International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 05, May-2019

# OPTIMIZATION OF SPINACIA OLERACEA AND ANANAS COMOSUS FOR THE EXTRACTION OF NATURAL DYE

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***Abstract— Due to eco-friendliness of natural dyes and the awareness among people regarding the environmental and health hazards associated with the use of synthetic dyes, the craze for the clothing dyed with natural dye is increasing day by day. The aim of the work is to produce a variety of shades on the cotton fabric by using spinach leaves waste and pineapple skin with different types of mordent such as copper sulphate and ferrous sulphate. The colour fastness properties of dyed materials have also analyzed. After assessment of colour fastness, it was found satisfactory in some cases and improved in many cases. As spinach and pineapple is available and cheap, it will be convenient to produce unique shades of cotton fabrics, and to produce trendy and fashionable garments.***

***Keywords— Natural dye, spinach leaves, pineapple waste, mordents, cotton fabrics***

## I. INTRODUCTION

India has a very rich tradition in the use of natural dyes. Natural dyes have been a part of human life since time immemorial and were the only colorants in the world. But with the invent of synthetic dyes about 175 years back, use of natural dyes almost diminished. During last two decades, natural dyes have witnessed a process of revival1 . With the increasing awareness of consumers for eco textiles and need to preserve environment has lead to the revival of old practice of colouration with natural dyestuffs. Due to the carcinogenic nature of some synthetic dyes and their intermediates natural dyes are being looked at as an "eco solution" to the ill effects of synthetic dyes. The serious limitation associated with the natural dyes is that the process of dyeing with natural dyes is very lengthy and time consuming. Moreover reproducibility of shades is also a major problem faced in dyeing with natural dyes as traditional processes for their application on various substrates have been lost in the absence of proper documentation and years of neglect. Therefore, it becomes necessary to develop new techniques of colouration and also to standardize these processes with the help of modern scientific inputs so that these dyes can offer themselves as an effective eco option. Keeping in view the importance of eco textiles and their demand in the national and international market and to overcome the problem of shade variation the present investigation was carried out to prepare the ready to use powdered dye for dyeing of silk and silk blend and test its colour fastness properties[1].

Natural dyes are experiencing a new beginning in the field textile coloration. They are more compatible with the environment compared to synthetic dyes because they are eco-friendly, non-toxic, non-allergenic and biodegradable. [4] Natural dyes are colorants obtained from different natural sources without any synthesizing. It includes all the dyes derived from different natural sources such as plants, animals, and minerals. There are different types of natural dyes like henna, onion, turmeric, marigold, betel nut, etc. The roots, stems, barks, leaves, berries, and flowers of various dye plants are continuously using for dyeing carpets, rugs, and clothing. Due to no substantively of most of the natural dyes, it has to apply to the substrate with the help of different mordant's [2]. Even though Synthetic dyes have many benefits, it has one negative side which deluges all the benefits, and the negative side is that it is not compatible with our environment. It is the high time to reconsider the use of natural dyes [3]. In this regards, many commercial dyers already have started using natural dyes as a convenient replacement of synthetic dyes to overcome the environmental damage caused by synthetic dyes. Also, synthetic dyes such as azo dyes are found to be carcinogenic [4].

## II. RECENT SCENARIO OF NATURAL DYE

The ready availability and cost effectiveness of synthetic dyes made most of textile dyers and manufacturers shift towards the use of synthetic colorants. These synthetic colorants are synthesized from petrochemical sources through hazardous chemical processes that pose a threat on the environment. They are often highly toxic, carcinogenic, and sometimes even explosive. The dye effluents that are dumped into rivers are also highly toxic and kill the aquatic organisms.

Being eco-friendly is the buzzword in the present scenario of fashion design. Thus garment makers are shifting towards using natural dyes. Throughout history man has dyed his textiles using various locally available materials. 'Natural dyeing' is a technique that uses colorants derived from plants, invertebrates or minerals. India's expertise in vegetable dyes, in fact, dates back to the Vedic civilization (5).

