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Associazione Italiana di
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Per il 2025, il Pantone Color Institute seleziona PANTONE 17-1230 Mocha Mousse, una calda tonalità marrone intrisa di ricchezza. Ci nutre con la sua suggestione delle deliziose qualità del cioccolato e del caffè, rispondendo al nostro desiderio di comfort.

For 2025, the Pantone Color Institute selects PANTONE 17-1230 Mocha Mousse, a warming, brown hue imbued with richness. It nurtures us with its suggestion of the delectable qualities of chocolate and coffee, answering our desire for comfort.

Not knowing when the Dawn will come, I open Every Door.
Emily Dickinson

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Book of Abstracts

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Bio-based and eco-friendly agents with antibacterial properties for textile functionalization: insights from the Donizetti project.

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1 Introduction

Functionalization of textile fibers and fabrics improves their performance, increasing durability and longevity [1], and providing various biological activities, including antibacterial ones [2]. Antimicrobial textiles are functionally active textiles, which may kill microorganisms or inhibit their growth [3]. The antimicrobial effect is usually obtained through the application of chemical substances, employing expensive materials with high environmental impact, as well as thermal treatment [4]. For this reason, in the last decade, the textile industry has focused its attention on safer and more sustainable alternatives, using vegetable-based products, often obtained from residues or by-products from the agri-food industries, which have demonstrated to be a source of bioactive compounds with biocidal activity.

In this work, the antimicrobial and antioxidant properties of polyphenols (PPs), such as rosmarinic acid (RA) and eugenol (EU), are exploited. In particular, these biomolecules were used as coatings for cotton fabrics and their antimicrobial activity was evaluated against two bacterial strains, Gram-positive and Gram-negative bacteria.

2 Experimental

2.1 Materials and Methods

Cotton and PET fabrics were functionalized by dip-coating of bioactive molecules preceded by tissue surface activation through plasma treatment. Figure 1 shows the bioactive natural molecules extracted and used in this work

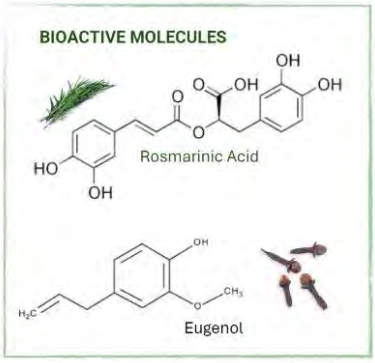

Figure 1. Chemical formula of rosmarinic acid and eugenol.

The antibacterial activities of rosmarinic acid (RA) and eugenol (EU) and of cotton treated with RA and EU were assessed. *Staphylococcus aureus* ATCC 6538 and *Escherichia coli* ATCC 11229 bacteria were cultured in aerobic conditions at a temperature of 37°C in Buffered Peptone Water and Yeast Extract Agar. The antimicrobial activity was evaluated according to the ASTM E 2149-2013 procedure ("*Standard test method for determining the antimicrobial activity of immobilized antimicrobial agents under*

dynamic contact conditions"). Contact time of samples with bacterial inoculum was 1 hour, under dynamic contact conditions. The percentage of bacterial reduction was calculated using the following equation:

$$\text{Bacterial reduction (\%)} = \frac{(A - B) \times 100}{A} \qquad \text{Equation 1}$$

where A is the number of viable microorganisms before treatment and B is the number of viable microorganisms after treatment.

3 Results and discussion

Rosmarinic acid and eugenol exerted excellent antibacterial activity. In fact, RA had a biocidal effect against *E. coli* and *S. aureus*, with a bacterial reduction ranging from 99.6% to 100%, respectively (Table 1). The antibacterial performance of EU against *E. coli* and *S. aureus* reached complete bacterial reduction (100%). Moreover, functionalized textiles proved to be effective against test microorganisms, with a bacterial reduction of 100%.

Table 1. Bacterial reduction (%) of rosmarinic acid, eugenol and functionalized textiles against *S. aureus* and *E. coli*.

Sample	**Bacterial reduction (%)**	
	S. aureus	*E. coli*
RA	100	99,6
EU	100	100
Cotton + RA	100	100
Cotton + EU	100	100

4 Conclusions

The use of antimicrobial compounds in textiles has significantly grown over the last decades. In this study, plant-derived compounds, particularly polyphenols, demonstrated biocidal activity against Gram-negative and Gram-positive microorganisms. The use of biomolecules for textile functionalization could represent a promising, safer, sustainable and eco-friendly alternative to commonly used chemical substances. In addition, the use of formulations with components of natural origin is consistent with the circular economy principles, using residues or by-products as secondary raw materials. Therefore, further research is needed in this area.

Aknowledgements

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