A Dissertation thesis entitled

"Sustainable Natural Dye Isolation & Characterization from Conventional Indian Plant Material"

Submitted in partial fulfillment of the requirements

For the award of the degree of

Master of Science

IN

INDUSTRIAL CHEMISTRY

Submitted By

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DEPARTMENT OF INDUSTRIAL CHEMISTRY

ATMIYA UNIVERSITY

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2022-2023

Dedicated to

My Beloved Family

Without their love, support and constant encouragement,

this would not have been possible

DECLARATION

We undersigned, hereby declare that the work assimilated in the dissertation thesis entitled **"An insights into the catalytic esterification & transesterification of waste ground nut oil to biodiesel using RDSA-Si catalyst"** has been carried out by us at Faculty of Science, Department of Industrial Chemistry, Atmiya University, Rajkot, Gujarat, India, under the supervision and Guidance of **Dr. Goving V. Vagadiya, Assistant Professor, Faculty of Science, Department of Industrial Chemistry, Atmiya University, Rajkot, Gujarat, India.**

To the best of our knowledge and belief, the work included in this thesis is quite original and has not submitted to any other Institution or University for the award of any degree either in this or any other form.

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ACKNOWLEGMENT

First and foremost, from the bottom of heart, body, mind and soul, praises and thanks to our parents, the god, an almighty, for his showers of blessings throughout this research work. We must pray in the lotus feet of **H.D.H. P.P. Hariprasad Swamiji Maharaj** for their divine blessings. We convey our heartfelt thanks to the **Faculty of Science, Department of Industrial Chemistry, Atmiya University, Rajkot,** for providing laboratory facilities for the course of this work.

We warmly thank **P.P Tyagvallabh Swamiji**, President, Atmiya University, **Dr. Shiv K. Tripathi**, Vice Chancellor, Atmiya University, **Dr. Sheela Ramchandran**, Pro-chancellor, Atmiya University, **Dr. Jayesh Deshkar**, Pro Vice Chancellor, Atmiya University, **Dr. D. D. Vyas,** Registrar, Atmiya University, **Dr. Ashish M. Kothari**, Director, Research, Innovation & Translation, Atmiya University and **Er. Ravi S. Tank**, Head, Department of Industrial Chemistry, Atmiya University, Rajkot for providing us all the required facilities to carry out our research work.

We warmly thank our research supervisor **Dr. Goving V. Vagadiya,** Assistant Professor, Department of Industrial Chemistry, Atmiya University, Rajkot for his splendid guidance, authentic supervision, moral support, constant encouragement and giving us an opportunity to work under him with compilation of magnificent experience.

We thank our Dissertation Review-I & II committee members **Er. Dhaval A. Tank, (Dr.) Viral Kariya** and **Dr. Goving V. Vagadiya** of Department of Industrial Chemistry for their insightful comments, suggestions and unconditional help in our research work.

We are very mach delightful to **NFDD Center**, **Saurashtra University, Rajkot**, **INDIA** for analytical assistance in spectral characterization of synthesized of samples.

At last but not least, we are very much thankful to the all teaching & non-teaching staff members, **Mr. Sagar Patel, Mr. Hemil Chavda, Mr. Jigneshbhai Gohil, Mr. Dharmikbhai, Mr. Sunilbhai Parmar** and co-researchers of Department of Industrial Chemistry for their helping hands.

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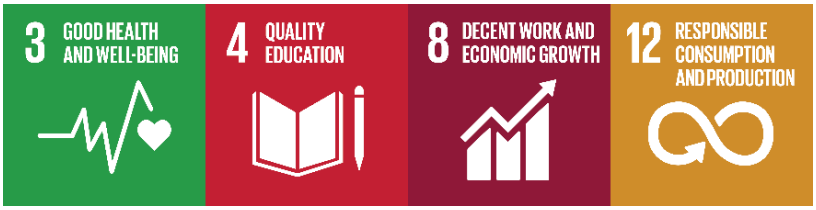
CONTENTS

1 ABSTRACT

Dyes are an integral part of the health of clothing, food, and other organisms, but the dyes commonly contain added corrosive chemicals that can cause corrosive effects on prolonged contact with the dye. In addition, the chemicals contain pollutants that pollute the water supply. saurashtra area is famous for living industries and the above-mentioned people are always concerned about the people.[1] So, this project proposes a solution by isolating the material of Kauri which is already prominent in the ancient night knowledge system but due to the invasion of aliens and the neglect of the society, it is visible today. he projects addresses the Sustainable Development Goals-2030, **Goal 3: Health and Welfare, Goal 4: Mathematical Education, Goal 8: Skills and Economic Growth, and Goal 12: Responsible Consumption and Production.**



2 INTRODUCTION

- ✓ What is Natural Dyes?
- ✓ Natural dye is defined as any dye, pigment, or any other substance derived from natural sources such as plants, animals and minerals are renewable and sustainable bioresource products with minimum environmental impact. They have been known since antiquity for their use in coloring of textiles, food substrate, natural protein fibers like wool, silk and cotton, and leather as well as food ingredients and cosmetics.

- ✓ Demerits or Disadvantages of Natural Dyes:
  There are some limitations of natural dyes which includes, lesser availability of colours, poor colour yield, complex dyeing processing, poor fastness properties and difficulty in blending dyes. As there are many advantages in using natural dye but they also have some drawbacks:

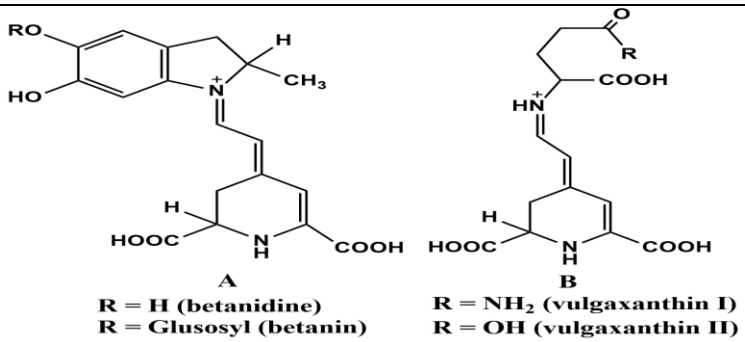
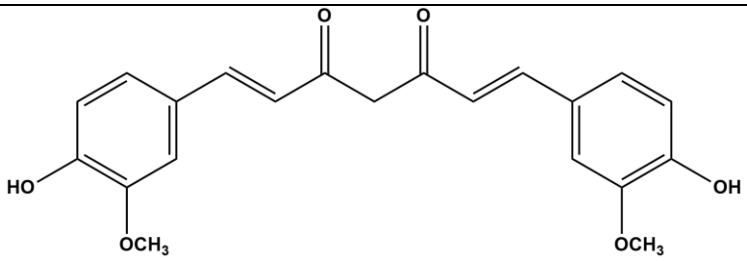
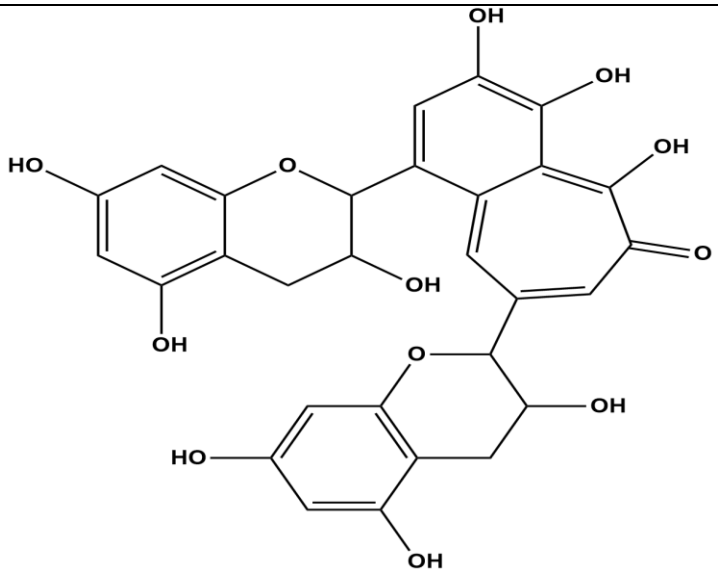
1. Expensive: Natural dyes are expensive due to being limited in source.
2. Faded easily: Sometimes their poor attachment on fabric makes them fade easily.
3. Difficult to produce/collect: Collection is somewhat difficult in large amounts.
4. Time consuming: The complete process like collection of dye takes long time.

