

## Defend Insect Biting by Using Marigold Leaves (*Calendula Offcinalis*)

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**Abstract:** An alarming increase in the range of insect is mainly due to deforestation, industrialized farming and stagnant water. Insect repellent finishes on textiles are one of the most growing ways to advance the textile field by providing the needed characteristics of protecting against mosquitoes and other diseases. Thus an endeavor has been made to apply protective finish 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 polyvinyl alcohol for different time and then subjected to test the wash durability and insect repellency.

**Key Words:** cotton fabric, marigold leaves, insect repellency.

### 1. INTRODUCTION:

The vast growth in technical textiles has generated many opportunities for the application of innovative finishes. Anti insect 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, such as infection control and barrier material. Due to rapid urbanization, climate change and other factors, the ill effects of insect bite are increasing day by day. Major source of illness and death worldwide is due to diseases spread by insects. Every year about 700 million persons get affected by diseases transmitted by mosquitoes. Wide variety of species are responsible for causing life threatening diseases like Malaria, Chikangunya, Filariasis, Dengue fever, Yellow fever etc. The Zika and ebola virus were spread by mosquitoes, which affect many people in the world. The use of the repellents such as lotions, coils and liquidators are limited in their efficacy due to various reasons. To ensure our security and safety from the future hazards, we need to equally development the technology for our protection. This has necessitated the development of insect repellent fabrics. A textile fabric with the insect protection is one of the revolutionary ways and the much needed feature of driving away the mosquitoes.

### 2. MATERIALS AND METHODS:

#### 2.1. Collection of materials:

**i. Marigold leaves:** Marigold leaves were washed in water, dried in shades at room temperature for one week. Grinded into fine powder form and sieved.

**ii. Textile material:** Pure white cotton fabric.

**iii. Chemicals:** Methanol, copper sulphate, polyvinyl alcohol for extraction of natural insect repellent and mordanting of finished sample, respectively.

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

**i.** 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.

**ii.** 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.

**iii.** 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 minutes. Cotton sample were finished by utilizing these parameters.

**iv. Mordanting of finished (insect repellent) Sample:** Tie dyed finished cotton samples were mordanted with 5, 10 and 15 per cent concentrations of polyvinyl alcohol 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<sup>0</sup> C ±2<sup>0</sup> 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

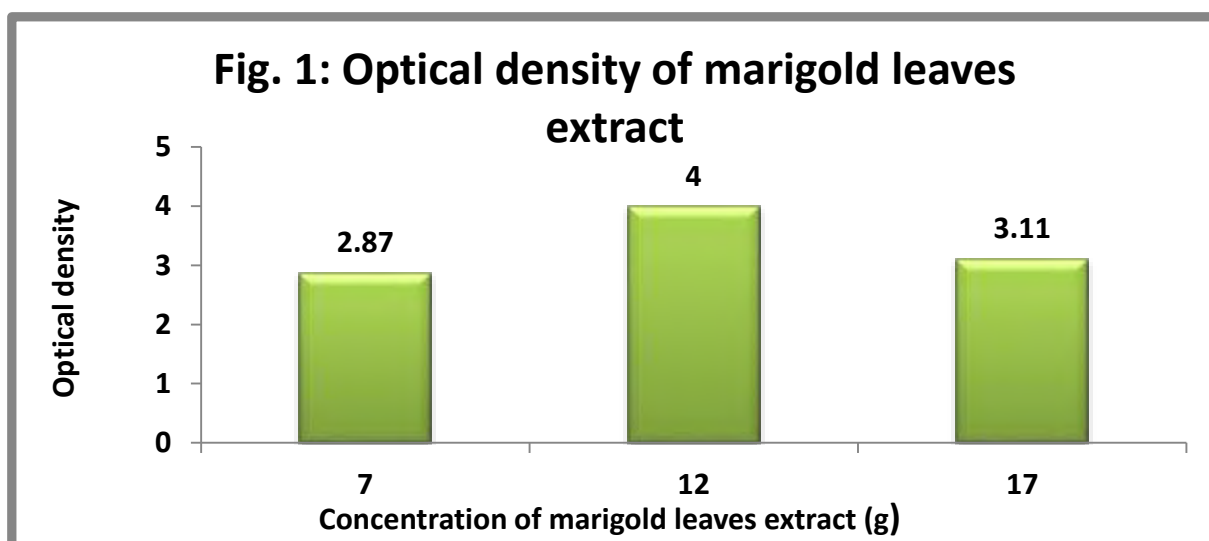
tests were performed during daylight hours only and each test was replicated four times. Note down the anti insect effectiveness by counting the number of mosquitoes which will rest on the unfinished and dyed samples during 2 minutes. Efficiency of insect repellency was calculated by using following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

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

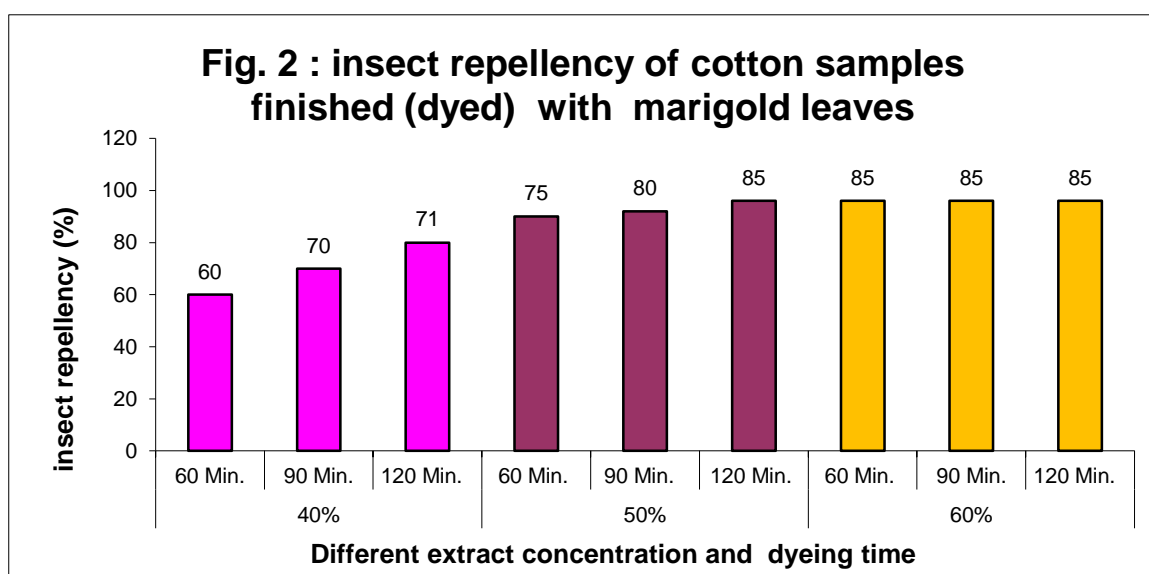
**Wash durability test:** Tie Dyed finished sample were dipped in 5 per cent mild detergent Ezee solution for 30 minutes. After that samples were washed with plain water, squeezed and dried in shade. Wash durability of dyed samples mordanted with different concentration of polyvinyl alcohol for different time were checked up to 5 to 10 launderings.

### 3. 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.



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.



### 3. Effect of finishing (insect repellent) Treatment on Physical Properties:

Tie dyed cotton finished 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

#### 4. 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, bio-degradable, non toxic, non irritant to the skin and low cost for vector control and can be used with minimum care. It shows good repellent property when applied on cotton fabric. It can be successfully utilized in apparel, insect net, window curtain and other home furnishings.

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