***Advantages of Natural Dye***

- Raw material is available in plenty
- Cause no harm to the human skin
- Possess a wide range of antimicrobial and medicinal properties
- No pollution is caused during the manufacturing process
- Sustainable as they are renewable and biodegradable
- Manual production process generates more employment and saves on energy

## III. OBJECTIVES OF THE STUDY

- To isolation of natural dyes from spinach leaves and pineapple waste.
- To find the use of different type of mordents.
- To find the efficiency of dyes on different cloth material.
- To replace synthetic dye with natural dye.
- To investigate whether using natural dyes is a truly sustainable alternative to chemical dyes.
- To learn new dye techniques and applications.
- To use the new knowledge and skills in my studio practice

## IV. MATERIALS AND METHOD

*A. Source*

Waste spinach leaves and pineapple were collected in clean and clear polythene bags from kitchen of the Indus university campus Spinach leaves and pineapple were collected in clean and clear polythene bags from kitchen of the Indus university campus

*B. Substrate*

100% soft cotton fabric were use as substrate

*C. Apparatus*

Beakers, volumetric flask, hot air oven, flocculator, weighing machine, safety gloves, water bath, Colorimeter, cotton cloths, etc

*D. 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

*E. Mordating*

The clean scouring clothes were treated with different mordents such as Ferrous Sulphate (FeSO4), Salt (NaCl), potassium dichromate (K2Cr2o7) Copper Sulphate (CuSO4)

*F. Proposed Methodology*

Extraction of colour dye was carried out by two different methods:-

- Aqueous extraction method
- Acidic extraction method

*Aqueous extraction method*

Step - 1 50 gm of waste spinach was taken in a beaker containing 500ml of distilled water and was stirred in a flocculate for about 15 minutes so that a uniform mixture is formed.

Step - 2 The mixture formed was boiled in a water bath at 100℃ for 30 minutes.

Step - 3 After 30 minutes, decolorized spinach was removed from the extraction solvent.

*Fig 1 Solvent1*

*Fig 2 Solvent2*

Step - 4 Cotton cloth was dipped in the extracted solvent and kept in hot air oven for 24 hours.

*Fig 3 Cotton sample dipped in the solvent containing mordant*

Step - 5 After 24 hours the cotton sample was removed and the amount of dye extracted was observed.
Step - 6 The cotton cloth was washed with the tap water and was allowed to dry under normal temperature.

*Acidic extraction method:-*

Step - 1 50 gram of pineapple waste was treated 1%acidic solution of total volume 500 ml and was stirred in flocculate for about 15 minutes so that the uniform mixture is formed.

*Fig 4 Pineapple mixture in flocculator*

Step - 2 The mixture formed was boiled at for 100°C for 30 minutes in water bath.
Step - 3 After 30 minutes the decolorized pineapple was removed from the extraction solvent


*Figure-5 Solvent with different mordants*

Step - 4 The cotton cloth was dipped in sample filterer solvent and kept in hot air oven for 24 hours


*Fig 6 cotton cloth dipped in solvent containing different Mordant*

Step - 5 After 24 hours the amount of dye extracted from cotton sample was observed.
Step - 6 The cotton cloth was washed with the tap water and was allowed to dry under normal temperature.
Step - 7 The difference between the cotton cloth before and after washing was observe

## V. RESULTS ANND DISCUSSION

*A. Water fastness result*

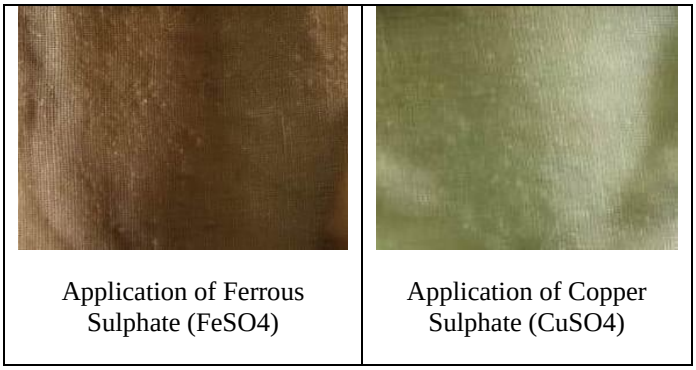
The different colour shades were obtained from various extracts of spinach and pineapple. The extracts shows variation in colour and which is mainly depends upon the extraction solvents. The Rating of fastness properties of dye and Mordent are given in the Table-

TABLE 1
WATER FASTNESS RESULTS

| Sr. No | Solvents | Cotton fabrics |
|---|---|---|
| 1 | Aqueous | Good |
| 2 | Acidic | Good |

*B. Dye extraction result*

The amount of dye extracted from the spinach with application of different mordant