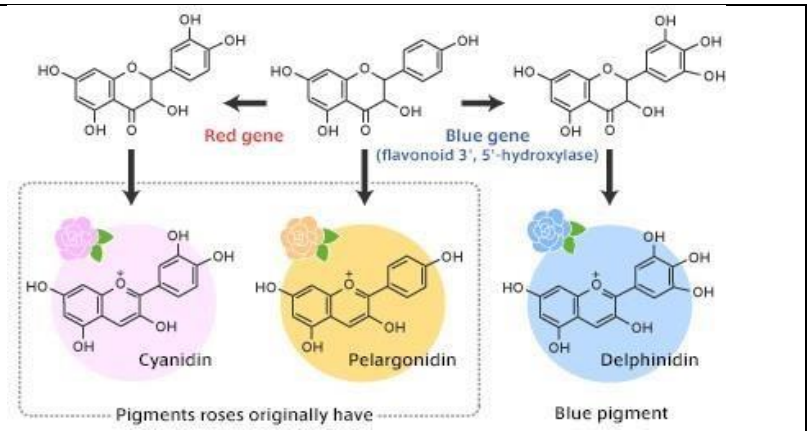
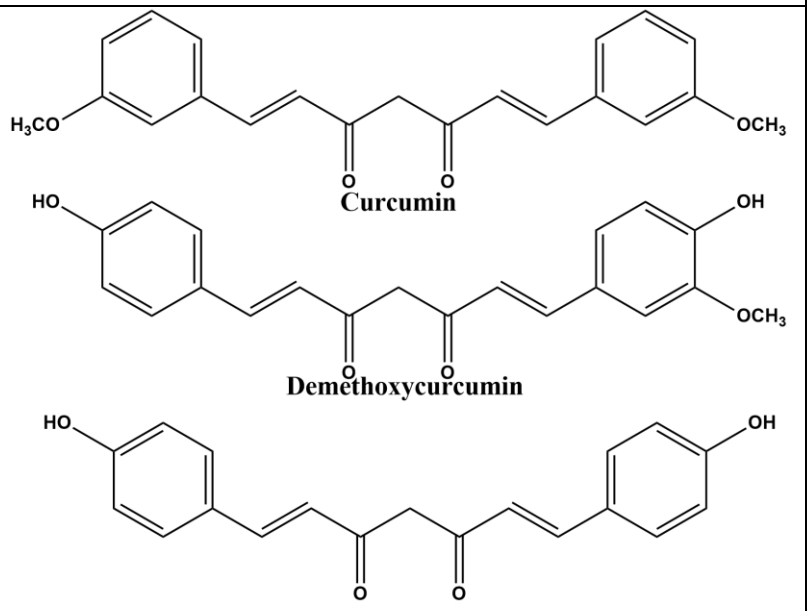
- ✓ Synthetic dyes are heavily used in textiles and industries while they have many problems like waste disposal. Other problems include they are not biodegradable, have water pollution, environment unfriendly, and carcinogenic. This situation leads to choose natural dyes as a reasonable replacement or solution, although we know that they are not successful in commercial.

- ✓ Demerits or Disadvantages of Synthetic Dyes

Some of these dyes are toxic, carcinogenic and can cause skin and eye irritation. 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.

2.1 STRUCTURE OF DYES

Beetroot	
Turmeric Powder	
Tea	

Rose	
Marigold	

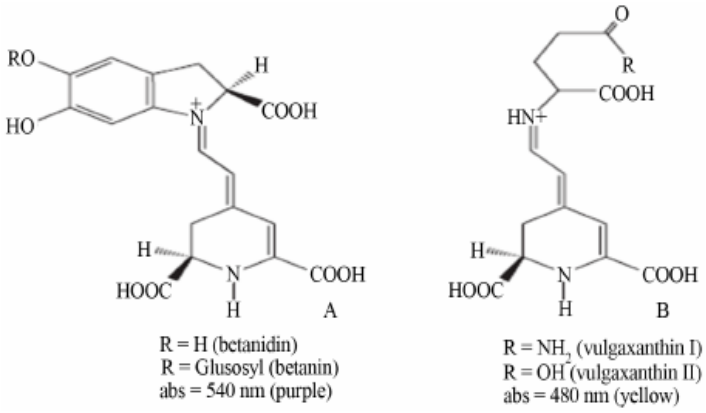
1.2 ACTION PLAN & TIMELINE

	July		August				September		Other details
	A-3	A-4	A-1	A-2	A-3	A-4	A-1	A-4	
Information	Information Education								
Production		Dye production							
Analysis				Analysis of dye chemical as physical					
Report writing			Advanced report writing			Final submission assignment Final submission assignment			
Report assignment						Advanced application assignment			

3 PROCESS

3.1 BEETROOT

Chemical structure



Process

There is a certain beauty to natural dyes that you just cannot get with regular fabric dyes. Although the results are not quite as colour-fast as store-bought dyes, they are gorgeous in their own way. The process is simple, and once you know how to do it with beets, you can try using other natural products, such as red cabbage or turmeric.[2]

In recent years used in various chemical or synthetic colours are used in major field like Agriculture molecular biology and food technology etc. (Fariha Kabir et al., 2019). the replacement of these harmful chemical colours must be done using natural colorants the natural colours of beet root enhance the physical as well as nutritional properties of food and food products such as (vitamins, minerals, and antioxidant). (Tanmay Sarkar et al., 2015). Now a days, the new trend in food additives tends to use of natural food colorant in colouring of food. Red beetroot is a good tonic for human health. (Dorcus Masih et al., 2019).

Soxhlet Extraction

Fig. - 1 Soxhlet Assembly

Table-1 Observation

Temperature(+1degreeCelsius)	Observation of water Sample after
5	Very light pink
10	Very very light pink
15	Pink
20	Pink
25	Dark pink
30	Very dark pink

Put the beets in a pot, then fill the pot with water. How much water you use depends on the size of the pot. Use enough water to fill the pot 1 to 2 inches (2.5 to 5.1 cm) apart. Do You will boil the water in no time, so the temperature does not matter. In a separate pot put white saturated or hemp cloth. The pot needs to be large enough to allow the cloth to move freely. For best results, wear clothes made of white cotton or linen use It would be a good idea to pre-wash the cloth. This will remove any chemicals that stain the color Can prevent adhesion. Natural dyes do not adhere well to synthetics, so use natural materials such as cotton or linen. You can also use this method to dye items of clothing, whether they are made from white cotton or linen.[3]

Fill a cloth pot with 1-to-4 times the water solution. First fill the vessel about one-fourth full with vinegar. Push through the cloth to soak it up, then fill the remaining three-quarters of the pot with water.

