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# Natural dyeing process for recycled paper from the waste vegetables

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**Abstract:** Present work is to innovative natural dyeing process using the waste vegetables extract as dyestuff as alternative to chemical dyes. This work consists of three major steps,i.e. extraction, characterization and dyeing processes. In this study, the removal of colour dye by using simple extraction by hot water treatment. The extract from the waste vegetables resulted high colour intensity on the paper. We have used selected few waste vegetables (Grapes, Coffee bean, Turmeric and Tea) was used as a natural dye for recycled paper. Recycled paper's surface, Raman finger prints (vicinity of 1040 $cm^{-1}$), colour intensity (-0.06 cd) were recorded using SEM, Raman Spectroscopy (532 nm) laser and CIE Lab respectively.
**Keywords:** Recycled paper, dye and waste vegetables.

## 1.Introduction

Dyes are widely used in paper, textile and cosmetic industries, in this research, we tried to use years vegetable dyes are taken advantages [1]. Natural dyes colourants that are obtained from animals or vegetables matter without chemical processing .The common source of vegetable dyes are as under the part of plants such as leaves, root, fruits, flowers and seeds [2]. Vegetable dyes do not cause any harm to human skin and no hazards are anticipated in their manufacturing, rather some of the dyes act as health cure. And the chemical reaction is almost absent in the manufacture of vegetable dyes and no pollution problem [3]. Moreover that natural dyes own some limitations such as lesser availability, poor colour yield, complexity of bond process and non-reproduce ability of shades. They offer much more advantages including renewable sources, minimal health hazard, mild reaction conditions, no disposal problems and harmonization with nature [1-3]. At present, there is demand for recycled paper to reduced deforestation, only limitations of the recycled paper are expensive [10-11].

Our group already optimised the recycled paper for the evaluated answer scripts [9]. Further, in this work the extracted dyes are used for recycled paper. A number of waste vegetables are used during the production process. The dyeing of recycled paper are produced by hot water treatment processes. The hot water treatment were used to extract the natural colourant of the waste vegetables. The following vegetables (grapess, coffee bean, turmeric and Tea) was chosen as a source for a natural dye. The aim of the present work is to analysis the recycled paper.

## 2. Research Methodology

### 2.1 Vegetables extracted procedure

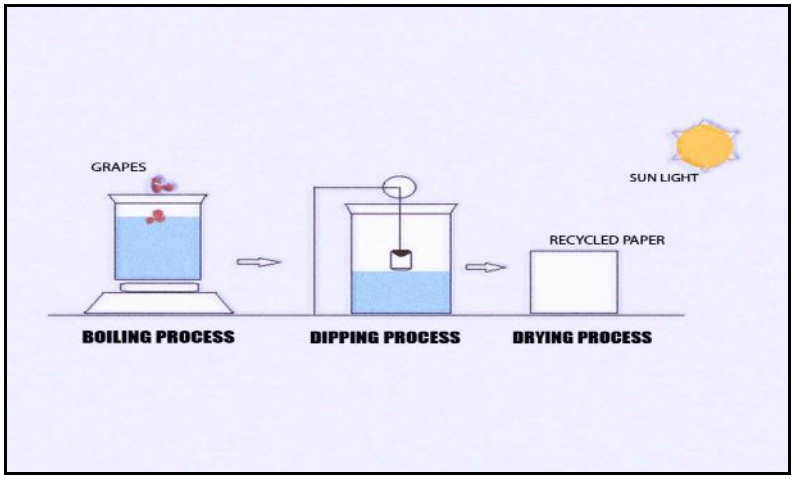
The vegetables dyes extraction is broadly divided into extraction methods and extraction technology. The extraction methods of vegetable dyes basically depends on medium in which the dye is extracted. They are mainly four methods used in extraction of natural dyes i.e. aqueous method, alkaline method, acidic method and alcoholic method. We were used aqueous method for vegetables extraction.

### 2.2 Hot water treatment

### (i)Vegetables waste

For extraction of dye, 100 gm of grape, coffee bean, tea and turmeric was mixed in 500 ml water. The obtained dye was boiled at 100 $^{o}$C at atmospheric pressure for 1 hour. Recycled paper is dipped into vegetables waste for 5 hours. Then dipped recycled paper is on sunlight for 1 day, the paper turned into colour.

