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# Eco- Fashion by Application of Tagetes Erecta Flowers Waste on Sustainable Textile Material

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**Abstract**

Textiles play a vital role in everyday life of human. Synthetic chemicals used from raw material to finished product throughout the supply chain are very large in number. Most of them are carcinogenic, non renewable and non biodegradable thus hazardous to health and environment. Therefore there is an urgent need to create awareness towards sustainable fashion by using eco friendly materials at various stages of apparel production. In present investigation apparels were constructed using sustainable fabrics such as organic cotton, linen and silk. These textile materials were dyed by sustainable dyeing procedure using natural dyes. Tagetes erecta (marigold flowers) obtained from temple wastes were used to dye the fabrics using natural mordants punicagranatum (pomegranate rind) and Emblica officinalis (amla). The results of study shows that Tagetes erecta dyed fabric using punicagranatum and Emblica officinalis mordants give yellowish shade with good fastness properties. Further apparels were constructed from these dyed fabrics to create sustainable or eco fashion.

**Keywords:** Eco-Fashion, Eco Friendly, Sustainable, Tagetes Erecta (Marigold Flowers), Punicagranatum (Pomegranate Rind), Emblica Officinalis (Amla).

**Introduction**

*Green fashion is a biggest movement for sustainability and is also called as eco-fashion.*Green-fashion is about making clothes that take into account the biodegradability, renewability, overall environment, health of consumers, working conditions of people in the fashion industry. It focuses on reducing the carbon footprint by emerging less amount of carbon dioxide[1,2]. Eco-fashion or green fashion is still in its early stage. Thus to give impetus to eco fashion the textile industries and *f*ashion designers collectively need to start using sustainable materials and eco-friendly processes from fibre cultivation/ production to finishing. Eco-friendly dyeing is a new perception on the textile substance throughout the world due to current eco-consciousnes[3]. Natural dyes are renewable, biodegradable and available in abundance. These dyes are known for their soft and restful colours to human eyes. They are obtained from plants, trees, insects, etc[4]. Green-fashion based clothes are prepared using organic raw materials, such as organic cotton grown-up without synthetic fertilizers, pesticides, herbicides and insecticides. These clothes don't involve the use of harmful chemicals, auxiliaries and dyes to impart colour to fabrics. Eco-fashion based apparels can be made from recycled clothes and even cast-off plastic bottles too to reduce the burdon of non biodegradable used apparel and other related consumer's waste. Eco-fashion is completely free form synthetic chemicals and toxic irritants as well as fully organic, sustainable and biodegradable. Although, eco-fashion can often be costly as recycling may be time consuming and needs investment. Perhaps ecologicaly awared consumers are willing to spend the money if it fits their pocket and requirement with style[5-7]. Huge amount of rose, marigold flowers, etc. offered to God and Goddesses creates large amount of waste which can be used for dyeing and printing of various fabrics[8-10]. Similarly cotton and linen can also be dyed from tea or punicagranatum rind waste obtained as by-product from juice industries [11,12]. Dyeing of cotton and linen with natural dyes needs mordant for fixation. So the natural dye must be applied on textiles substrate with the help of mordants which helps to absorb the dye into the textile material

to make possible chemical reaction taking place between the textile fibre and the dye or pigment. It was reported that tannic acid, pomegranate rind, cow dung and lemon juice can be used as a natural mordant to normalize the dying effect of marigold and turmeric dyes on cotton and silk fabric[13].

**Some of the Eco-Friendly Brands Who Support Green Fashion**

Some of the designers emphasize on Eco fashion by using traditional dyeing techniques like block prints from Rajasthan, chikankari embroidery from Lucknow, bandhani and leheriya with unique creations[14].

**Some Brands on Eco Fashion are as Follows**

**Amrich [15]**

Amrich, as a brand, uses the tie-dye techniques with complicated designs and hand embroidery with vibrant colours of Ikat *and jamdan i* by the help of traditional craft clusters to incorporating techniques like natural dyeing, resist-dyeing, printing and embroideries.

**Bhu: Sattva[15]**

Bhu: sattva, as a brand, uses natural fibres like hemp, bamboo, organic cotton and silk, soya bean, aloe vera, modal, banana, pineapple and milk protein fibre, flax, jute, khadi, etc with different type of natural dyes.

**Forty Red Bangles [15]**

An international brand inspired by its creator, forty red wedding bangles. It creates beautiful designs from traditional natural sources. This brand is also associated with many community partners for symbiotic approach. It is an innovative organisation which makes the clothing using sustainable textile and dyes.