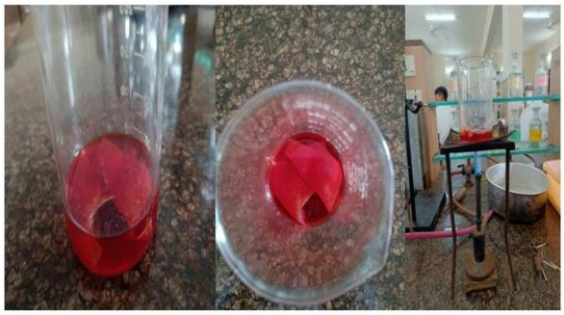


Fig-2 beetroot dyeing in fabric

Pour folic into the pot, then stir. Be careful to pour the dye slowly so that it does not splash. Then, shake the pan to make sure everything is submerged; Under the folds of your clothes May have to push to stay. You cannot fill the phallic pot all the way. This is because when you cook them How much water was evaporated from the beet.Soak the cloth in off-heat dye for 12 to 24 hours. There is no need to soak it for more than that. However, ensure that the fabric is fully submerged, otherwise it may not dye evenly. If necessary, weigh down with a cloth plate, bowl or jar.[4] Remove the vessel from the stove. Do not let the sadhu dye bath boil for 12 to 24 hours.

Doing some work and getting the colors. Remove the fabric from the dye bath and wring it out. Do not rinse the cloth, or you will burn However, you can bring a vignette. Just pull out the fabric and the excess dye from it Squeeze gently. It may be a good idea to wear plastic gloves for this step. Beet water for few days May stain your hands. If you do not mind a light shade of pink, you can wash the fabric in cold water. Dry the cloth in hot sun or in a dryer. Heat is key to setting the color in the fabric. If you live in a breezy, sunny climate, drying the fabric outside is best. Otherwise, throw the fabric in the dryer and dry it on a low heat setting. you are drying the fabric outside, place a dish or bucket underneath it to catch any dye drips.[5]

3.1.1 Preparing the Dye and Fabric

Peel 3 to 4 beets, then cut them into large chunks. The size of the chunks doesn't really matter, but something between 1 and 2 inches (2.5 and 5.1 cm) would work great. Don't use whole beets, because they won't release enough dye. You don't want to cut the beets too small. If you do, the pieces will be harder to remove later on.

Place the beets into a pot, then fill the pot with water. How much water you use will depend on the size of the pot. Use enough water to fill the pot 1 to 2 inches (2.5 to 5.1 cm) from the rim. You will be boiling the water shortly, so the temperature does not matter.

Fill the clothing pot with a 1-to-4 ratio of vinegar-to-water. Fill the pot about a quarter of the way with vinegar first. Push the fabric into the vinegar to ensure that it's soaked through, then fill the remaining three-quarters of the pot with water.[4]

You are only doing this for the pot that has the fabric in it. Don't add anything to the pot with the beets in it.

The vinegar will act as a fixative and help the dye adhere better to the fabric.

Alternatively, use 1/2 cup (150 g) of salt for every 8 cups (1.9 L) of water

3.1.2 Dyeing the Fabric

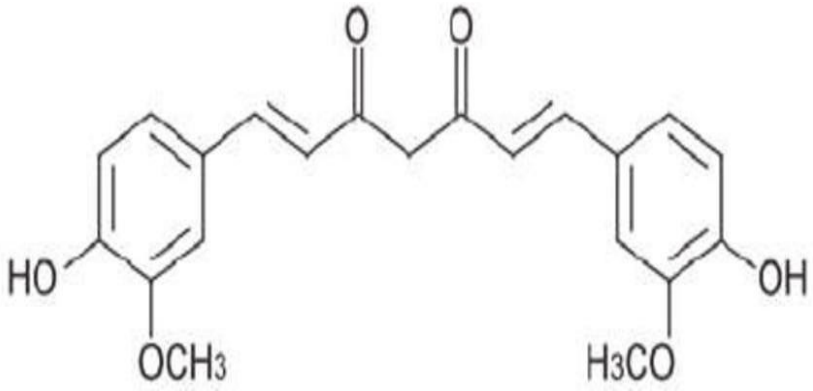
- ✓ **Bring both pots to a boil on the stove.** Set each pot down on a separate burner. Turn the heat up to medium or medium-high, then wait for the water to come to a boil. This may take a few minutes.[6]
- ✓ Wait for *both* pots to come to a boil before moving on to the next step.
- ✓ **Reduce the heat to low, then let both pots simmer for 1.5 to 2.5 hours.** Again, you want this to happen simultaneously for both pots. Turn the knobs for both burners to low, then wait for the water to reduce to a simmer. Set the timer for anywhere between 1.5 and 2.5 hours.
- ✓ The longer you let the water simmer, the brighter the color will be.
- ✓ **Empty the water from the fabric pot.** Use a wooden spoon, or something similar, to hold the fabric in place as you pour out the vinegar water. Don't worry if there is some liquid left in the pot.

    - Don't empty the water from the dye pot.s

- **Remove the beets from the dye pot.** You can use a regular spoon to do this, but a slotted spoon would work even better. Discard the beets or save them for a recipe.[9]
    - Save the red dye leftover from the beets. Do not dump this out.
- **Pour the dye into the fabric pot, then stir the dye.** Be sure to pour the dye slowly so that it does not splash. Next, stir the pot to ensure that everything is submerged; you may have to poke the folds of fabric to get them to stay down
- **Soak the fabric off-heat in the dye for 12 to 24 hours.** There is no need to soak it for longer than that. Make sure that the fabric is fully submerged, however, or it may not dye evenly. If you need to, weigh the fabric down with a plate, bowl, or jar.[11]
- Take the pot off the stove for this. Don’t let the dye bath keep simmering for these 12 to 24 hours.

3.2 TURMERIC POWDER

Chemical structure



Process

a sophisticated poerculation method. This method of distillation is also called Soxhlet distillation because of the specially designed apparatus. This is a phenomenon where the same amount of solvent by evaporation and subsequent condensation, the drug is made to circulate through the extractor. is coming. In separating solvent and glassware containing RBF, sample compartment and flux condenser is coming. which is assembled with suitable materials to form a complete device.[6]

The solvent in the bottom vessel is heated to boiling and the vapor is passed through the side Then the flux goes to the condenser. Here, the vapor liquefies and drops into the base containing the thimble Does what has to be done. The condensed liquid gently penetrates the contents of the thimble and its Removes ingredients. This increases the level and siphon tube as the liquid reaches the point of return, and the contents of the decomposition chamber are transferred to the RBF.Evaporation and reflux of the solvent can be continued as many times as possible without changing the solvent, so that an efficient purification can be obtained. The final amount is collected in the RBF.

Advantages

- ✓ Small amount of solvent is required due to solvent reduction.
- ✓ Completion and completion in less time.
- ✓ Suitable for lab-scale operation.
- ✓ Can be a model to compare with recent methods of imaging.

Disadvantages

- ✓ Thermolabile is not suitable for hydrocortamates, because the case is constantly heated.
- ✓ Not suitable for large incisions.
- ✓ Not suitable for high boiling solvents such as water.
- ✓ It takes 8, 16 or 24 hours to complete the screening process, which is a waste of time and money.

