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## Natural dyeing of marigold leaves extract against insects

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### Abstract

Antimosquito repellent textiles with improved functionality find a variety of applications such as health and hygiene products, specially the garments worn close to the skin and several medical applications. To overcome all these symptomatic problems it is better to use repellants from natural sources over synthetic chemicals. Repellents ideally should have no adverse reactions. Thus the study is a small step in developing an eco-friendly natural anti insect finishes from leaves extracts on cotton fabric by using *Calendula officinalis* (maigold) leaves extract. The concentration of insect repellent extract, concentration of mordant and dyeing time was standardized on the basis of insect repellence repellency test. These samples were given after treatment with various concentrations of citric acid for different time and then subjected to test the wash durability and insect repellency.

**Keywords:** Cotton fabric, marigold leaves, insect repellency

### Introduction

Health and hygiene are the primary requirements for human beings to live comfortably and work with maximum efficiency. The abundance of medicinal plants on the earth surface has led to an increasing interest in the investigation of different extracts obtained from the plants as potential sources of new mosquito repellent agent. We are going through advancements of technology in every field of this industry. The world where this would lead us would be astonishingly hi-tech and materialistic. With regard to textiles, the protective textile field of the smart textiles has to fulfill this requirement. The art of dyeing is as old as our civilization. Dyed textile remnants found during archaeological excavations at different places all over the world provide evidence to the practice of dyeing in ancient civilizations. Synthetic insect repellent used for control of vectors are causing irreversible damage to ecosystem and also chemicals are non-degradable in nature. To ensure our security and safety from the future hazards, we need to equally development the technology for our protection.

### Materials and Methods

#### 1. Collection of materials

1. **Marigold leaves:** Marigold leaves were washed in water, dried in shades at room temperature for one week. Grinded into fine powder form and sieved.
2. **Textile material:** Pure white cotton fabric.
3. **Chemicals:** Methanol, copper sulphate, citric acid for extraction of natural insect repellent and mordanting of finished sample, respectively.

#### 2. Optimization of variables for insect repellent finishes

1. Optimization of concentrations (7, 12 and 17 per cent) of natural insect repellent done on optical density basis measured through spectrophotometer. Experiments were conducted with concentrations of marigold leaves.
2. After optimization, extraction of the marigold leaves was done by using methanol. This extract solution was further diluted in three concentrations i.e.; 45, 50, and 55 per cent and 0.1 per cent concentration copper sulphate was diluted in to one finalized extract solution.
3. Scoured cotton fabric immersed in different concentrations of natural insect repellents. Dyeing time for cotton samples with extract of marigold leaves were 60, 90 and 120

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minutes. Cotton sample were finished by utilizing these parameters.

- Mordanting of finished Sample: Tie dyed cotton samples were mordanted with 5, 10 and 15 per cent concentrations of citric acid tested for insect repellency and wash durability.

**Insect Repellency Test**

Prepared tie and dyed samples were tested for insect repellency in insect cage box. Cage test is the quick and cost effective way to determine the insect repelling qualities of treated materials. A box of 30×30×30 cm made out of transparent glasses with 25 °C ±2 °C temperature and 60 to 70 per cent humidity was maintained. In the glass box, dyed and unfinished fabrics samples were placed. Release 20 mosquitoes in the box and allow them for 2 minutes. Mosquitoes were deprived of all the nutrition and water for a minimum of 4 hours before exposure. Laboratory tests were performed during daylight hours only and each test was

replicated four times. Note down the anti insect effectiveness by counting the number of mosquitoes which will rest on the unfinished and dyed samples during 2 minutes. Efficiency of insect repellency was calculated by using following formula:

$$Efficiency\ of\ insect\ repellency\ (\%) = \frac{No.\ of\ escaped\ specimen + No.\ of\ specimen\ dead}{No.\ of\ specimen\ exposed} \times 100$$

**Wash durability test:** Tie Dyed sample were dipped in 5 per cent mild detergent Ezee solution for 30 minutes. After that samples were washed with plain water, squeezed and dried in shade. Wash durability of dyed samples mordanted with different concentration of citric acid for different time were checked up to 5 to 7 laundings.

**Results and Discussion**

Optical density of 7, 12, 17 g marigold leaves powder in 100ml methanol gave the highest value (4.0) therefore, 12g selected as optimum.