### 2.3 Dyeing method




### 2.4 Colour Measurement

The Spectra Flash-Data Colour were used to induced the colour changes during recycled paper dyeing. The colour values were obtained in terms of CIELAB with illuminant D65/10, A/10 and TL84/10. In this study, we have used only the turmeric recycled paper for colour measurements are shown in Table.1

**Table.1 Colour Measurment of Turmeric recycled paper using CIELAB**

| CIELAB 1976/DIN 6174 | D65/10 | A/10 | TL84/10 |
|---|---|---|---|
| dL* | -0.06 | -0.04 | -0.06 |
| da* | 0.25 | 0.18 | 0.17 |
| db* | -0.22 | -0.14 | -0.22 |
| dc*(ab) | -0.20 | -0.11 | -0.22 |
| dH*(ab) | -0.26 | -0.21 | -0.18 |
| dE*(ab) | 0.24 | 0.24 | 0.28 |
| dL* | Darker | Darker | Darker |
| da* | Redder | Redder | Redder |
| db* | Bluer | Bluer | Bluer |
| dc*(ab) | Duller | | Duller |
| dH*(ab) | Redder | Redder | |

## 3. Results and Discussion

### 3.1 Surface Imaging using SEM

Electron microscopy is one of the approach to the analysis of paper materials. The papermaking can be characterized by SEM to improve their performance or for quality control in productions. SEM is clearly the best method for some sutivations and also easily evaluated the structural properties. And we analysed the structure and microtexture of recycled paper using Scanning electron microscope. Fig.1 shows the SEM image of grape waste recycled paper, we noticed the porous structure of the tissue and the crimping of fibers from creping. Embossing or folding. SEM images of paper revealed the degree of fiber relationship and the amount of external fibrillation. Some of the grape stalk particles can be detected. In this paper collapse of individual fibers and, sometimes, their internal fibrillation are also observed.

The SEM (fig. 2) provides information on the microstructure of the composites, observation of the interaction and dispersion of particles on the coffee bean waste recycled paper. The microfiber of the surface structure of the composites are shown in figure 2. From this image (fig.2) we observed more porous structure and folding, as a result of the strong interaction between coffee bean stalk and fibers. In some places, large number of uneven structures and aggregates of fibers were observed.

We have seen small broken rods and turmeric stalk in the fig.3. There are lot of porous present in the individual fibers. In fig.4 some places are uneven structure and more porous are present. Our group have carried green synthesis of silvernanoparticles to protect recycled paper, tissue paper and cancer drug delivery [5-7]. In continuation of this research work, we made an attempt to dye recycled paper using natural process.