Method

About 50 g of turmeric powder was extracted with 95% alcohol in a Soxhlet assembly, The matter was drawn out until all the color was gone. The alcoholic extract was distilled to a dark brown solid (about 4.5%) The crude extract was dissolved in 50 ml of benzene and extracted twice with equal volumes of 0.1 per cent sodium hydroxide. Combines alkaline extracts and

acidifies with dilute hydrochloric acid. A yellow precipitate was formed. Allow to settle for about fifteen minutes.[8]

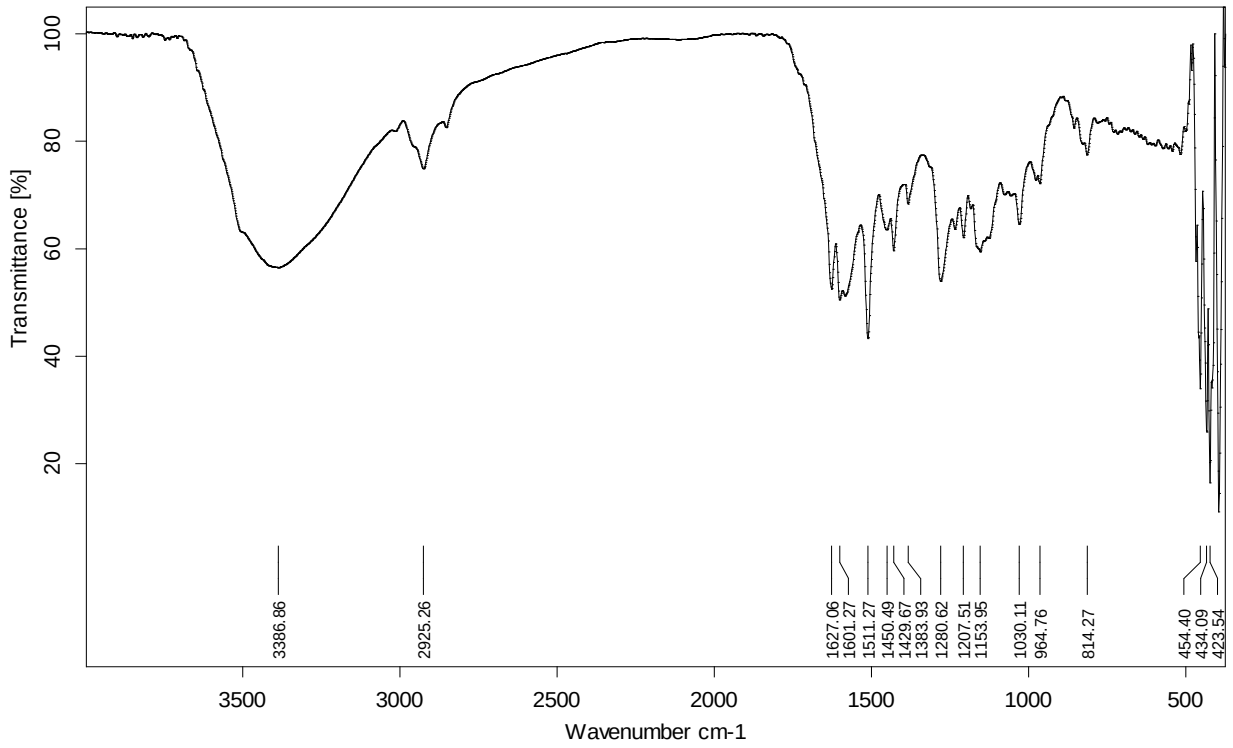
After the precipitate has set, concentrate the extract by boiling on a water bath or by dissolving the precipitate in boiling water at the same time. During this process of boiling, which solidifies aggregates and forms a lumpy mass. The solution was heated and concentrated to a very small volume by filtration. It was set aside for slow precipitation of turmeric, which was later dried, denatured and the percentage yield was calculated.

FIG-3 TURMERIC DYEING IN FABRIC

- Turmeric Soxhlet was isolated from turmeric powder by extraction method. The percentage yield was 1.96 W/wt.
- Pour a 1- to 4-fold vinegar-to-water solution into a dishcloth. First fill the vessel about one-fourth full with vinegar. Dip a cloth in the vinegar to soak it up, then fill the remaining three-quarters of the pot with water. You are only doing this for those pots that contain phallic.[9] Do not add anything to the pot with it.The vinegar will act as a depressant and help the dye adhere better to the fabric.Boil both the vessels on the stove. Set each pot down on a separate rack. Thermal K Turn the stove to medium-high, then wait for the water to boil. This may take some bending. Wait for both pots to boil before proceeding to the next step.
- Lower the heat, then let both the vessels simmer for 1.5 to 2.5 hours. Again, you want this to happen simultaneously for both pots. Turn the water knob to low, then wait for the water to reduce to a boil. Set the timer anywhere between 1.5 to 2.5 hours. Pour folic into the pot, then stir. Be careful to pour the dye slowly so that it does not splash. Then, shake the pan to make sure everything is submerged; Under the folds of your clothes.

- May have to push to stay. You cannot fill the phallic pot all the way. This is because when you cook them How much water was evaporated from the beet.
- Soak the cloth in off-heat dye for 12 to 24 hours. There is no need to soak it for more than that. However, ensure that the fabric is fully submerged, otherwise it may not dye evenly. If necessary, weigh down with a cloth plate, bowl or jar. [10] Remove the vessel from the stove. Do not allow the dye bath to boil for these 12 to 24 hours.

✓ IR THE TURMERIC POWDER



C:\Program Files\OPUS_65\MEAS\Turmeric.0	Turmeric	Instrument type and / or accessory	16/09/2022

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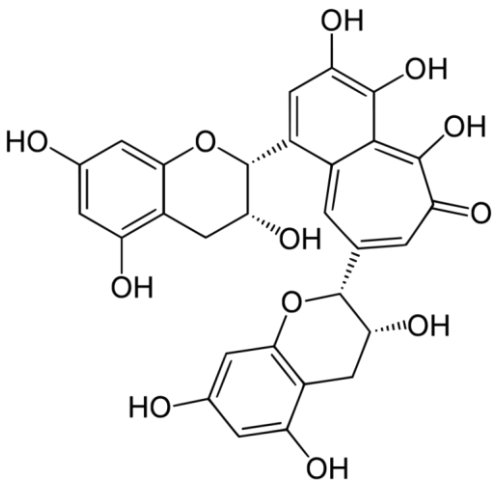
Table-2 Curcumin IR Value

Bond	Wavenumber(cm^{-1})
O-H	3380
C-H	2840-3095
C=O	1600-1700
C-H=O	1720-1740

3.3 TEA POWDER

Chemical structure



Process

50 g of tea powder was dissolved in 95% alcohol in a Soxhlet assembly. It was, until all the colors were gone, this matter was taken out. Alcoholic acid was observed as a semi-solid brown mass (about 4.5%). A portion of the crude was dissolved in 50 ml of benzene and the equivalent of 0.1 per cent sodium hydroxide. Was taken out indiscriminately with the quantity. Alkaline alkanes form and react with hydrochloric acid. yellow A colored precipitate was formed. About fifteen Namanut monks agreed to settle down. The precipitate is then concentrated by boiling on a water bath and boiling at the same time. Concentrate the unit by dissolving the precipitate in water. During this period of boiling, the solids accumulate and form a lumpy water. Solyshu was deflated in a non-hot condition and a very small amount of concentrate was deflated. It was set aside for slow precipitation of Karkanyuman, which was subsequently dried, placed in a dense scatterer, and the percentage yield calculated.

