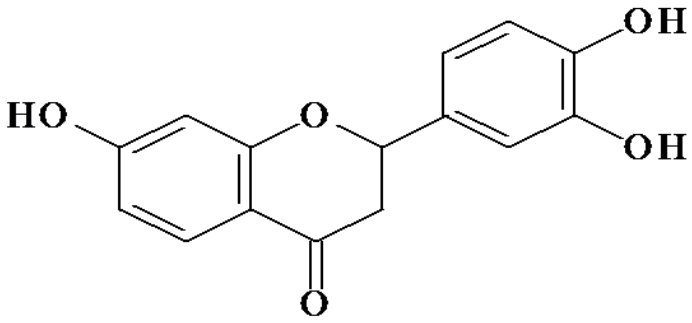
- Sappan wood
- Tulsi
- Alkanet root
- Tessu-Pomergranate
- Al root
- Eucalyptus

Structures of dyes isolated

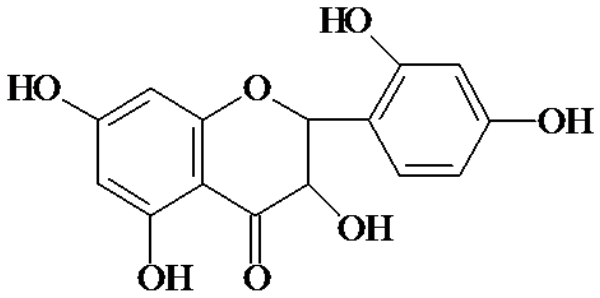


Alkanin

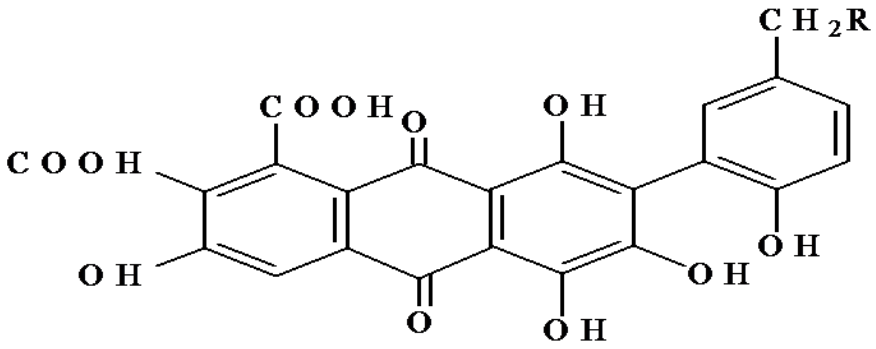




Fustin



Morin



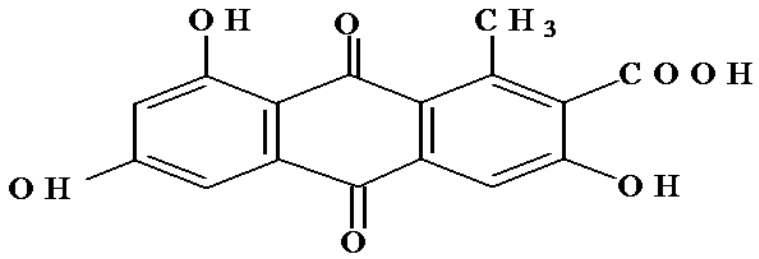
Laccaic acid- A (R=CH 2NHCOCH 3

B (R=CH 2OH)

C (R=CHNH 2)

COOH

E (R=CH 2NH 2)



Laccaic Acid-D

RUBBING FASTNESS

	Micro wave		Sonicator	
	Dry	Wet	Dry	Wet
•Tulsi (Alc)	4-5	4-5	5	5
•Sappan(Aq)	4	3-4	4-4	4
•Sappan (Alc)	3	3-4	3-4	3
•Alkanet (Alc)	2-3	3-3	3-4	4
•Al root	4-5	4/5	4/5	4-5
•Eucalyptus	4	4/5	4/5	4-5
•Tessu-Pomergranate	4/5	4/5	4/5	4-5

WASHING FASTNESS

	Micro wave	Sonicator
(i) Tulsi (Alc)	4-5	5
(ii) Sappan(Aq)	4	4-5
(iii) Sappan (Alc)	2	3
(iiii) Alkanet (Alc)	4-3	4-5
(v) Al root	4/5	4-5
(vi) Eucalyptus	4-5	5
(vii) Tessu-Pomergranate	4/5	4-5

FASTNESS PROPERTIES OF TULSI

Mordant	Dyed	Shade	Fastness Properties					
	Pre	Post	Wash	Light	Rubbing		Perspiration	
					Dry	Wet	Alkaline	Acidic
Stannic Chloride	light green	light green	4/5	4-5	4	3/4	4/5	4/5
Stannous Chloride	Fluorescent green	light green	3/4	4	3	3/4	4	4
Ferrous Sulphate	Khaki green	khaki dirty	4	4	3-4	3-4	4	4
Alum	green	green	4	4	3/4	3-4	3-4	3-4

