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The evaluation of the antibacterial capacity of tea tree functionalized microcapsules in textiles

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Introduction

The textile industry develops products that go beyond aesthetic concerns. Manufacturers functionalize these new textile products to provide them with new technical properties, to meet and even exceed user needs. The technical properties are diverse, from ultraviolet protection to antimicrobial or self-cleaning properties. The growth of microorganisms on textiles can result in unpleasant odors, stains or even accelerate the wear and tear of textile products. Microcapsules may contain natural or synthetic components in their core, capable of providing the desired properties to textiles (Figure 1). In addition, a shell protects the core and its design allows a gradual release of the main component. In this work, microcapsules were dyed to prevent the appearance of stains. This research tested the antibacterial capacity of microcapsules functionalized with tea tree essential oil on polyester fabric (PES). The fabric was tested with dyed and undyed microcapsules to ensure no dye interference. This research evaluates antibacterial capacity using the following standard bacteria: Staphylococcus aureus and Escherichia coli.

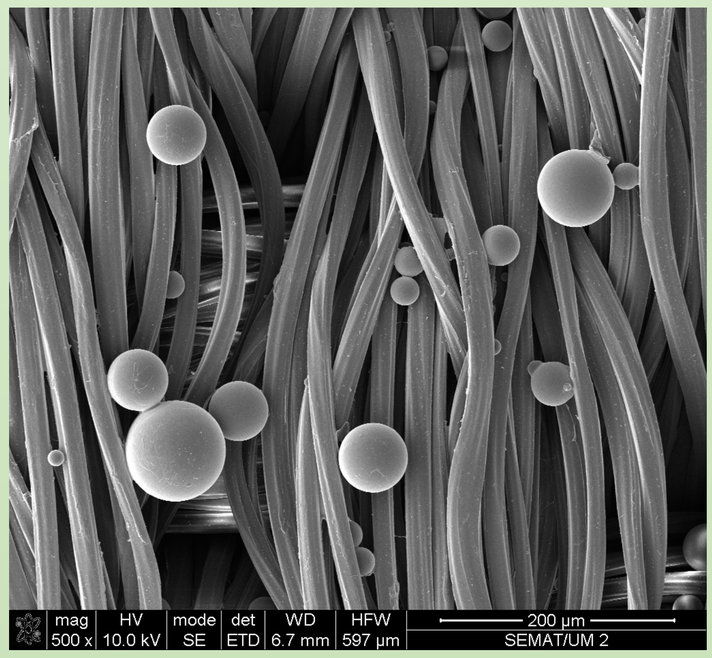

Figure 1 – SEM image of microcapsules

Results & Discussion

1 – The process of microcapsule dyeing

The microcapsules were dyed using a disperse dye at 130 degrees Celsius for 3 hours (Figure 2). The microcapsules were, after, applied on the textile using the pad-dry-cure method (Figure 3).