FIG-4 TEA DYEING IN FABRIC

Step 1: Dyeing tea towels is an easy, inexpensive way to change the look of kitchen towels, tea towels, or any textile item. This tea does not drastically change the color of white fabrics, but it can help hide light stains and give clothes a vintage look. The best part is, as long as you can boil water,you can dye any phallic with water

Cultivation of tea

FIG-4 TEA BAG

- Remove the tea bags from their packaging and cut the strings. To prepare the tea, unwrap the tea bags and discard the packaging. Use a pair of scissors to remove the string, and discard it as well let Black tea works best for dyeing fabrics because the color of linen is deep. Like white or green tea Light colored teas do not work either.[11]
- You can also use loose tea to color your felik if you want. However, keep in mind that if you use tea bags, theprocess is less messy.
- Fill a big pot with water and boil it with salt. Fill a large pot with enough water to cover your cloth and let it drain freely. Add a little table salt, and place the pan on the stove. Turn the heat to high, and bring the water to a boil.
- Generally, you will need 4 cups or 1 liter for every yard or meter of fabric you are dyeing.(0.26 US gallons) of water you want to use.
- Let the tea steep in the water. When the water boils, take the pot off the heat and put it in a neti bag Put me down. Allow them to soak in water until the color comes out of the tea. In most cases, you will want to let the tea steep for at least 15 minutes. The longer you let the tea steep, the more color will come out and the darker your dyed fabric will be. Keep checking on the water to see if you are happy with the color before adding the fabric.[12]

- You can choose to soak the fabric overnight in tea to ensure that it has been dyed in a remarkable color. It is a good idea to stir or agitate the cloth in the tea bath frequently while it is soaking. It will help ensure that it colors evenly. You can see how dark it has become by removing it from the cloth at regular intervals. like,Be aware that the cloth will dry much lighter than it appears when wet, so you may continue to soak it longer than you think.[13]

DYEING PROCEDURE

The cotton samples were dyed with dye extract keeping M: L ratio as 1:50 dyeing was carried out at 95°c and continued for 1hour in aqueous extracts and 15 min in Hexane and Ethanol solvents in water bath.

EFFECT OF EXTRACTION TECHNIQUES ON THE COLOR MEASUREMENTS OF THE COTTON FABRIC

The test results as reported in (Fig. 3) revealed that the microwave extraction technique was much better than the Soxhlet extraction and water bath. When the natural dye containing plant materials is treated with water or any other solvent in the presence of ultrasound, very small bubbles or cavitations are formed in the liquid. These increase in size but upon reaching a certain size, they cannot retain their shape. When this happens, the cavity collapses or the bubbles burst creating high temperature and pressure. Millions of these bubbles forms and collapse every second. The creation of very high temperature and pressure during extraction increases the extraction efficiency within a short time. Also the process can be performed at lower temperature and therefore extraction of heat-sensitive dye molecules is better.[14]

EFFECT OF MORDANTS ON THE COLOR MEASUREMENTS OF THE COTTON FABRIC

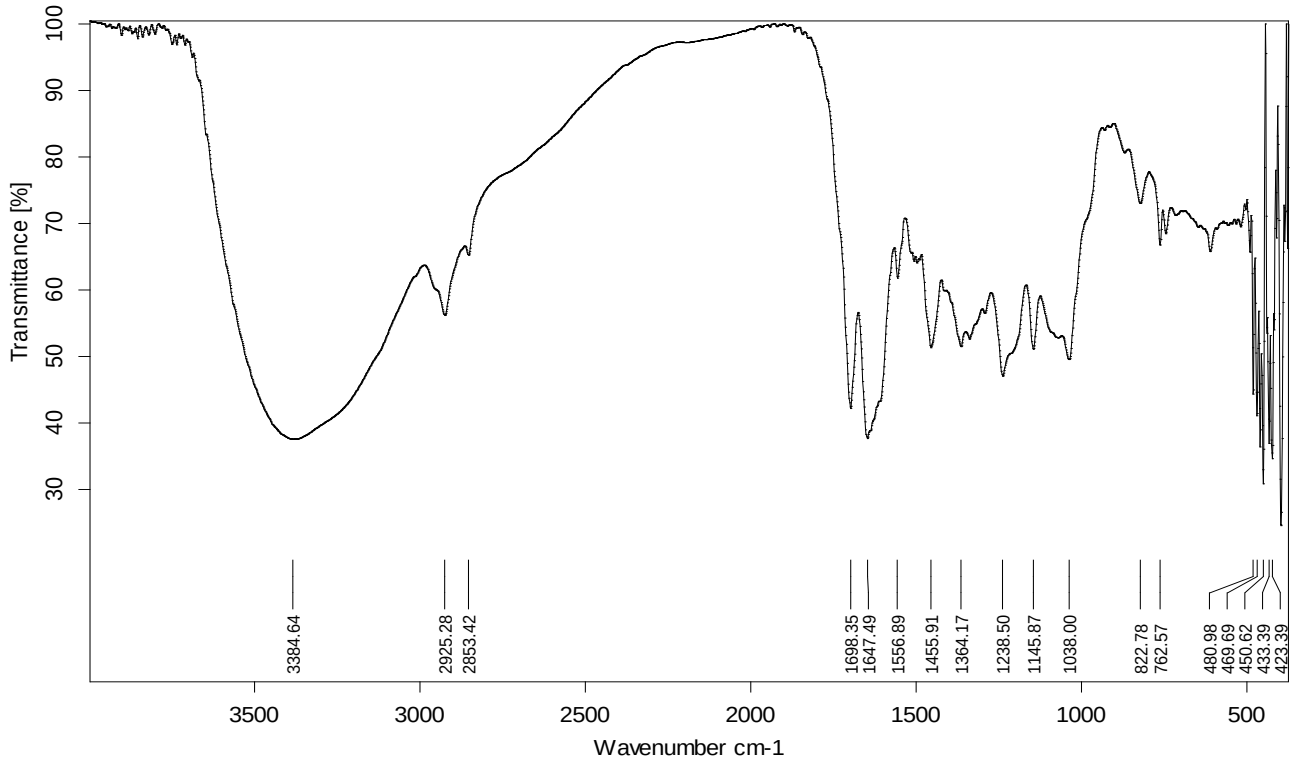
The results showed a marginal difference between K/S values of blank samples with and without mordents except in the case of ferrous sulphate which had the highest mean value of dyeing response. Use of ferrous sulfate following a pre-mordanting method increased the depth of shade of cotton much more than that obtained for the presence of (Copper sulphate, Tannic acid and Alum) in the dye bath. It is most likely that the Fe, with its complex forming ability form complex readily with theaflavins and thearubigins having hydroxyl and carboxyl groups in their structure as soon as such coloring component were exhausted into the cotton.