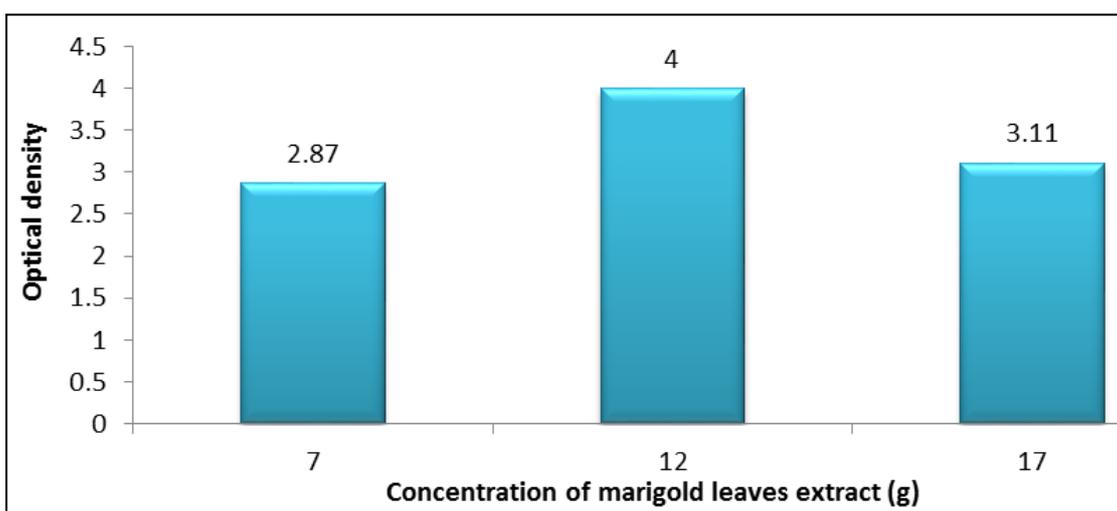


Fig 1: Optical density of marigold leaves extract

Marigold leaves extract was taken in 40, 50 and 60% concentration. Data depicts that on increasing concentration from 40-50 per cent insect repellency also increases from 80-

85%, therefore 50 per cent extract was standardized for dyeing of cotton fabric.

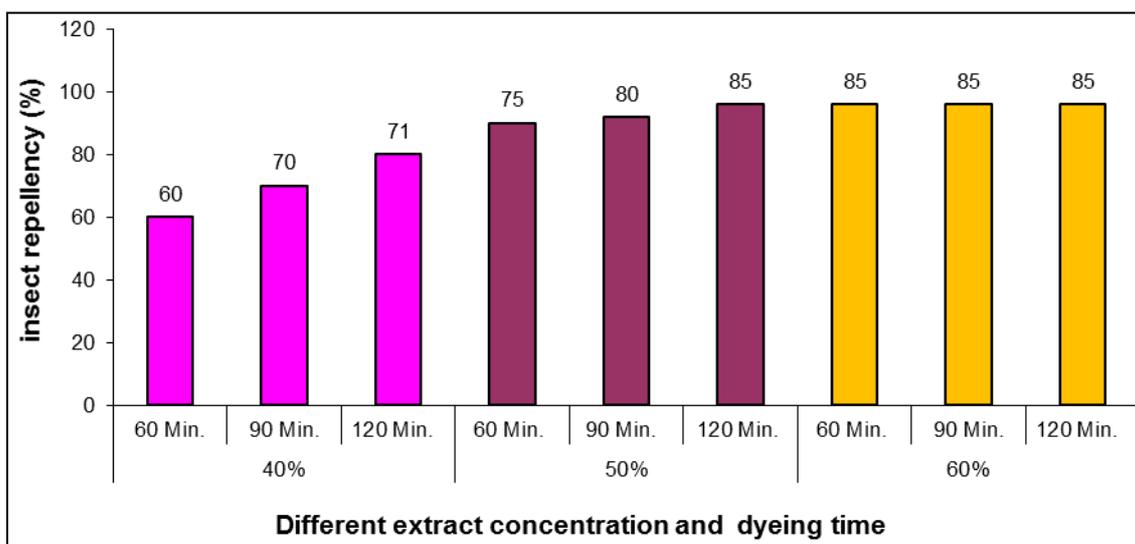


Fig 2: Insect repellency of cotton samples (dyed) with marigold leaves

**3. Effect of finishing Treatment on Physical Properties**

Tie dyed cotton sample was evaluated for fabric stiffness,

tensile strength, crease recovery and drape co-efficient

Effect of finishing treatment on cotton fabric properties

	Stiffness	Crease recovery	Drapeability	Tensile strength
Control (Warp)	3.62	35.8	0.84	29.40
Finished	2.5	68.08	0.7	26.80
Control (Weft)	3.46	53.6	0.86	36.40
Finished	2.94	53.8	0.67	36.60

### Conclusion

Cotton fabric finished with marigold leaves protects the human beings from the bite of insect and there by promising safety from insect vector diseases and it is eco-friendly, biodegradable, non toxic, non irritant to the skin and low cost for vector control and can be used with minimum care. It can be successfully utilized in apparel, insect net, window curtain and other home furnishings. It shows good repellent property when applied on cotton fabric.

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