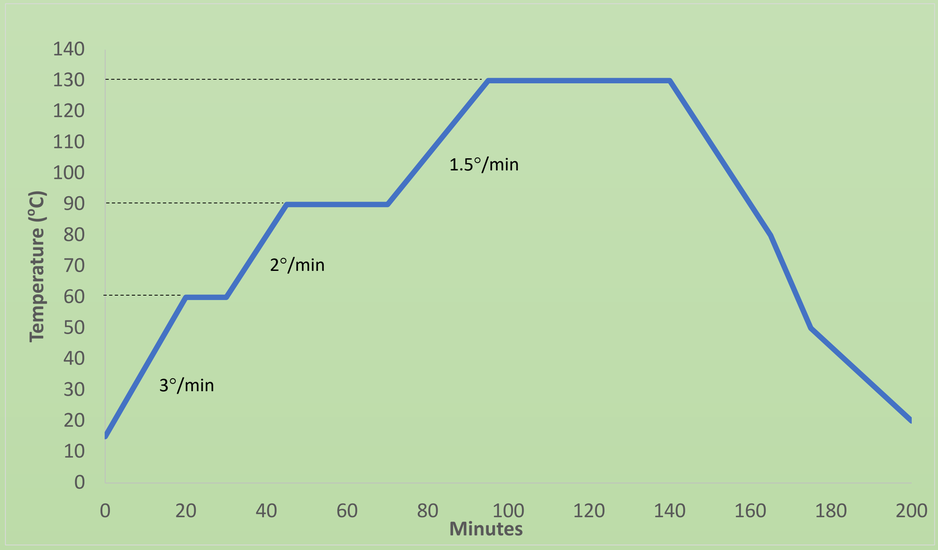

Figure 2 – Microcapsule dyeing scheme

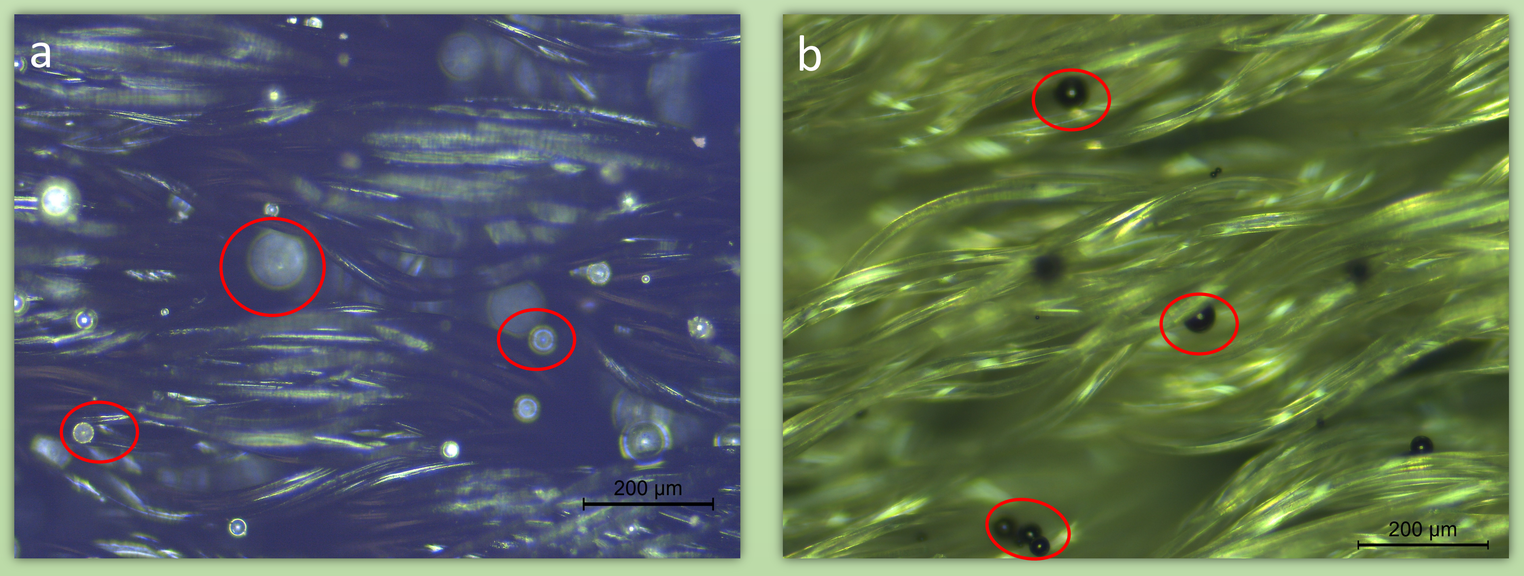

Figure 3 – Optical microscope imaging (magnification x100) of a) undyed microcapsules and b) dyed microcapsules

2 – Antibacterial capability

The dying process did not affect the antibacterial capability of microcapsules (PES-undyed X PES-dyed), as they show comparable results in magnitude for S. aureus (Figure 4) and E. coli (Figure 5).
The results of contact killing (CK) tests indicate that the proposed functionalization presents considerable bactericidal activity (> 6-log) for S. aureus, which indicates a sterilization level (Figure 4).

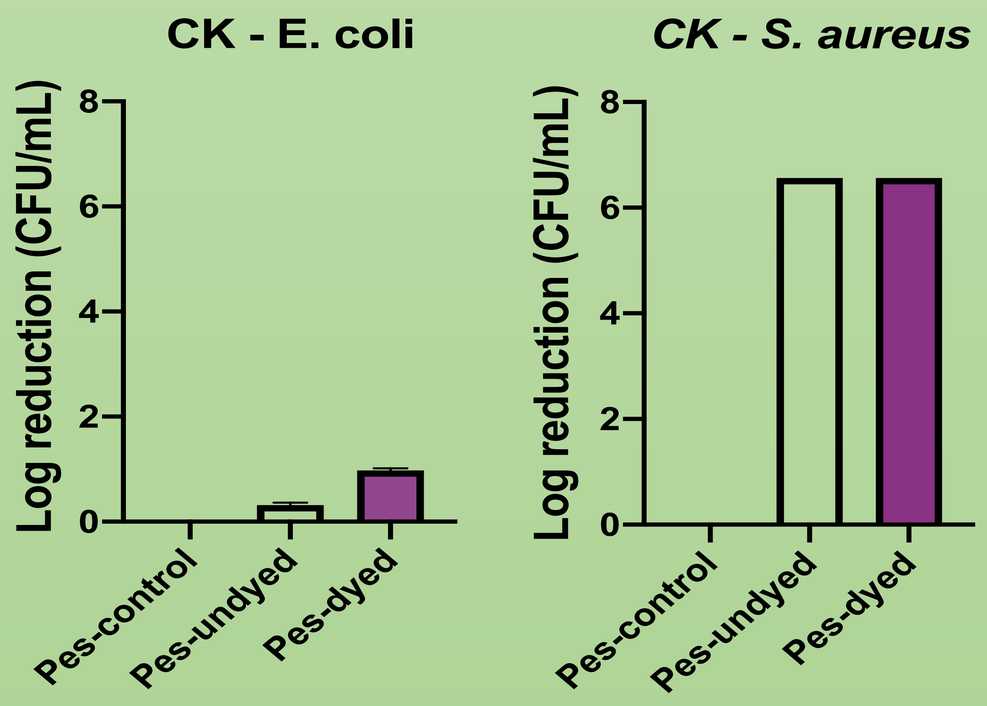

Figure 4 – Contact killing for E. coli and S. aureus

Conclusion and future perspectives

antibacterial activity was observed for S. aureus with sterilization properties (> 6-log). No antibacterial activity was observed for E. coli. These results denote a selective antibacterial potential for the application of microcapsules functionalized with tea tree essential oil. However, there might be other essential oils that encompass a greater antimicrobial scope.

Acknowledgments

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