The present study was inspired from aforesaid eco-friendly supporting designers and brands which have developed dresses using natural fibre and eco-friendly dyeing processing. Different mordanting techniques were carried out on cotton, silk and linen fabrics. Marigold flowers obtained from temple waste were used for dyeing using pomegranate peel and amla powder as natural mordant. Different yellow colour hues were obtained and shade cards were prepared using all dyed samples. All the dyed samples were found to give fair to good fastness properties. Furthers, various dresses were developed from these natural dyed fabric samples.

**Material and Methods**

**Materials**

**Natural Dye**

Waste dark yellow variety of marigold flowers collected from various temples of Sonipat, Haryana (India) were used as natural dye after the extraction.

**Natural Mordants**

Punicagranatum (Pomegranate rind) and Emblica officinalis (Amla) were used as natural mordants. Pomegranate peel waste abundantly available at juice corners was collected from local market of Sonipat. These peels were crushed into powder form and after drying used as a mordant. Similarly amla powder was also purchased from local market and used as natural mordant.

**Substrates**

Different fabrics were used in present investigation. The specifications of these fabrics are as follows:-

**Cotton**

Plain weave; GSM: - 104 g/m$^2$; EPI: - 48; PPI: - 88.

**Linen**

Plain weave; GSM: -304 g/m$^2$; EPI:-28; PPI: - 24.

**Silk**

Plain weave; GSM: -44 g/m$^2$; EPI:-110; PPI: - 126.

All the fabrics were purchased from local cloth market. The purchased fabrics were definished by washing with soap solution prior to dyeing operation.

**Methodology**

**Dye Extraction**

Petals of collected marigold flower were separated and dried in sunlight for 5-6 days. Marigold petals (100 grams) were subjected to aqueous extraction with one litre of distilled water. Aqueous solution was heated up to 100º C at pH 6-7. Extract was filtered and allowed to cool. Finally extracted solution was maintained to one litre.

**Mordanting**

In this study Punicagranatum and Emblica officinalis were used as natural mordants. The mordant, 25% owing weight of fabric (owf) was dissolved in distilled water to make a material to liquor ratio of 1:40. Further fabric was incubated for 30 minutes at 85ºC. After mordanting, the fabric samples were rinsed, squeezed and dried at room temperature. The mordanted samples were dyed or dyed samples were mordanted vice-versa immediately as per the requirement. Different mordanting techniques were performed which are mentioned below:-

**Pre-Mordanting**

In pre-mordanting the fabric was treated with the mordants and then dyed with marigold extract in the separate bath.

**Simultaneous Mordanting**

In this method the fabric was simultaneously mordanted and dyed in the same bath.

**Post-Mordanting**

In the case of post-mordanting, fabric is initially dyed with marigold extract and thereafter treated with mordants[16,17].

**Dyeing**

Dyeing was performed by exhaust method in open water bath. Natural dye of 10% owf was dissolved to make a material to liquor ratio of 1:40 at 85ºC for 45 minutes. Further samples were soaped and rinsed with cold water at room temperature[18,19].

**Colour Fastness Test**

The dyed material was tested for wash, rubbing and light fastness as per the standards.

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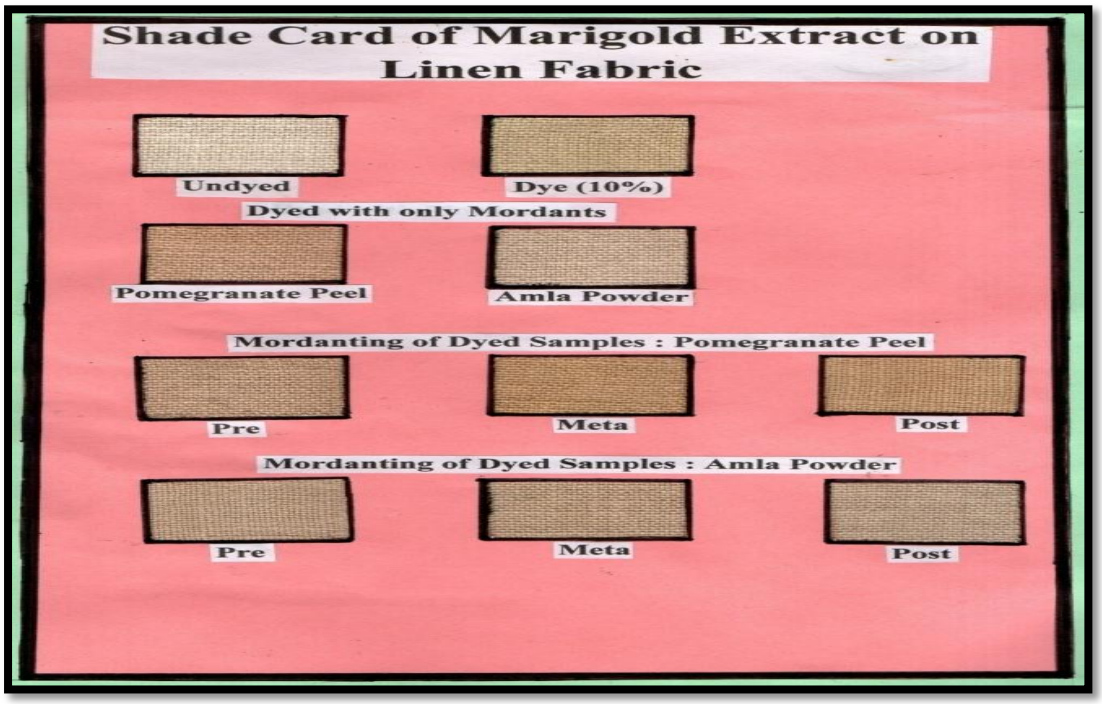
**Results and Discussions**