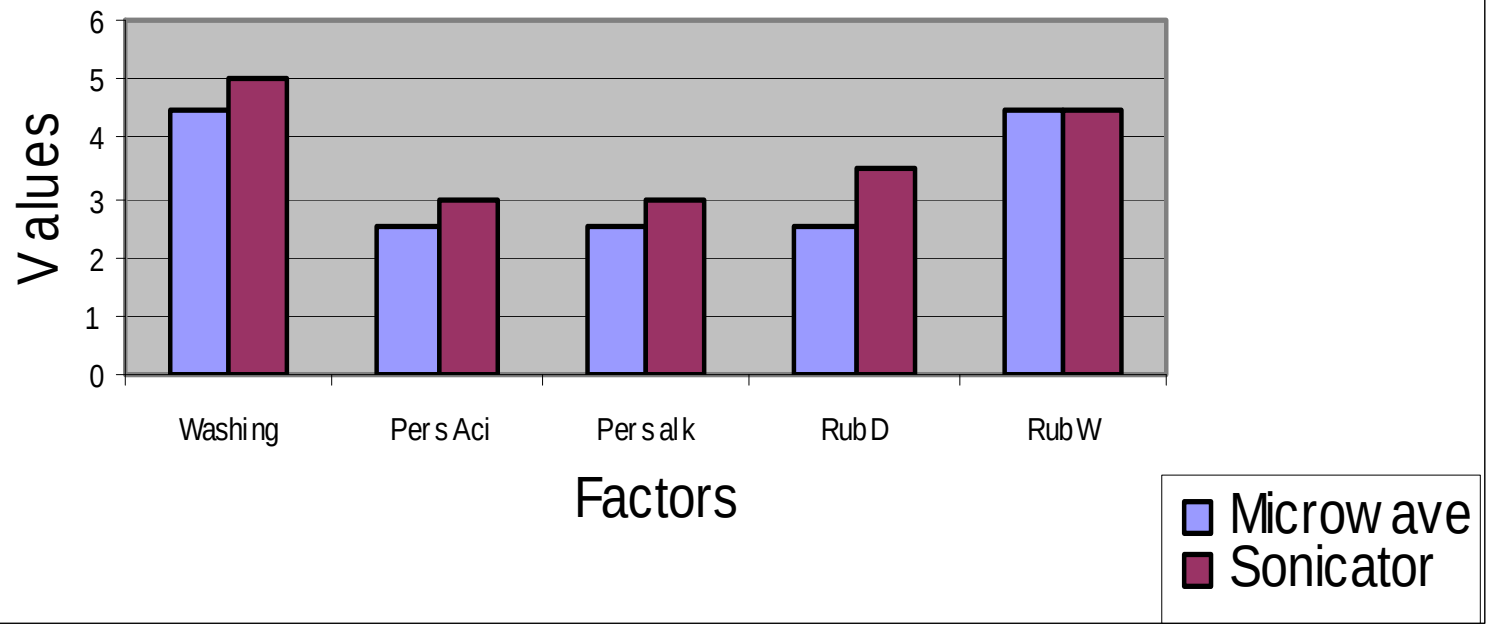
ANTIMICROBIAL PROP. OF TULSI

1.	**Tensile strength after soil burial**	Before Treatment	very poor		
		After treatment	1% good	2% very good	5% add on excellent
2.	**Dyeing Property**		Light Fastness	Wash Fastness	Rubbing Fastness
		With Mordant	4/5	4/5	5
		Without mordant	3/4	4/5	2/3

Fastness properties of Eucalyptus

Mordant	Dyed	Shade	Fastness Properties					
	Pre	Post	Wash	Light	Rubbing		Perspiration	
					Dry	Wet	Alkaline	Acidic
Stannic Chloride (M)	Dark brown	light brown	4-5	5	4-5	4	4/5	4/5
Stannic Chloride (W)	Brown	Skin Colour	4/5	4/5	4	3	4/5	4/5
Alum(M)	Brown	Skin Colour	4/4	4	3-4	3	3-4	3-4
Ferrous Sulphate (M)	Dark brown	Light brown	3/3	3	2	2-3	4	4
Ferrous Sulphate (W)	Khaki green	khaki dirty	3-4	3-4	3-4	3-4	3-4	3-4
Stannous Chloride (M)	Bright brown	Dark brown	4	4	2-3	2	3-4	3-4
Stannous Chloride (W)	Reddish Brown	Light Brown	4/4	4	4	2-3	¾	4

Fastness properties of Dyed cotton fabric with SCFE of Eucalyptus bark



TESTING FOR ECOFRIENDLINESS

- **Testing for ECO-friendliness:** The dyed hosiery materials were tested for the presence of heavy metal pesticides and banned arylamines by the methods prescribed as follows:

- **I. Heavy metals:**By Inductively Coupled Plasma Spectrometer (ICP).

- **II. Pesticides:** Extraction,clean up and detection by GC/ECD.

- **III Banned Amines:** By GC-MS or HPLC