



NATURAL DYE EXTRACTION FROM SOLANUM LYCOPERSICUM

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Abstract — The wastewater released from textile plants causes high amount of pollution considering the volume generated as well as the effluent composition. To combat the problem, this paper focuses on alternative dying options using the organic waste present in households like tomato remains. The dye was extracted by alcoholic method and the dye was analysed by applying on 100% cotton fabric. Different shades were produced using mordents like ferrous sulphate, copper sulphate, sodium chloride and potassium dichromate. Since tomato remains are readily available and are cheap, they can be used to create natural and biodegradable dye.

Keywords- Tomato, Cotton Cloth, Natural Dye, Mordent, Organic waste.

I. INTRODUCTION

It is estimated that over 10,000 different dyes and pigments are used industrially and over 7×10^5 tons of synthetic dyes are annually produced worldwide. Unfortunately, most of these dyes escape conventional wastewater treatment processes and persist in the environment as a result of their high stability to light, temperature, water, detergents, chemicals, soap and other parameters such as bleach. The wastewater from textile plants is classified as the most polluting of all the industrial sectors, considering the volume generated as well as the effluent composition. In addition, the increased demand for textile products and the proportional increase in their production, and the use of synthetic dyes have together contributed to dye wastewater becoming one of the substantial sources of severe pollution problems in current times.[1]

Thus, need of the hour is more ecofriendly and biodegradable dyes. The purpose of this project is to produce a variety of shades on the cotton fabric by using kitchen waste such as tomato with different types of mordent such as copper sulphate, ferrous sulphate, potassium dichromate and sodium chloride. As tomato waste is readily available and of negligible cost it will be more cost effective to use. These project work focuses on finding out the efficiency of tomato produced dye and whether the shift towards this ecological option is viable option or not.

II. DISADVANTAGES OF SYNTHETIC DYE

1. **Environmentally Unfriendly:** The production of synthetic dyes requires strong acids, alkalis, solvents, high temperatures, and heavy metal catalysts.
2. **Increase in Cost of Feedstock or Energy:** Petroleum is the starting material for all synthetic dyes and thus the price of dyes is sensitive to the price of petroleum. Also, since synthesis is energy intensive (uses super-heated steam, boiling acids, etc.), the process is sensitive to energy prices and also generates greenhouse gases.
3. **Hazardous Waste Generation:** Since synthetic production of dyes need very toxic and hazardous chemicals, it also generates a hazardous waste, the disposal of which is a major environmental and economic challenge.
4. **Increasing Transportation Costs:** Since dyes are hazardous materials and are produced at central facilities, transportation of dyes from manufacturing plants to textile dyeing and printing facilities is a major cost item and a logistic challenge.
5. **Toxic and Allergic Reactions:** There are occupational safety issues involved since production processes use the toxic and hazardous materials.[2]

III. ADVANTAGES OF NATURAL DYE

In the present scenario, several advantages conferred by natural dyes make them an attractive option. Those are as follows:

1. **Minimal Environmental Impact** – Because they come from natural sources, natural dyes are not harmful to the environment, which makes it so appealing for consumers. Natural dyes are biodegradable and disposing them don't cause pollution.

2. **Renewable** – Natural dyes are obtained from renewable sources that can be harnessed without imposing harm to the environment.
3. **Color pay-off** – If you're going for a soft hue or soothing shade, natural dyes can help you achieve that look.
4. **Safe** – Some natural dyes, such as carmine found in lipsticks, will not cause harm or health problems when ingested.[3]

IV. OBJECTIVE

- To produce natural dye from tomato remains.
- To find effect of different type of mordents.
- To find the efficiency of dyes on different cloth material.
- To know the effectiveness of natural dye.
- To investigate whether using natural dyes is a truly sustainable alternative to chemical dyes.

V. MATERIALS AND PREPARATION

Source: Tomato remains were collected from organic waste in clean polythene bags from kitchen of the Indus university campus.

Substrate: 100% soft cotton fabric were use as substrate.

Scouring of cotton cloth: Cotton clothes used for dyeing were boiled in 10 percent NaOH solution for 10 minutes to remove starch and other impurities from the cloth. The NaOH treated clothes were than thoroughly washed with cold distilled water.

Mordant: The clean scour clothes were treated with different mordents such as Ferrous Sulphate (FeSO_4), Copper Sulphate (CuSO_4), Sodium Chloride (NaCl) and Potassium dichromate .

Chemicals used: Ethanol.

V. METHODOLOGY

ALCOHOLIC EXTRACTION METHOD:

Step 1-50 gm of tomato remains was boiled in 50 percent alcohol solution of ethanol of total volume 500 ml for 30 minutes.

Step 2-After 30 minutes , the solution was filtered and cotton sample was dipped in filtered solution for 24 hours .