**Results of Dyeing and Fastness Properties**




Marigold flowers extraction was found in hues of yellow colour. The results revealed that there were many shades of yellow colour obtained after dyeing the cotton, linen and silk fabrics with marigold flowers petals using different mordanting techniques. It was observed in case of marigold dyeing of cotton and linen and silk with pomegranate peel and amla as a mordant that obtained shades are in yellow colour range with slight reddishness. The shade card of marigold extract dyed, cotton and linen are shown in Fig. 1, Fig. 2 and Fig. 3, respectively.

**Figure 1: Shade Card of Dyed Fabric Samples of Cotton with Tagetes Erecta and Natural Mordants**

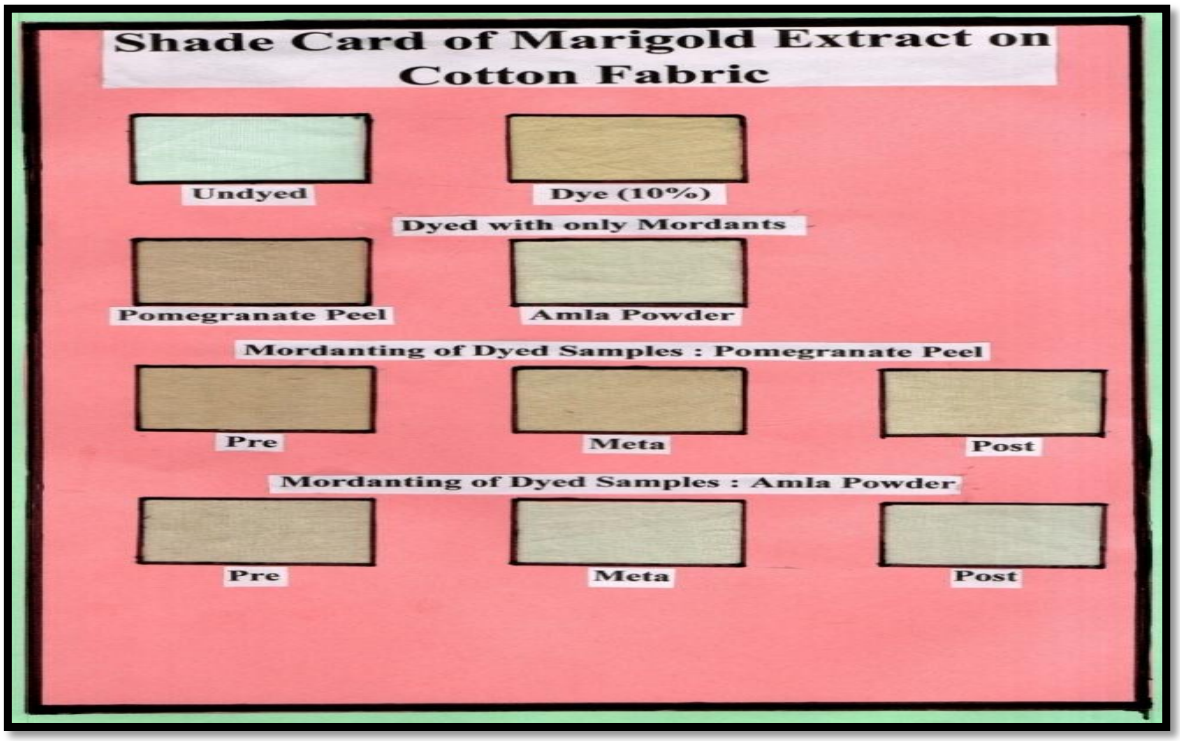



**Figure 2: Shade Card of Dyed Fabric Samples of Linen with Tagetes Erecta and Natural Mordants**

**Figure 3: Shade card of Dyed Fabric Samples of Silk with Tagetes Erecta and Natural Mordants**


The determination of colour co-ordinates values i.e. L, a, b and K/S of dyed samples with the help of computer colour matching and evaluation of wash, rubbing and light fastness are under investigation. Although in preliminary investigation it was observed that shades of Tagetes erecta on cotton, linen and silk was found in yellow colour range irrespective to used natural mordants and applied different mordanting techniques. The colour fastness properties of dyed samples were also found suitable with good fastness ratting.

**Creation of Eco-Fashion by Developing Apparels using Marigold Dyed Sustainable Fabrics**

Marigold dyed fabrics were used for preparation of varied types of dresses. The collection of apparels was named as "yellow petals" which is made of eco-friendly dyeing of sustainable fabrics using different dyeing and embellishment techniques[14,15]. The details of apparels creation are as follows:

**Shervani**

Linen fabric was dyed with Tagetes erecta using Emblica officinalis as mordanting agent by pre mordanting method. The dyed fabric was used as the base material to prepare a shervani inspired by traditional clothing of Rajasthan (Illustration of outfit at Fig. 4 a). Golden and white colours of brooches were attached on the front panel of shervani for an attractive look. The shervani kurti is developed on the basis of attractive appearance of dyed samples (swatch at Fig. 4 b). Beside this a pajami was prepared using dyed cotton fabric. This cotton fabric was dyed by emblica officinalis powder using tie &dye technique with the help of pebbles (swatch at Fig. 4 c). This constructed shervani is developed for the kids of 5-6 age group as shown in Fig. 4 d.

**Figure 4: Illustration of Shervani Inspired by Traditional Clothing of Rajasthan**

**(a). Illustration of outfit** **(b). Dyed Kurti Swatch** **(c). Tye and Dyed Pajami Swatch** **(d). Front View of Constructed Dress**

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**Party Wear Skirt**

This skirt is inspired from traditional party wear skirt which is illustrated in Fig.5 a.Tagetes erecta dyed silk fabric (Fig. 5 c) was used as the base material to prepare children party wear skirt. After completion of skirt, extra dyed fabric was used to make a flower and to attach with skirt for decoration purpose. This dress is developed for the kids of 4-5 age groups. Beside this, silk fabric dyed by pre mordanting with Punicagranatum peel and marigold dye was used for draping like a crop top (swatch at Fig. 5 b).

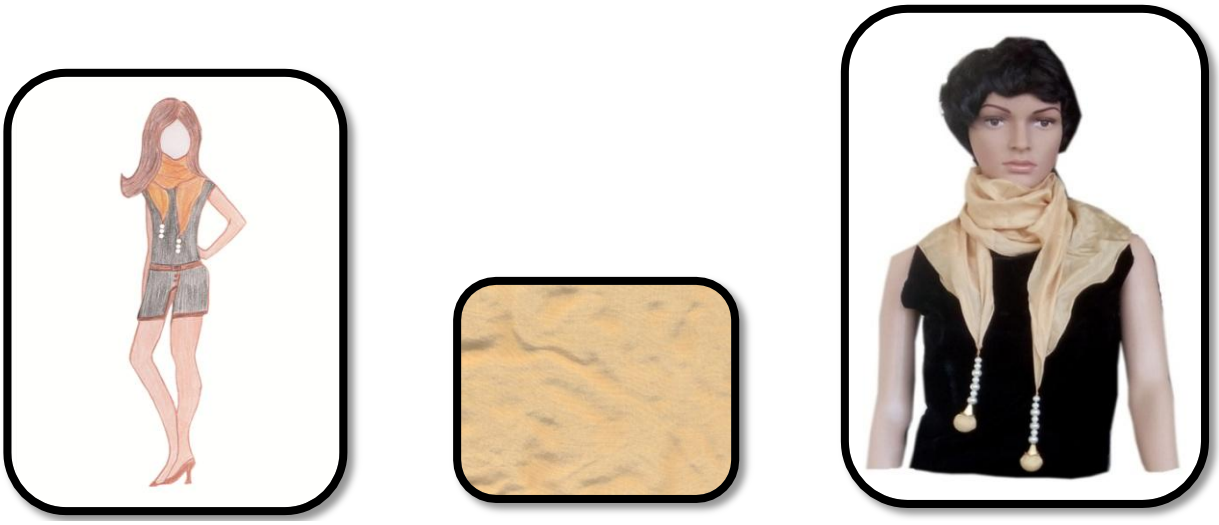
**Figure 5: Illustration of Part Wear Skirt Inspired by Traditional Party Wear Skirt**

