International Journal of Research in Engineering, Science and Management
Volume 6, Issue 1, January 2023
https://www.ijresm.com | ISSN (Online): 2581-5792

Extraction of Eco-Friendly Natural Dye from Variety of Vegetables

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***Abstract*: A large number of experiments have been performed of natural dyes from plants and vegetable wastes. Natural dyes helps in the reduction of pollution level in textile dyeing, in realization of eco- friendly agriculture productions, and pollution. The main idea of extracting dyes from natural sources is to avoid the environmental pollution. Present days with global concern over the use of eco-friendly and bio degradable materials, considerable research work is being undertaken around the world on the application of natural dyes in textile industry. The present study deals with the extraction of natural dye from this species, and their application on textiles. Pre mordant technique methods for extraction of dye from collected vegetables were evaluated to determine. The cotton types of fabrics were used in the experiment to observe the strength of dye. This method following steps: vegetables are naturally dried, and are added into deionized water for soaking then baking soda is added for regulating the pH value to 6-8, the temperature is increased to 70-100 and is maintained for 60-90 min, and the obtained product is cooled and filtered, and residue is removed. The vegetable dye is obtained. The various extract were analysed phytochemical compounds. The extracts were then treated with cotton fabric using the various chemical mordants. Based on analysis, the best mordant and technique for using mordant were determined for dying fabric.**

***Keywords*: Natural dye, Vegetable dye, Eco-friendly dye.**

1. Introduction

The main idea of extracting dyes from plants. Source is to avoid the environmental pollution. Present days with global concern over the use of eco- friendly and biodegradable materials, considerable research work is being undertaken around the world on the application of natural dyes in the textile industry, the effluent problem of synthetic dyes occur not only during their application in the textile industry, but also during their manufacture and possibly during the synthesis of their intermediates and other raw materials. The e of natural dyes for textile dyeing purpose, decreased to a large extent after the discovery of synthetic dyes in 1856. Dyes derived from natural source have emerged as an important alternative to synthetic dyes. Analytical studies such as IR spectrophotometry were performed on the extract. Natural dyes are dyes or colorant derived from plants, invertebrates, or minerals. The majority of natural dyes are vegetable dyes from plant sources – roots, berries, bark, leaves, and wood and other biological sources such as fungi.

Beetroot:

Betalain pigment can be used as an unnatural additive for food, cosmetics, and drugs. Beet powder can be a good source of antioxidants. To increase the acceptability of food. Beetroot dyes are less toxic. Beetroot are a great source of fiber, folate manganese, potassium, iron, and vitamin C. Beetroot juice have been associated with numerous health benefits, including improved blood flow, lower blood pressure. Beetroot are a unique source of betalains - a type of phytonutrient. These compounds are known to provide powerful antioxidant, anti-inflammatory and detoxification. It prevents fatty acids from building up and stimulates the liver, Cells. Now a days growing demand for eco- friendly / non- toxic colorants, specifically for health sensitive application such as coloration of food.

Onion:

Plant have been used for thousands of years to make natural dyes. Onion skins are one of the best natural source. In recent years, the textile industry has been severely criticized for their contribution to environmental pollution. The dry outer skins of onions can be used for coloring natural textile materials. Onion skins are simple for a few reasons, they are easy to source, they are food safe, and they do not require the aid of a mordant to achieve colorfast fabric. Onion skins do not need a mordant because they are naturally high in tannin, which binds of the color to the fabric, creating lasting, colorfast fabrics. Onion skin create an earthy range of colors. Protein fibers such as wool and silk, dye pale to medium nutmeg brown. Cellulose fibers such as cotton, hemp, with a mix out of champagne, pale, and silver pink. It is possible to extract natural dyes from byproduct such as food, wood and agricultural waste at lower costs, these extracts have other interesting properties that allow the functionalization of textiles with UV protection and antimicrobial activity.

Carrot:

In India, it was widely used for coloring of fabrics and other materials. In order of meet the growing demand for natural colorants, new pigment crops are being sought. Natural dyes from plants are of increase attention as alternate source for synthetic dye in the food. And pharmaceutical industry and they increase their added value if they possess positive effects on health and some added qualities like antifungal properties. The ancient people exclusively used dyestuffs of vegetable, minerals, and animal origin, all easily obtained in their own

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vicinity. It is a cheap and abundantly available dye source. On a different research line this work has been focused on the development of new dye source and rapid method for the effective dyeing with carrot or daucus carrot. Carotenoids are the pigment responsible for the colors of many plants including carrot roots.

