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## Research on Insect Repellent Tie Dyeing Finish on Cotton Fabric

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**ABSTRACT** 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 insects. Thus an endeavour has been made to apply dyeing finish on cotton fabric by using *Eucalyptus citriodora* (lemon eucalyptus) leaves extract. This natural insect repellent finishing agent is very effective, environment friendly, biodegradable as well as inexpensive. In this direction a research is mainly carried out for the development of insect repellent finished cotton fabric using lemon eucalyptus leaves extract. A series of experiment were conducted to optimize the concentration of lemon eucalyptus leaves, concentration of lemon eucalyptus leaves extract and concentration of mordant and dyeing time on the basis of optical density test. After that dyed samples with lemon eucalyptus leaves were mordanted with different concentration of polyvinyl alcohol for different time and tested for wash durability and insect repellency test.

**KEYWORDS** Cotton fabrics, Lemon eucalyptus leaves, Wash durability

### I. INTRODUCTION

The world where this would lead us would be astonishingly hi-tech and materialistic. To ensure our security and safety from the future hazards, we need to equally development the technology for our protection. Medicinal plants are the gift of nature to cure limitless number of diseases among human being. The abundance of plants on the earth surface has led to an increasing interest in the investigation of different extracts obtained from the traditional medicinal plants as potential sources of new mosquito repellent agent [1]. 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 [2]. 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 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 the application.

### II. MATERIALS AND METHODS

The investigation was carried out to optimize the process of natural insect repellent tie and dye with leaves of lemon eucalyptus.

#### 1. Collection of materials:

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

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

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

## 2. Optimization of variables for insect repellent tie and dye

i. Optimization of concentrations (5, 10 and 15 per cent) of natural insect repellent done on optical density basis measured through spectrophotometer. Experiments were conducted with concentrations of lemon eucalyptus leaves.

ii. After optimization, extraction of the lemon eucalyptus leaves was done by using methanol. This extract solution was further diluted in three concentrations i.e.; 45, 50, and 55 per cent and 0.5 per cent concentration ferrous 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 lemon eucalyptus leaves were 60, 90 and 120 minutes. Cotton sample were tie dyed by utilizing these parameters.

iv. **Mordanting of tie dyed Sample:** Tie dyed cotton samples were mordanted with 5, 10 and 15 per cent concentrations of polyvinyl alcohol and tested for insect repellency and wash durability.

**Insects repellency test:** Prepared tie and dyed samples was 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 insects in the box and allow them for 2 minutes. Insects 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 insects which will rest on the unfinished and dyed samples during 2 minutes. Efficiency of insect repellency was calculated by using following formula:

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

**Wash durability test:** Tie and 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 polyvinyl alcohol for different time were checked up to 15 to 20 laundings. {3}

## III. RESULTS AND DISCUSSION

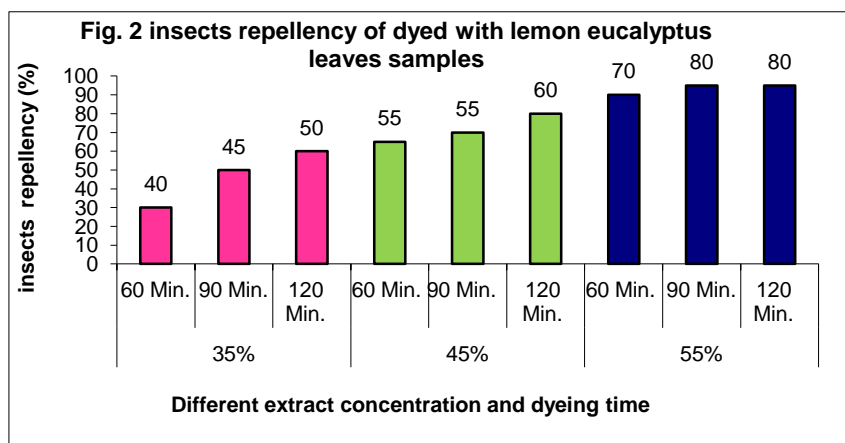
Results reveal that 10 per cent of lemon eucalyptus leaves showed maximum optical density hence optimized for finishing process. Lemon eucalyptus leaves extract in 55 percent concentration for 90 minutes dyeing time produced excellent insect repellency. Dyed cotton samples were mordanted with 10 per cent concentration of polyvinyl alcohol for 90 minutes, revealed good wash durability up to 15<sup>th</sup> laundering. Therefore these finishing conditions were optimized for dyeing of cotton fabric. Thus, cotton fabric finished with lemon eucalyptus leaves protects the human beings from the bite of insect and there by promising safety from insect borne diseases like malaria, dengue fever and filarasis.

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Lemon eucalyptus leaves extract was taken in 35, 45 and 55% concentration. Data depicts that on increasing concentration from 40-55 per cent insect repellency also increases from 70-80%, therefore 55 per cent extract was standardized for dyeing of cotton fabric.

### Effect of tie and dye treatment on cotton fabric properties:

	Stiffness	Crease recovery	Drapeability	Tensile strength
Control (Warp)	3.62	35.8	0.84	29.40
Finished	2.5	47.8	0.05	26.80
Control (Weft)	3.46	33.6	0.86	36.40
Finished	2.94	53.6	0.01	36.60

Table reveals that fabric become softer and pliable after dyeing with lemon eucalyptus leaves. Crease recovery and drape of tie and dyed cotton fabric also improved. Tensile strength increased in weft direction while slight decrease was observed in warp direction

### IV. CONCLUSION

Cotton fabric tie dyed with lemon eucalyptus 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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