Fig-5 Tea Dyeing in Fabric

Table-3 Extracted method

Extracted Methods	Mordants	Ethanol		Water		Hexane	
		Blank Sample	Collagen Sample	Blank Sample	Collagen Sample	Blank Sample	Collagen Sample
Soxhlet Extracted	Pure	1.37	0.37	0.98	2.71	2.16	0.60
	Ferrous	2.87	3.00	2.67	2.34	2.03	1.61
	Aluminium	2.28	1.64	1.21	3.00	1.61	0.36
	Copper	1.83	2.75	1.00	3.36	1.83	0.67
	Tannic	1.37	2.07	1.03	3.80	1.35	1.55
Water bath Extracted	Pure	0.46	0.48	0.93	1.98	0.12	0.36
	Ferrous	1.30	1.35	0.87	1.92	0.93	0.92
	Aluminium	0.22	1.35	1.31	1.06	0.21	0.26
	Copper	0.48	1.06	2.60	0.95	0.37	0.35
	Tannic	0.54	1.31	0.88	1.53	0.32	1.00

➢ IR SPECTROSCOPY



C:\Program Files\OPUS_65\MEAS\TEA.0	TEA	Instrument type and / or accessory	16/09/2022

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Table-4 Tea IR value

Bond	Wavenumber(cm^{-1})
O-H	3380
C-H	2840-3095
C=O	1600-1700
C-H=O	1720-1740

CONCLUSION

The present work showed that, tea leaves can be used as dye for coloring textiles. Different shades of color can be obtained using different chemical and natural mordants. The color yield of dyed samples K/S, and the total difference ΔE of all dyeing with collagen and mordants were quite good especially ferrous sulphate and also dye has good scope in the commercial dyeing of cotton.

3.4 ROSE

Chemical Formula

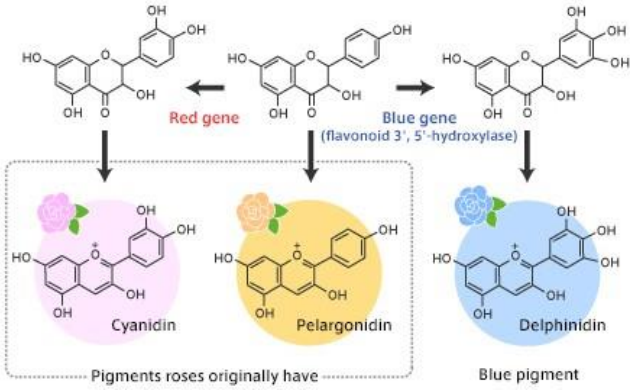


FIG-6 ROSE SOXHLET ASSEMBLY

Process

Prepare rose petals. In case of fresh, cooked eggs, you can use fresh or dried eggs.

- **Enforced methods**

In the aqueous solution, 10 g of fresh petals are slightly moistened with 1% aqueous solution. For boiling at 100 C temperature was done. Finally, default and study more Use for Alcoholic disinfection methods In the alcoholic sterilization method, 10 grams of fresh leaves are soaked in 50% alcohol for 30 minutes. A leaflet was used for further study.[15]

- **Alcoholic methods**

- Satu Rau cloth used for dyeing is boiled in 10% NaOH solution for 10 minutes. To remove starchy and other impurities from fabrics. NaOH treated satu Rau fabrics Then they were washed thoroughly with cold tap water.

- **Dyeing and Mordening**

- Ferrous Sulphate (FeSO4), Stanno chloride (SnCl2) and Copper Sulphate on clean raw cloth. (CuSO4) was treated with ninety percent modifiers.

- ✓ **Result and Discussion**

- Shades of ninety-nine colors were obtained from the ninety-nine parts of the red rose flower. A single color indicates solubility, which is mainly dependent on the denatured solvent. The rating of fastness properties of dyes and modifiers is given in Table-1.

Sr. No.	Solvents	Cotton fabrics
1	Aqueous	Good
2	Alkaline	Good
3	Acidic	Good
4	Alcoholic	Good

1) Aqueous Extract

2) Alkaline Extract

3) Acidic Extract

4) Alcoholic Extract

Fig-7 Solvent extraction with combinations of nine red and yellow color mordents (Plate-1,2,3 and 4) were obtained from colors

1) Aqueous Extract

2) Alkaline Extract

1) Aqueous Extract

2) Alkaline extract

3) Acidic Extract

4) Alcoholic Extract

3) Acidic Extract

4) Alcoholic Extract

Fig-9 PLATE- 1 APPLICATION OF FERROUS SULPHATE (FESO4) WITH DIFFERENT EXTRACTS ON COTTON FABRIC

PLATE- 2 APPLICATION OF STANNOUS CHLORIDE (SNCL2) WITH DIFFERENT EXTRACTS ON COTTON FABRICS

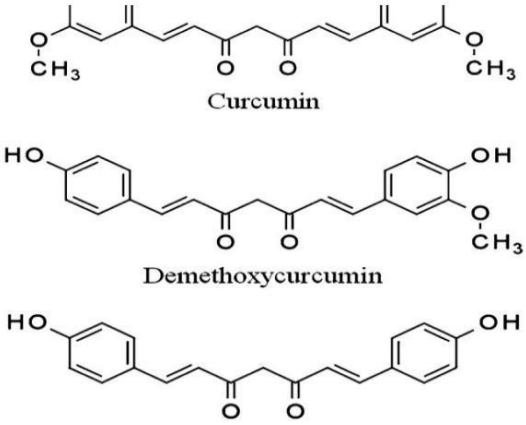
PLATE- 3 APPLICATION OF COPPER SULPHATE (CUSO4) WITH DIFFERENT EXTRACTS ON COTTON FABRIC.

The colour strength also depends upon use of Mordent [(4)]. Mordents are the metals salts having tendency to co-ordinate with dye and fibers [(5)]. The aqueous extract gives gray colored shade with combination of Mordent such as $FeSO_4$, $SnCl_2$ while, in combination with $CuSO_4$ gives dark black colored shade on cotton fabrics. The brown, yellow and Spanish olive colour shades were obtained in alkaline extract with $FeSO_4$, $SnCl_2$ and $CuSO_4$ Mordent respectively. The acidic extract with $FeSO_4$, $SnCl_2$ and $CuSO_4$ mordant gives pink, dark red and copper colored shades respectively. While, alcoholic extract gives Black colour with $FeSO_4$, violet with $SnCl_2$ and dark pink shade with $CuSO_4$ Mordent. Our results showed close conformity with findings of Neha Grover and Vidya Patni [16]. They obtained various colour shades with three different Mordent viz. $FeSO_4$, $SnCl_2$ and $CuSO_4$.

Conclusion:

Thus, results obtained from present investigation revealed that, the red rose flower has the dying potential as a source for cotton dying. Dyes obtained from red rose flower can be used as cost effective and economically commercial for various industries such as textile, cosmetics, leather, food and pharmaceuticals.

3.5 MARIGOLD DYE



- Mexican Mary Gold, Tegetseracta, is originally native to central and northern Mexico around the state of Panama. However, it has become one of the world's most popular flowering plants due to its brilliant yellow flowers and ease of cultivation. In the United States it is often eaten as a garnish, but in Thailand also as a topping for flower petals or salads. is used. In India, galgota is grown on a large scale and in the streets outside sold in.[17]
- Recommended readings

- **Dipo**t. Use a large die-pot to hold your fish, which has plenty of room to move around and
- allow the liquid to circulate freely. The dye particles may stick to the fabric and cause darkling.
- **Metal Tongs**. A pair of tongs is useful for pulling in and out of cloth. Use tongs for painting, notfor food preparation.
- **rubber gloves**. Wear rubber gloves when handling any powder and before handling the modified/dyed fibers.
- **Candy thermometer**. The best way to keep track of temperature is to use a candy thermometer

- Clips into the side of the dipot. scale. For weighing fiber, modient and akaya powder Use a scale.