Cabbage:

Cabbage is an important winter vegetable crop, which provides more vitamins, minerals and fibers to our diet and also have some medicinal properties. Red cabbage contains are anthocyanin based dye that can be used as Commonly used as a solvent in the food industry. It is rich source of an anthocyanin pigments. The importance of color in textile has been recognized from thousands of years and ancient writing contains frequent reference for it.

2. Materials and Method

A. Sample Collection

Fresh vegetables especially with bright colors were selected from local market.

1) Preparation of vegetable extract

Vegetables especially with bright colors were selected. The vegetables using for petal extraction .5-10gms of grated vegetables was added to 100ml of distilled water and was boiled well until the dye was released in water. This can be done for at least 15-20 mins for the complete extraction. After the dye is extraction, it is stored in the refrigerator for further use.

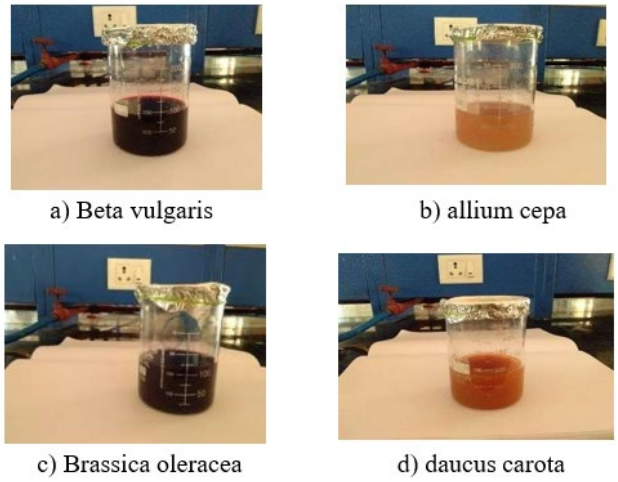

Fig. 1.

2) Mordant

A mordant or dye fixative is a substance used to set (i.e. bind) dyes on fabrics by forming co-ordination compounds with the dye, which then attaches to the fabric (or tissue). It may be used for dyeing fabrics or for intensifying stains in cell or tissue preparations. Although mordants are still used, especially by small batch dyers, it has been largely displaced in industry by directs. The term mordant comes from the Latin *mordere*, "to bite". In the past, it was thought that a mordant helped the dye bite onto the fiber so that it would hold fast during washing. A mordant is often a polyvalent metal often chromium (III). The resulting coordination complex of dye and ion is colloidal and can be either acidic or alkaline

Mordanting was carried out in three stages:

- Pre-mordanting
- Simultaneous mordanting
- Post-mordanting

Pre-mordanting:

In pre-mordanting the scored fabrics were first treated with mordant and then dyed using extracts for each plant separately. The fabrics were treated with each of the mordant mentioned above at the 1:10 M:L ratio for 40 minutes at 30 ± 20C. Then the mordanted fabric was used for dyeing.

Simultaneous mordanting:

In this method the fabrics were immersed in equal mixture of the mordant and the dye extract for 40 min at 28 C followed by washing and drying of the dyed fabrics.

Post-mordanting:

In case of post-mordanting, the dyed fabric was treated with mordants at 30±20C for 50 min with M:L ratio 1:10

Preparation of mordant:

Alum:

0.748g of alum and 0.187g of washing soda were mixed in 100 ml of water and was stored for further use.

Vinegar:

50ml of 5% acetic acid is mixed with 100ml of water. From that 25ml of it were taken and mixed with 100ml of distilled water.

Salt:

5g of sodium chloride was mixed in 100ml of distilled water and was used as a mordant and stored for further use. The vegetable is prepared. In another pot, the fixative recipe is prepared. It is brought to a light boil and the fabric is added. The fabric is simmed in the fixative for at least an hour. After an hour, the fabric is carefully pulled out from the simmering fixative and is wrung out completely. Next, a new pot with the fixed fabric is taken. The fixed fabric is immersed in the dye which is already extracted it is then boiled and simmed until the fabric taken up the dye at least for an hour. The fabric is then removed and placed on the newspaper or tile to dry. Since the fabric takes up the dye it is ready to be used for commercial purpose.