(a). **Illustration of Outfit** **(b). Dyed Crop Top Swatch** **(c). Skirt Swatch** **(d). Front View of Constructed Dress**

**Scarf**

The designed scarf is inspired by oval leaves shape and is shown in Fig. 6 a.Taget eserecta dyed Silk fabric was used as the base material which was dyed using Punicagranatum peel as a mordant (Fig. 6 b). The dyed fabric was used for making scarf as shown in Fig.6c. After completion of scarf, hangings were made by natural dyed fabric using pearl beads and plastic balls. The scarf is soft and smooth with sophisticated colour. It is prepared for the persons of 15-20 age groups.

**Figure 6: Illustration of Scarf is inspired by Oval Leaves Shape**



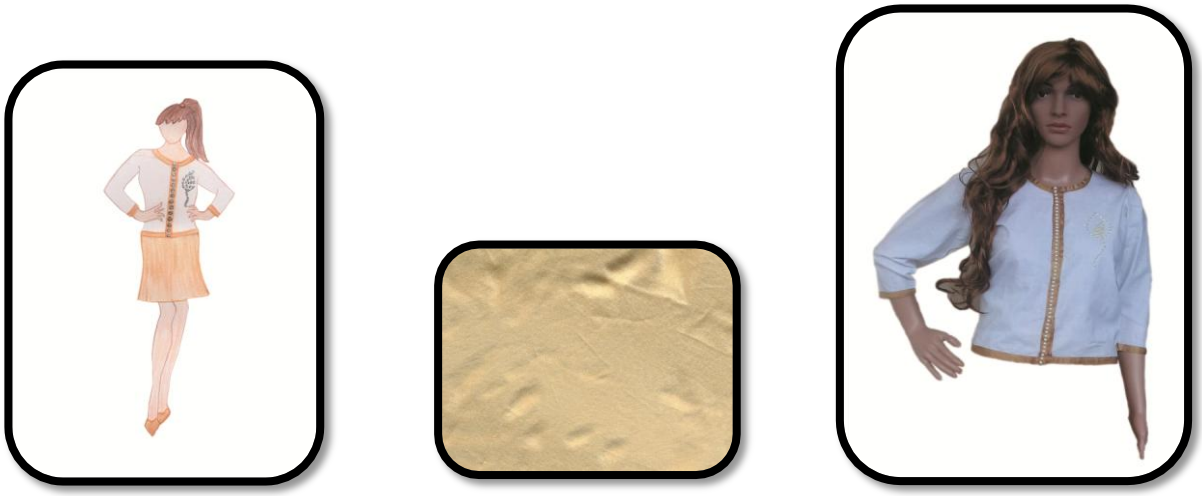
**(a) Illustration of Outfit** **(b) Dyed Scarf Swatch** **(c) Front View of Constructed Dress**

**Ladies Shirt**

Cotton fabric was used as the base material to make a teenager shirt inspired by Indian party wear. The illustration of outfit is shown in Fig. 7 a. Tagetes erecta dyed silk fabric was used as a stripe on neckline, placket, sleeve hem and bottom of shirt. The fabric was dyed by meta mordanting with Punicagranatumpeel and Tagetes erecta (Fig. 7 b). The dyed fabric was selected because of its highest colour values. Various pearl beads were used on dyed stripes of shirt and motifs were made using beads at the front and back side on undyed cotton to enhance the value of shirt. The shirt was prepared for

the persons of 15- 18 age group. This party wear designed shirt is shown in Fig. 7 c.

**Figure 7: Illustration of Party Wear Shirt Inspired by Indian Party Wear Shirt**



**(a). Illustration of Outfit** **(b). Dyed Fabric Swatch** **(c). Front View of Constructed Dress**

**Conclusion**

The results of the study shows that cotton, linen and silk can be successfully dyed sustainably with Tagetes erecta waste with good fastness properties. The obtained yellow shades gamut of colour has elegance appearance. The sustainable dyed organic cotton, silk and linen was further used in creating apparels with eco-fashion at small level. Overall, results are promising and there are great scopes to utilize such type of organic waste or by product in exploring the sustainable apparel construction.

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