  - Recommended Supplies

- **Diapot.** :- Use your large diapot to hold all your fibers, In which there is a lot of space for them to rotate and the liquid can rotate. Otherwise, The pigments can be crushed on the skin and as a result, the clouds can be scratched. Tongs of metal. A pair of tongs is used for waving and pulling out the fabric. Coloring Use nested tongs, not to prepare food.
- Rubber socks. While managing the away powder and the moderate/dyed fiber
- Wear rubber socks while operating you before it has done.
- **Candithrmometer:** - The best way to keep track of the temperature is to use a candy thermometer which Claps to the side of the diapot. Scale. To weigh fiber, moderate and other powder Use Scale

Pre-treatment

- Color Extract
- Mordting (compress the color with fiber)
- Dye

Fig-10 Marigold Dye extract

• The destruction of Galgota powder The petals were separated, dried in the sun, Powder was made and −20 °C for further study. was preserved .

✓ **Fastness tests**

- The dyed material was tested for wash fastness, light fastness, and rubbing fastness. The colour is usually rated by loss of depth of colour in original sample [7]. The required condition for the tests is specified in different standard
- including International Organization for standardization (ISO) and the American Association of Textile Chemists and Colourists (ATCC). ISO 105 B02:1994 Amd: 2000, AATCC TM 61-2010, ISO 105 X12:2001 were used for light fastness, wash fastness and rubbing fastness respectively.
- Scores for wash fastness and rubbing fastness: 5-excellent; 4-Good, 3- Fair, 2-Poor, 1-Very Poor
- Scores for light fastness: 1- Very Poor; 2-Poor; 3- Moderate; 4- Fairly good; 5-Good; 6-Very good; 7- Excellent; 8- Outstanding.

✓ **GC-MS analysis**

C-MS analysis of the dye extracts (Ethanol extract, Methanol extract and aqueous extract) obtained from the flowers

of Tageteserecta L. was performed using a Perker- Elmer Clarus 680 system coupled with Clarus 600 (EI) Mass spectrometer (MS). The Acquisition parameters of the GC-MS system were as follows: Oven: Initial temp 60°C for 2 min, ramp 10°C/min to 300°C, hold 6 min, InjAauto=250°C, Volume=0 µL, Split=10:1, Carrier Oven: Initial temp 60°C for 2 min, ramp 10°C/min to 300°C, hold 6 min, Inj Aauto=250°C, Volume=0 µL, Split=10:1, Carrier Gas=He, Solvent Delay=2.00 min, Transfer Temp=240°C, Source Temp=240°C, Scan: 50 to 600Da, Column 30.0m x 250µm.The results were analysed using Library version NIST-2008 (software:

Turbo Mass ver.5.4.2).

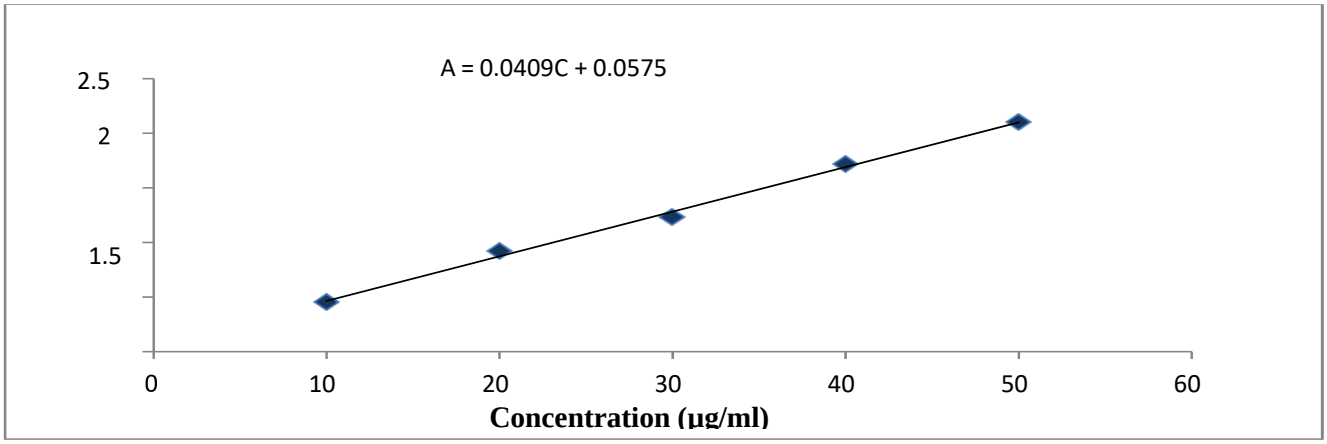


Fig.11. Standard curve of Quercetin

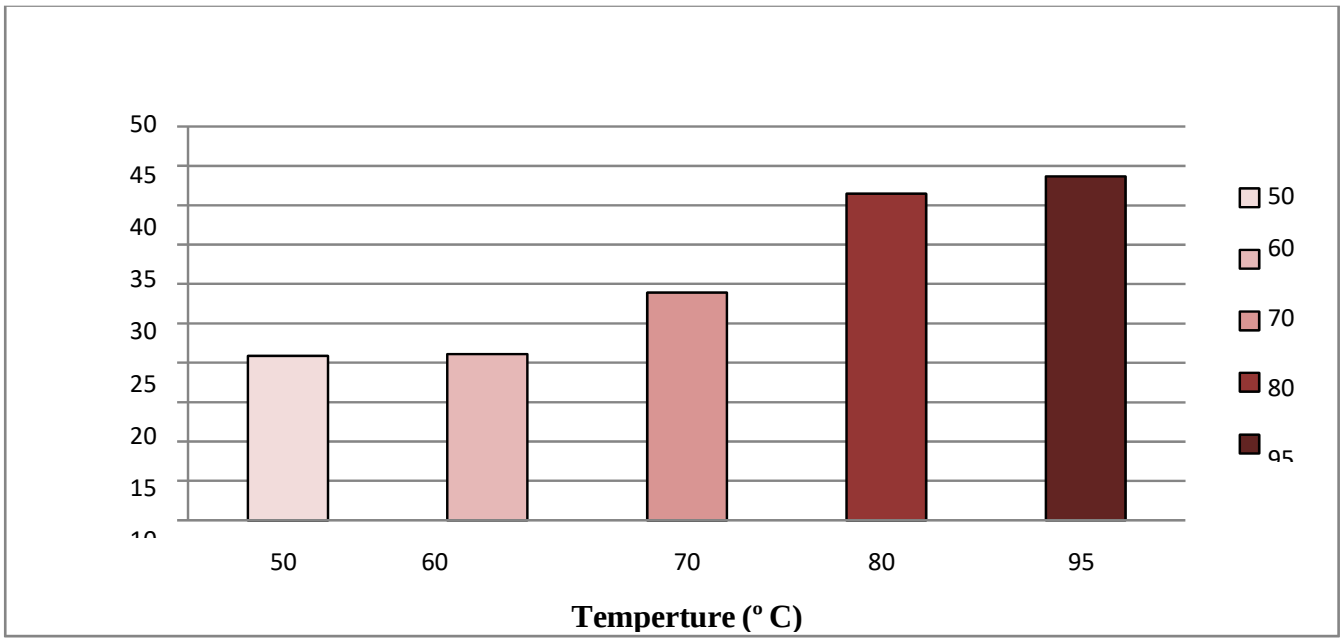


Fig.12 Dye concentration at different temperatures (Aqueous extraction)

A dark yellow natural dye extract was obtained from Tageteserecta by using conventional methods and Soxhlet extraction method. In case of conventional methods, the extraction process was carried at different temperatures and with different solvents with an explicit objective of determining the optimum extraction conditions. The strength of the dye extracts increases with increasing temperature. Dye extracted from the marigold usually contains flavonoids and carotenoids. The major flavonoids present in the marigold flower are Quercetagin-7-methyl ether, Quercetagin- 5-methyl ether, Quercetagin-5, 7-dimethyl ether and Quercetagin-3-O-glucoside [16]. Figure (2) shows the concentration of dye extracts obtained at different temperatures in aqueous extraction method. The maximum concentration of dye extract was obtained at 95ºC. Whereas figure (3) shows the concentration of dye extracts obtained using different solvents. The maximum concentration was obtained when 70% Ethanol was used as an organic solvent.