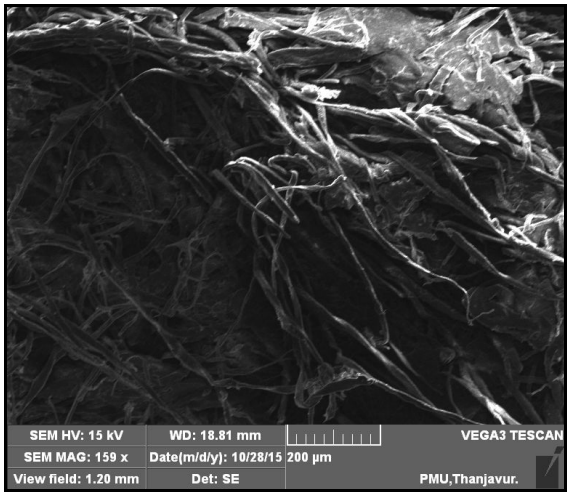



**Fig. 1 SEM image of grape waste recycled paper**

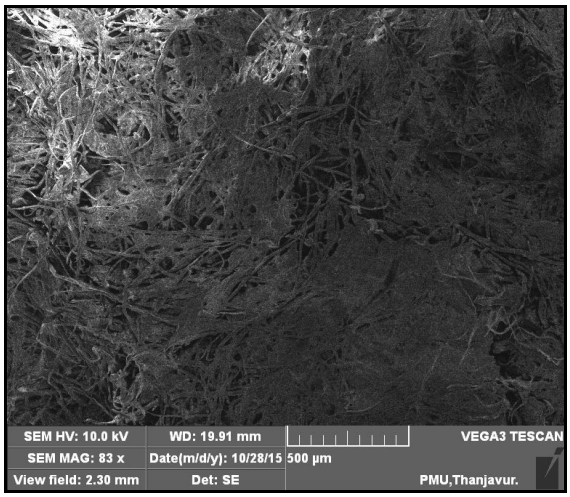



**Fig. 2 SEM image of coffee bean waste recycled paper**

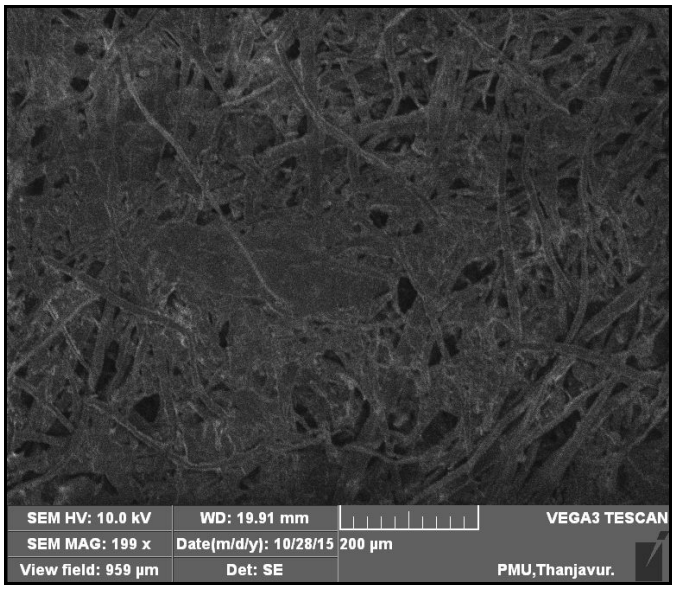



**Fig. 3 SEM image of turmeric waste recycled paper**

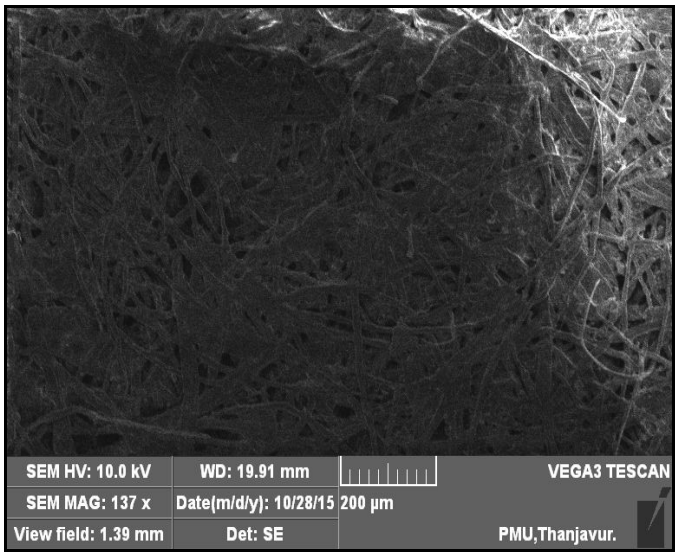



**Fig. 4 SEM image of Tea waste recycled paper**

### 3.2 Raman Spectroscopy techniques

Raman spectroscopy is one of the modern advanced system for operating the parameters. The recorded Raman spectrum of the dye obtained from the waste fruits are shown in Fig. 5,6,7and 8,respectively. Raman spectrum of grape dye is shown in Fig. 5. It shows peaks at 2287 and 2658 $cm^{-1}$. Most of the peaks were observed in the region of 2300 to 2700 $cm^{-1}$.In fig 7 it shows the spectrum of coffee dye, the strong bands observed at 1585 cm-1 corresponds to symmetric vibrationalmodes of C=C stretching and $CH_3$ scissoring mode, respectively[4]. Figure 6 shows a spectrum of Tea in this grapes a strong band at 1040 $cm^{-1}$ peaks corresponds to C=O=C vibrational mode. The peaks observed at 1631 $cm^{-1}$ and1641 $cm^{-1}$ attributed to CH stretching modes [5]. In fig 8it shows the Raman vibrations of Turmeric at 511 $cm^{-1}$ due to some strong bond of C-$CH_3$ and CCO deformation.