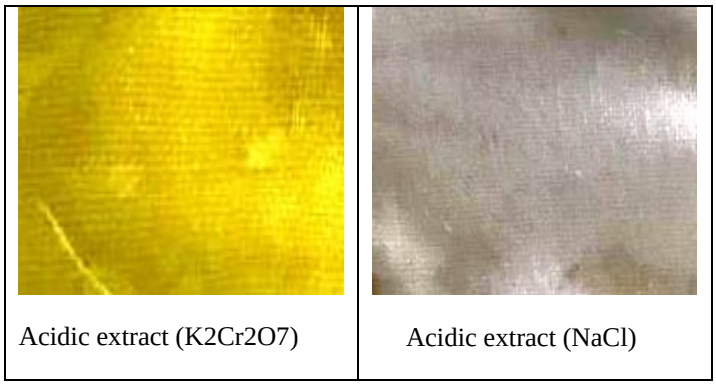


Application of Ferrous Sulphate (FeSO4) | Application of Copper Sulphate (CuSO4)

*Fig 7 Dye extracted from spinach*

The amount of dye extracted from the pineapple with application of different mordant

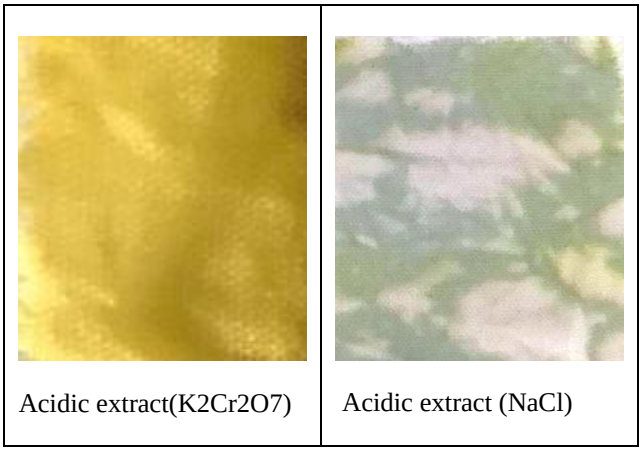
Application of Ferrous Sulphate (FeSO4) with Acidic extracts on cotton fabric



Acidic extract (K2Cr2O7) | Acidic extract (NaCl)

*Fig 8 Dye extracted from pineapple*

Application of Copper Sulphate (CuSO4) with Acidic extracts on cotton fabric



Acidic extract(K2Cr2O7) | Acidic extract (NaCl)

*Fig 9 Dye extracted from waste 2/2*

The colour strength also depends upon use of Mordent (6). Mordents are the metals salts having tendency to co-ordinate with dye and fibres (7). The aqueous extract gives dark brown coloured shade with combination of Mordent such as FeSO4 and , while, in combination with CuSO4 gives lemon green coloured shade on cotton fabrics. The acidic extract with FeSO4 combination with pinch of potassium dichromate (K2Cr2o7) and salt gives yellow shade and and light brown shade. The acidic extract with CuSO4 combination with pinch of potassium dichromate (K2Cr2o7) and salt (NaCL) gives bright yellow shade and sky blue shade Respectively.

*C. Colorimeter results*

Colorimeter is instrument used for the measurement of coloured substance in solution. The instrument is operative in vide range of the electromagnetic spectrum. It is the most common analytical technique used in biochemical estimation in clinical laboratory. • It involves the quantitative estimation of colour. • A substance to be estimated colorimetrically must be coloured or it should be capable of forming chromo gens (coloured complexes) through the addition of reagents.

TABLE 2
RESULT OF AQUOUES EXTRACT

| Sr no: | Filters | Hazen(unit) |
|---|---|---|
| 1 | A | 151 |
| 2 | B | 134 |
| 3 | C | 158 |
| 4 | D | 150 |
| 5 | E | 149 |
| 6 | F | 136 |
| 7 | G | 150 |
| 8 | H | 145 |

TABLE 3
RESULT OF ACIDIC EXTRACT

| Sr no:- | Filters | Hazen(unit) |
|---|---|---|
| 1 | A | 120 |
| 2 | B | 145 |
| 3 | C | 178 |
| 4 | D | 183 |
| 5 | E | 122 |
| 6 | F | 132 |
| 7 | G | 145 |
| 8 | H | 154 |

## VI. CONCLUSIONS

Thus, results obtained from present investigation revealed that, the spinach and pineapple has the dying potential as a source for cotton dying. Dyes obtained from spinach and pineapple waste 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 became more sustainable option. Natural dye were used in ancient times and can be used in future if roper research and resources are used to convert them in a more economically and easily available option.

ACKNOWLEDGEMENT

The success and final outcome of this project required a lot of guidance and assistance from many people and I am extremely privileged to have got this all along the completion of my project. All that I have done is only due to such supervision and assistance and I would not forget to thank them.

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