Phytochemical test:

Phytochemical are naturally occurring, biologically active chemical compounds in plants. He prefix `phyto' is from a Greek work meaning plant. The presence of certain type of phytochemicals in some plants can act as a natural defense system providing protection against such things as attack from insects and grazing animals. In contrast, other plants product phytochemicals that provide color, aroma and flavor, thus inviting attention from potential consumers.

Phenol:

A small amount of the substance is taken and a few drops at alcohol and few drops of ferric chloride were added. It is shaken well till the appearance of greenish yellow color which indicator presence of phenol.

Tannin:

0.5g of substance is mixed with 20ml of distilled water and

it is boiled for some time and then few drops of 0.1% ferric chloride was added. It is mixed well till the appearance of brownish green color which will indicator the presence of tannin.

Flavonoids:

Small amount of substance is taken and mixed with 10% sodium hydroxide which results in greenish brown color which indicator the present of flavonoids. This compound is present in almost all the brightly colored flowers, fruits, and vegetables.

Saponin:

Small amount of substance is shaken with a small amount of distilled water appear of frothing indicator the presence of saponin.

Steroids:

The small amount of substance is mixed well with a few drops of chloroform. Then, a drop of acetic acid it added and mixture is heated for few min after which few drops of concentrated sulphuric acid is added. Appearance of orange color will indicates the presence of steroids.

Quinine:

The substance is mixed with few drops concentrated hydrochloric acid appear of green color indicator the presence of quinine.

Cellulose:

Small amount of substance is mixed with iodine crystal and then a few drops of concentrated sulphuric acid added. Appear of brown color indicator the presence of cellulose.

Table 1

Vegetables	Alum	Vinegar	Salt
Beetroot	-	+	-
Onion	+	-	-
Carrot	-	-	+
Red Cabbage	-	+	-

Terpenoids:

The substance is mixed with 2ml of chloroform and then few drops of concentrated sulphuric acid is added. Light orange color appear confirms the presence of terpenoids.

Glycosides:

The substance is mixed with 2ml of glacial acetic acid and one drop of ferric chloride is added followed by 1ml of concentrator sulphuric acid and is mixed well. Appearance of brown color indicator the presence of glycosides.

3. Results and Discussion

The dye extracted from the plant and the color of the dye is depended on the compounds present in the respective plants. The dye is then used in the cotton fabric for the fixation of color. The cloth which is displayed above got fixed to the respective dye with the help of mordant. Different mordant were used for different plants. The mordant used, were shown in table 2.

Table 2

S.no.	Samples	Result
1	Beetroot	Vingar
2	Onion	Alum
3	Carrot	Salt
4	Red cabbage	Vingar

These mordants when added to the dye gave different shades of color and thus enable us to make different types of shades from one plant using the mordant. The mordants alum and cream of tartar is directly added to the dye whereas, in case of vinegar and salt the cloth is treated with those mordant and then it is immersed into the dyes. This gives better results than directly adding the mordant into the bye. Because, when treated using heat the mordant sticks into the fabric well again and when the cloth is treated with the dyes, the color does not fade and stays forever

Phytochemical Test:

Table 3

Compounds	S1	S2	S3	S4
Phenol	+	+	-	+
Tannin	+	+	-	+
Flavonoids	+	-	+	+
Saponin	+	+	+	+
Steriods	-	-	-	+
Quinin	-	-	+	-
Cellulose	+	+	+	+
Terpenoids	+	+	+	-
Glycoside	-	+	+	+

4. Conclusion

The present scenario is focused more towards the utilization of the vast diversity of natural resources of colour pigments for their use in food materials, pharmaceuticals and textiles, in place of their synthetic counterparts. We used different type of natural dyes extracted from selected vegetables. This natural dye was extracted with help of boiling as per required for process. In this work dye is applied on 100% cotton fabric with mordant (Alum, Salt, Vinegar). This natural dye does not have any effect on human body. Our analysis was to choose proper dyeing recipe for cotton , so that we could get the optimum results ,from our research came to know that the natural dyes along with mordant are giving better result on 100% cotton fabric for given natural dyes .

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