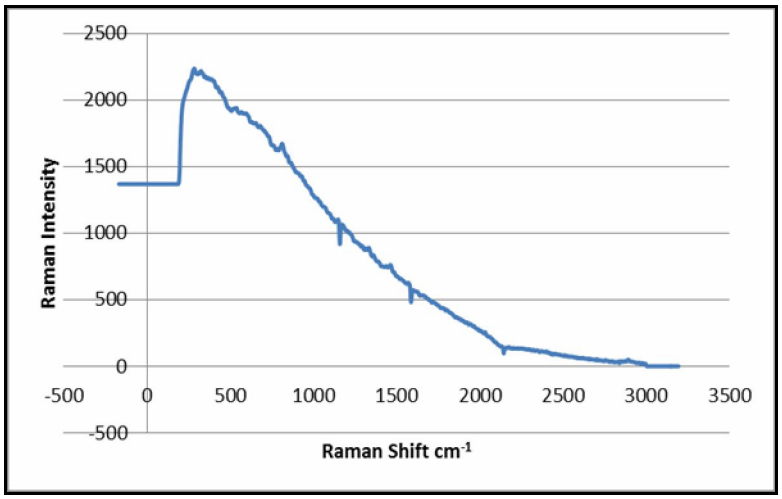



**Fig 5. Raman Spectrum of Grape dye**

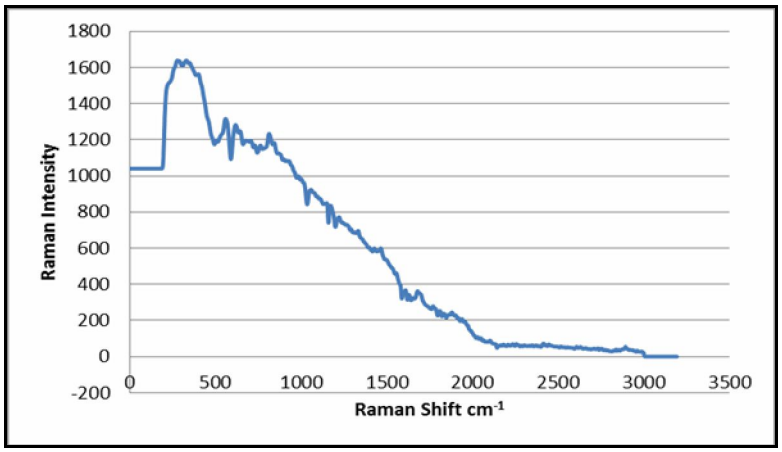



**Fig 6. Raman Spectrum of Tea dye**

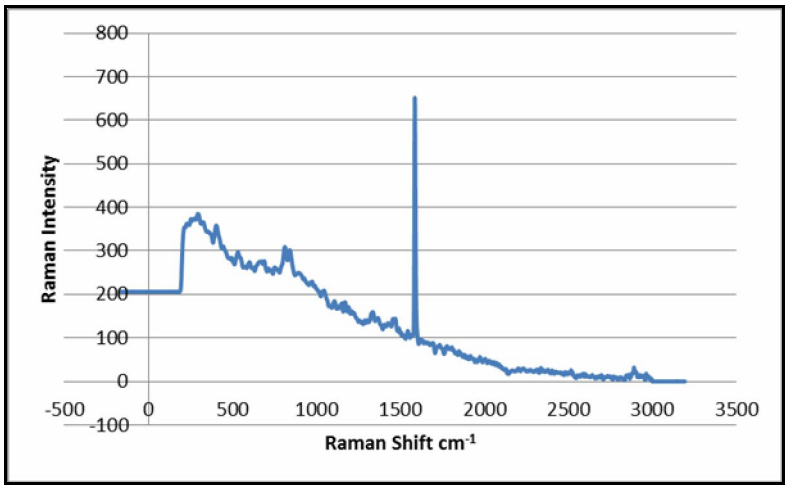



**Fig 7. Raman Spectrum of Coffee dye**

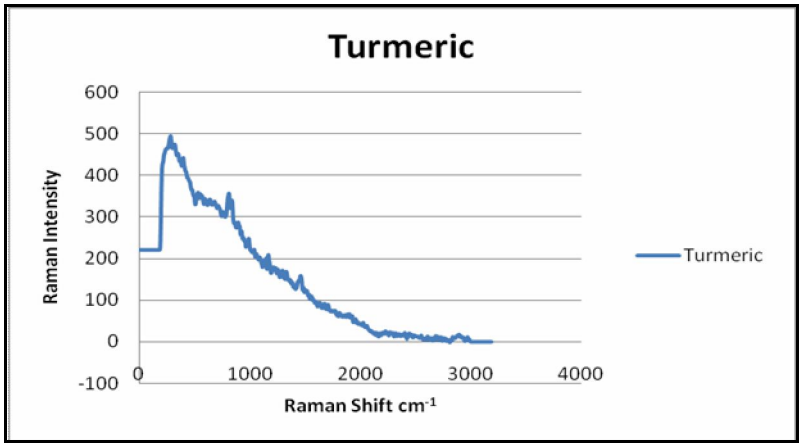



**Fig 8. Raman Spectrum of Turmeric dye**

## 5. Conclusion

The extracts obtained from the fruits and vegetables dye were used in recycled paper. Different shades of colour were obtained from the dyes using by aqueous extraction method. Good fastness properties were also obtained. Overall aspects of this work to make one remarkable application for recycled papers.

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