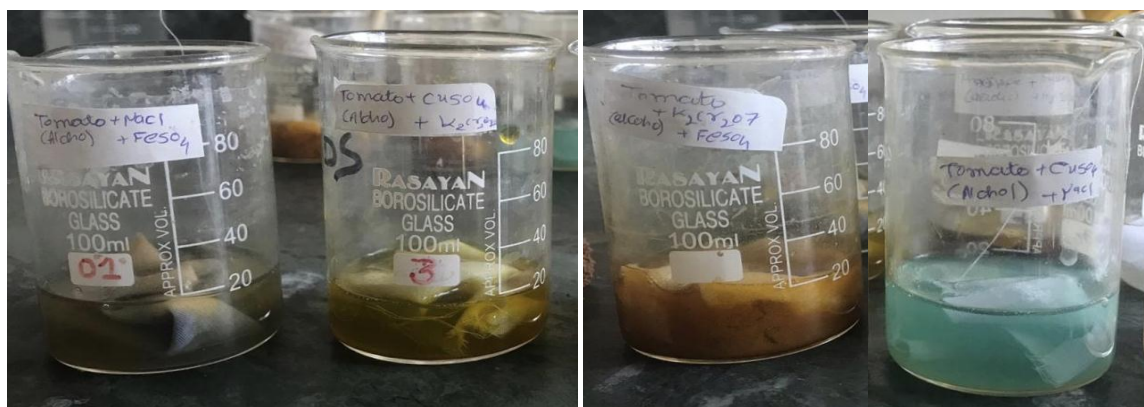


fig-1 Cotton samples in different mordants

Step 3-After 24 hours , the amount of dye extracted was calculated through colorimeter.



fig-2 Result obtained after 24 hours


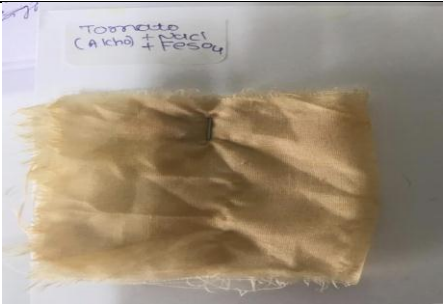
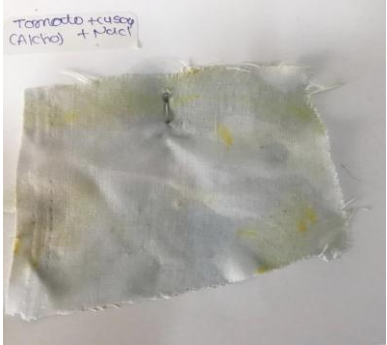
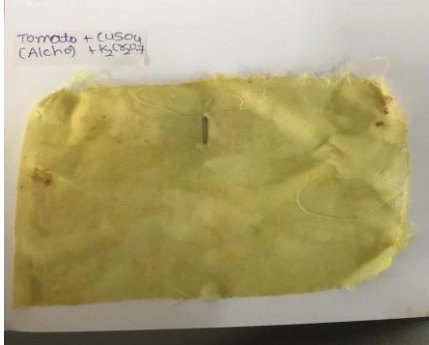
VI. RESULT

The different colour shades were obtained when different mordants were mixed with tomato remains. The Rating of fastness properties of dye and Mordent are given in the Table-1

Table 1- Results obtained

Sr.No	Mordants	Cotton fabrics
1	Ferrous Sulphate + Potassium dichromate	Good
2	Ferrous Sulphate + Sodium Chloride	Good
3	Copper Sulphate + Potassium dichromate	Good
4	Copper Sulphate + Sodium Chloride	Good

❖ The amount of dye extracted from tomato remains with application of different mordants:

 <p>Application of Ferrous Sulphate with potassium dichromate</p>	 <p>Application of Ferrous Sulphate with sodium chloride</p>
 <p>Application of Copper Sulphate with sodium chloride</p>	 <p>Application of Copper Sulphate with potassium dichromate</p>

VII. CONCLUSION

Thus, results obtained from present investigation revealed that, the tomato remains has the potential as a source for cotton dyeing. Dyes obtained from tomato can be used as cost effective and economically commercial for various industries such as textile, cosmetics, leather, food and pharmaceuticals. As the dyes are made from kitchen waste it solves the problem of waste disposal as well as becomes a more sustainable option. Natural dyes were used in ancient times and can be used again in future if proper research and resources are used to convert them in a more economical and easily available option.

Dyes produced by tomato remains along with Copper Sulphate mordant can be used when one requires soft green-yellow shade whereas the dye produce by using Ferrous Sulphate as mordant can be used to provide light to dark shades of brown and yellow. Thus tomato remains, can produce variable and viable shades when used along with different mordants.

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