COLOURING EFFECT OF EXTRACTED DYE AND MORDANTS

Dark yellow extract was obtained from the flowers of Tageteserecta. Mordants play a very important role in imparting color to the fabric. The mordants used in combination in different ratios gave various shades to the fabrics and yarn samples. Better color strength results are dependent on the mordant used. The different shades were obtained from a single dye, using different mordants like Potassium dichromate, stannous chloride, Potash alum, Copper sulfate, and ferrous sulfate. The mordanted cotton and wool yarns were immediately used for dyeing because some mordants are light sensitive. Figure 4 shows the samples dyed with the extracted dye without using any mordant, whereas figures 5, 6, 7, 8 and 9 show the dyed samples pre-mordanted with Potassium dichromate, Stannous chloride, Potash alum, Copper sulfate and Ferrous sulphate respectively. The intensity of the color produced on cloth and yarns by dyeing without mordanting was found slightly less than that obtained for mordants and dye used successively. The application of natural dyes in textile industry for various purposes, viz. Dyeing of yarns, which are then woven into cloth, carpet or any other usable form; dyeing of cloths woven earlier and block printing, where the textile materials are printed with the help of printing blocks. Natural dyes are now as days in demand not only in textile industry but also in cosmetics, food, leather, and pharmaceuticals. The rich diversity of our country has provided us plenty of raw materials, yet sustainable linkage must be developed between cultivation, collection, and their use.[18]

Fig-13: Coloring effect of dye (no mordant)

Fig-14: Potassium dichromate as a mordant

Fig-15: Stannous chloride as a mordant

Fig-16: Potash alum as a mordant

Table.6: Color measurement values for standard cotton sample

Sample	Illuminating sources	L*	a*	b*	% STR-WSUM
Standard for cotton samples	D65-10	76	-3.21	31.59	**100**
	A-10	77.46	3.88	30.39	**100**
	F02-10 (CWF)	**77.01**	**-2.49**	**36.5**	**100**

4 FASTNESS PROPERTY

DYE-1						
WATER	R1	R2	R3	R5	R6	R7
	0.5H	1.0H	1.5H	2.5H	3.0H	3.5H
25 DEGREE C	Good	Good	Good	Good	Good	Good
100 DEGREE C	Poor	Poor	Poor	Poor	Poor	Poor

DYE-1						
DETERGENT	DETERGENT	DETERGENT	DETERGENT	R5	R6	R7
				2.5H	3.0H	3.5H
DETERGENT	Poor	Poor	Poor	Poor	Poor	Poor
BLEACHING AGENT	Good	Bad	Bad	Bad	Bad	Bad

DYE-2						
DURATION	H2SO4	HNO3	CH3COOH	NaOH	KOH	Ca(OH)2
	1N	1N	1N	1N	1N	1N
1H	Good	Good	Good	Good	Bad	Bad
2H	Good	Good	Good	Good	Bad	Bad
3H	Good	Good	Good	Good	Bad	Bad

DYE-2						
WATER	R1	R2	R3	R5	R6	R7
	0.5H	1.0H	1.5H	2.5H	3.0H	3.5H
25 DEGREE C	Good	Good	Good	Good	Good	Good
100 DEGREE C	Poor	Poor	Poor	Poor	Poor	Poor

DYE-2						
DETERGENT	DETERGENT	DETERGENT	DETERGENT	R5	R6	R7
				2.5H	3.0H	3.5H
DETERGENT	Poor	Poor	Poor	Poor	Poor	Poor
BLEACHING AGENT	Good	Bad	Bad	Bad	Bad	Bad

DYE-3						
DURATION	H2SO4	HNO3	CH3COOH	NaOH	KOH	Ca(OH)2
	1N	1N	1N	1N	1N	1N
1H	Good	Good	Good	Good	Bad	Bad
2H	Good	Good	Good	Good	Bad	Bad
3H	Good	Good	Good	Good	Bad	Bad

DYE-3						
WATER	R1	R2	R3	R5	R6	R7
	0.5H	1.0H	1.5H	2.5H	3.0H	3.5H
25 DEGREE C	Good	Good	Good	Good	Good	Good
100 DEGREE C	Poor	Poor	Poor	Poor	Poor	Poor

DYE-3						
DETERGENT	DETERGENT	DETERGENT	DETERGENT	R5	R6	R7
				2.5H	3.0H	3.5H
DETERGENT	Poor	Poor	Poor	Poor	Poor	Poor
BLEACHING AGENT	Good	Bad	Bad	Bad	Bad	Bad

DYE-4						
DURATION	H2SO4	HNO3	CH3COOH	NaOH	KOH	Ca(OH)2
	1N	1N	1N	1N	1N	1N
1H	Good	Good	Good	Good	Bad	Bad
2H	Good	Good	Good	Good	Bad	Bad
3H	Good	Good	Good	Good	Bad	Bad

DYE-4						
WATER	R1	R2	R3	R5	R6	R7
	0.5H	1.0H	1.5H	2.5H	3.0H	3.5H
25 DEGREE C	Good	Good	Good	Good	Good	Good
100 DEGREE C	Poor	Poor	Poor	Poor	Poor	Poor

DYE-4						
DETERGENT	DETERGENT	DETERGENT	DETERGENT	R5	R6	R7
				2.5H	3.0H	3.5H
DETERGENT	Poor	Poor	Poor	Poor	Poor	Poor
BLEACHING AGENT	Good	Bad	Bad	Bad	Bad	Bad

DYE-5						
DURATION	H2SO4	HNO3	CH3COOH	NaOH	KOH	Ca(OH)2
	1N	1N	1N	1N	1N	1N
1H	Good	Good	Good	Good	Bad	Bad
2H	Good	Good	Good	Good	Bad	Bad
3H	Good	Good	Good	Good	Bad	Bad

DYE-5						
WATER	R1	R2	R3	R5	R6	R7
	0.5H	1.0H	1.5H	2.5H	3.0H	3.5H
25 DEGREE C	Good	Good	Good	Good	Good	Good
100 DEGREE C	Poor	Poor	Poor	Poor	Poor	Poor

DYE-5						
DETERGENT	DETERGENT	DETERGENT	DETERGENT	R5	R6	R7
				2.5H	3.0H	3.5H
DETERGENT	Poor	Poor	Poor	Poor	Poor	Poor
BLEACHING AGENT	Good	Bad	Bad	Bad	Bad	Bad

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