



RESEARCH ARTICLE

DEVELOPMENT OF ECO FRIENDLY MOSQUITO REPELLENT COTTON FABRIC

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ABSTRACT

Controlling mosquito is of utmost importance in the present day scenario with rising number of mosquito borne diseases. An alarming increase in the range of mosquito is mainly due to deforestation, industrialized farming and stagnant water. Thus, special products like mosquito repellents for combating mosquitoes are required. The present study was an endeavor in this direction, where attempt has been made to collect, the information on natural mosquito repellent and to standardize the tie dye recipes with (natural mosquito repellent) for cotton fabric. In this direction a research is mainly carried out for the development of mosquito 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, concentration of mordant and dyeing time on the basis of optical density and mosquito repellency 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 mosquito repellency test and its provides 95 percent mosquito repellency.

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INTRODUCTION

Textile sector is facing new challenges in the modern days and every technician is giving the best to face these challenges. Health and hygiene are the primary requirements for human beings to live comfortably and work with maximum efficiency. The abundance of 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. Natural mosquito repellents fabrics may be one of the most effective tools for protecting human from vector borne diseases such as malaria (having >75 million cases every year resulting in 8 lakh deaths)*, dengue fever (2500 million people at risk worldwide)*, chickengunia and filariasis (420 million people at risk in India)*. 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, such as infection control and barrier material. 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. To ensure our security and safety from the future hazards, we need to equally development the technology for our protection. 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 mosquito repellent used for control of vectors are causing irreversible damage to ecosystem and also chemicals are non-degradable in nature. To overcome the problem, natural base mosquito repellent is best alternative for DEET base synthetic chemical mosquito repellent. These herbal extracts are eco-friendly and biodegradable in nature.

*K. Park (2008)

MATERIALS AND METHODS

The investigation was carried out to optimize the process of natural mosquito 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, ferrous sulphate, polyvinyl alcohol and for extraction of natural mosquito repellent and mordanting of tie dyed sample, respectively.

2. Optimization of variables for mosquito repellent tie and dye

- i. Optimization of concentrations (5, 10 and 15 per cent) of natural mosquito 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 mosquito 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 (mosquito repellent) Sample:** Tie dyed cotton samples were mordanted with 5, 10 and 15 per cent concentrations of polyvinyl alcohol and tested for mosquito repellency and wash durability.

Mosquito repellency test: Prepared tie and dyed samples were tested for mosquito repellency in mosquito cage box. Cage test is the quick and cost effective way to determine the mosquito repelling qualities of treated materials. A box of 30×30×30 cm made out of transparent glasses with 25⁰ C ±2⁰ 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 mosquito effectiveness by counting the number of mosquitoes which will rest on the unfinished and dyed samples during 2 minutes. Efficiency of mosquito repellency was calculated by using following formula:

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

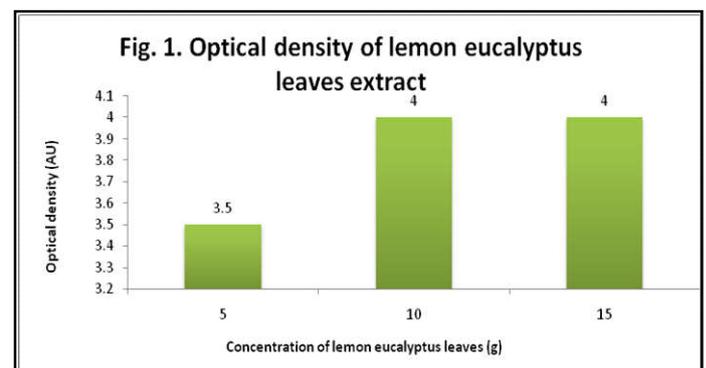
Wash durability test: Tie and Dyed sample were dipped in 5 per cent mild detergent (Ezee/Genteel etc.) solution for 30 minutes. After that samples were washed with plain water, squeezed and dried in shade. Wash durability of dyed samples mordanted with different concentration of polyvinyl alcohol for different time were checked up to 15 to 20 launderings.

3. Effect of Tie and dyeing (mosquito repellent) on Physical Properties:

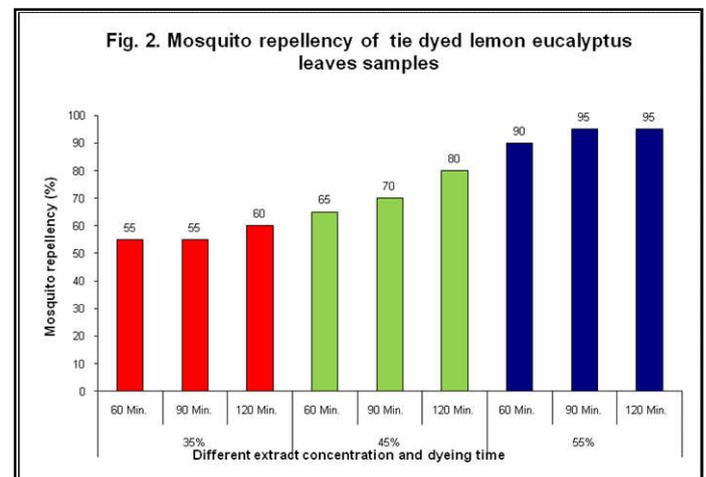
Tie and dyed cotton sample was evaluated for fabric stiffness, tensile strength, crease recovery and drape co-efficient.

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 mosquito repellency. Dyed cotton samples were mordanted with 10 per cent concentration of polyvinyl alcohol for 90 minutes, revealed good wash durability up to 15th 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 mosquito and there by promising safety from mosquito borne diseases like malaria, dengue fever and filarasis.



Optical density of 5, 10, 15 g lemon eucalyptus leaves powder in 100ml methanol gave the highest value (4.0) therefore, 10g selected as optimum.



Effect of tie and dye treatment on cotton fabric properties

	Stiffness	Crease recovery	Drapeability	Tensile strenght
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

Lemon eucalyptus leaves extract was taken in 35, 45 and 55% concentration. Data depicts that on increasing concentration from 35-55 per cent mosquito repellency also increases from

55-95%, therefore 55 per cent extract was standardized for dyeing of cotton fabric. 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

Conclusion

Cotton fabric tie dyed with lemon eucalyptus leaves protects the human beings from the bite of mosquito and there by promising safety from mosquito 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, mosquito net, window curtain and other home furnishings.

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