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Mini Review

Antibacterial Finishes on Textile Materials with *Eucalyptus*

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Abstract

During the past few years, there has been a growing awareness regarding healthy living and choice of healthy products in all areas including the textile goods. Hence, antibacterial textile products shall gain importance in this aspect. In order to achieve this objective, various chemicals have been used. However, various investigations relating to the use of some different industrial crops have shown interesting outcomes. In order to dye and impart antibacterial property *Eucalyptus* leaves that have been dried and ground, and the extraction so obtained has been used for imparting the required finish. Herein, beyond the known industrial crops and herbal wastes, dried and ground *Eucalyptus* leaves were extracted and used in finishing of wool to color and gain an antibacterial activity. A specific liquor ratio has been selected in the finishing process and studies have been conducted using mordants and without as well. The finishing processes have been followed by assessment with regard to colors achieved and antibacterial activities against *S. aureus* and *E. coli* bacteria. On the other hand, studies relating to FT-IR and ICP-MS, color fastness, and SEM images of the finished test fabrics have also been observed. Based on the outcome of such processes, the wool fibres have been found to develop antimicrobial properties through application of *Eucalyptus* leaves and are and dyeable. The colours have been varied owing to the addition of mordants, and fabrics have also developed bacterial resistance against *E. coli*.

Keywords: *Antibacterial Finish; Eucalyptus; Coloration; Bacteria; Gram Positive; Gram Negative*

Introduction

The present age witnesses the growing popularity of medical and healthcare textiles since they provide a safe, healthy and comfortable living environment and the protection from the infection of pathogenic microorganisms [1]. But, natural fibers like wool and cotton, are prone to get affected by bacteria, fungus, etc. due to the conditions caused by them and hence many antibacterial finishing techniques have been evolved and an increasing focus has been witnessed toward the use of fabrics characterized by nontoxic and durable antimicrobial finishing with regard to various uses [2,3]. Also, a considerable problem arises from multidrug resistance in pathogens that would affect human health and use of harmful chemicals for combating bacteria has proved to be a major concern due to their adverse effects on mankind and their surroundings [4,5]. Presently, mankind have to select substances of natural origin with regard to health [6]. The herbal medicines obtained from plants have been recognized as are considered safe substitute to synthetic drugs [7]. Hence, there is an increasing interest towards medicines and products that are of natural origin [8]. The use of medicines obtained from plant extracts possess

innumerable merits that include renewable nature, less side effects, economy and easier reach have promoted their use as antimicrobial agents [9]. Based on the rationale and need, the *Eucalyptus* leaves have undergone trials for determination as a source of antibacterial feature for textile materials. *Eucalyptus* relates to Myrtaceae family and it consists of around nine hundred species and subspecies [10]. The plants belonging to this gene culture possess the property to relate to be one of the types of an aromatic plant that is abundant in a bioactive compound that include monoterpenes, oxygenated monoterpenes, sesquiterpenes, oxygenated sesquiterpenes, commonly observed in essential oil [11]. There is a high emitting of biogenic volatile organic compounds by *Eucalyptus*, particularly volatile isoprenoids [12]. Important oils of the gene culture *Eucalyptus* provide abundant source of antimicrobial and antioxidant products that find utilization in the pharmaceuticals, cosmetics and food industries and they are a good source for traditional medicines [13,14]. Also, the herbal sources could be utilized in natural textile dyeing. Each herb is utilized to prepare dye and over five hundred plants that give color, exist in nature [15]. Despite synthetic dyeing techniques taking precedence during the previous century, a good deal of dyeing materials are available in plenty in nature [16]. Owing to greater emphasis laid on water pollution, the sustainability of raw materials and products, biodegradability and environment, representation of natural dyes get due consideration in textiles [17]. Hence, the *Eucalyptus* leaves have been analyzed as a source of natural dyestuff and antibacterial agent.

Color and color fastness

Considering obtained photographs, the use of *Eucalyptus* leaf extracts in wool fabric finishing have ensured coloration of the fabrics. When considering the processing of wool samples with *Eucalyptus* extract, the shades obtained ranged between yellow to brown. The mordanting agent is found to have a strong influence in this regard. Tin (II) chloride and copper mordants have been used. The color efficiency or color value attained highest value during dyeing when copper mordant has been used. The least value has been achieved in the dyeing trial with potassium aluminium sulphate (alum) mordant material. The color efficiencies have been found to be almost at the same level, in other instances. With regard to change in color and the staining on standard fabric, the values of wash fastness have been very good. When considering values of wash fastness, in general there has been no difference owing to alteration in mordant in dyeing processes [18]. The findings relating to light fastness reveal that the *Eucalyptus* leaf extracts impart high resistance to the artificial light hence the fading of the colors by the light was low. The light fastness did not show considerable change in light fastness because of the change of mordant substance. Ultimately, it can be established that required fastness values have been achieved in the case of woollen fabric with regard to light and wash fastness values. Besides the study of the color, investigation with regard to the surface features of the test fabrics have also been conducted. With this objective, FTIR and SEM studies have been carried out. Similar to IR spectroscopy, there is no considerable difference in SEM images pertaining the differently treated test fabrics. That is, there was no difference in the superficial images between the woollen fabric which had not undergone any dyeing process and the type bacteria but in that case, no antibacterial effect was observed against *E. coli* type bacteria. But, by utilization of various mordants in finishing processes, 99.99% antibacterial effect values have been achieved against bacteria tested. Hence it can be stated that application of *Eucalyptus* in finishing proves effective to achieve antibacterial effect. However, there is increase in antibacterial activity by introduction of mordants and is considered valid for the bacteria tested. A different attempt has been made to study the cause of this feature and ICP-MS studies of *Eucalyptus* leaf extracts have also been carried out. Use of substances like potassium aluminium sulphate, iron (II) sulphate, tin (II) chloride, copper (II) sulphate at appropriate ml ratios, concentrations under specified temperature and time durations are thought to contribute to the antibacterial activity of *Eucalyptus* leaves.

Conclusion

Under the prevailing global situation, healthy life is considered crucial and has permeated into every area of science. Specifically, producers aim to introduce innovative and natural features to their products based on requirements of the consumers. It has been focussed to render the woollen fabrics to develop antibacterial activity besides dyeing processes through application of *Eucalyptus* leaves. In order

to conduct the antibacterial test, two categories of bacteria, namely, Gram-positive and Gram-negative have been utilized. Excellent antibacterial value has been achieved the extent of 99.99% in the caser of finishing process without the use of mordant and has been achieved only in the case of *S. Aureus* bacteria. But, in the case of finishing processes with use of mordant, antibacterial activities of 99.99% has been achieved against *S. aureus* as well as *E. coli* bacteria. Also, fastness tests have revealed that colored test fabrics had usable values with regard to light and washing fastness.

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