

ALGARVE'S PGI CITRUS ESSENTIAL OILS: UNLOCKING THE POTENTIAL OF FOOD INDUSTRY BY-PRODUCTS

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Introduction

Worldwide, the processing of citrus juices generates elevated amounts of waste (around 120 million tons, annually), due to the discard of these fruits by-products, such as peels, seeds and pulp, leading to an unprecedented environmental burden. Portugal's citrus fruits cultivated under the Protected Geographical Indication (PGI) designation, particularly, constitute a significant agricultural sector, which resulted in a production of approximately 398.83 thousand tons, in 2019 [1]. Nevertheless, the processing of these citrus results in wasting between 45% and 50% of the fruit, and contributes to environmental issues such as water and land pollution [2, 3]. Orange (*Citrus sinensis*) and lemon (*Citrus limon*) peels, for instance, contain valuable bioactive compounds such as polyphenols, essential oils, and fiber, which can be repurposed for novel food, pharmaceutical and cosmetic applications [2,3]. Regarding these promising compounds, citrus peels essential oils (EO's) have gained increasing attention for their diverse applications within the food preservation area, due to their properties, such as potential antimicrobial and antioxidant capacities [2,3]. Therefore, the repurpose of citrus by-products, particularly the essential oils extracted from their peels, presents a favorable solution for environmental challenges posed by excessive waste, bringing forward a valuable approach for innovative applications regarding the food industry, among other sectors.

Objectives

The present work aimed the extraction and characterization of essential oils, from orange (*Citrus sinensis*) and lemon (*Citrus limon*) peels, using a sustainable approach based on green chemistry principles, in a way to valorize these bioactive compounds through potential food preservation applications, promoting circular economy within the industry.

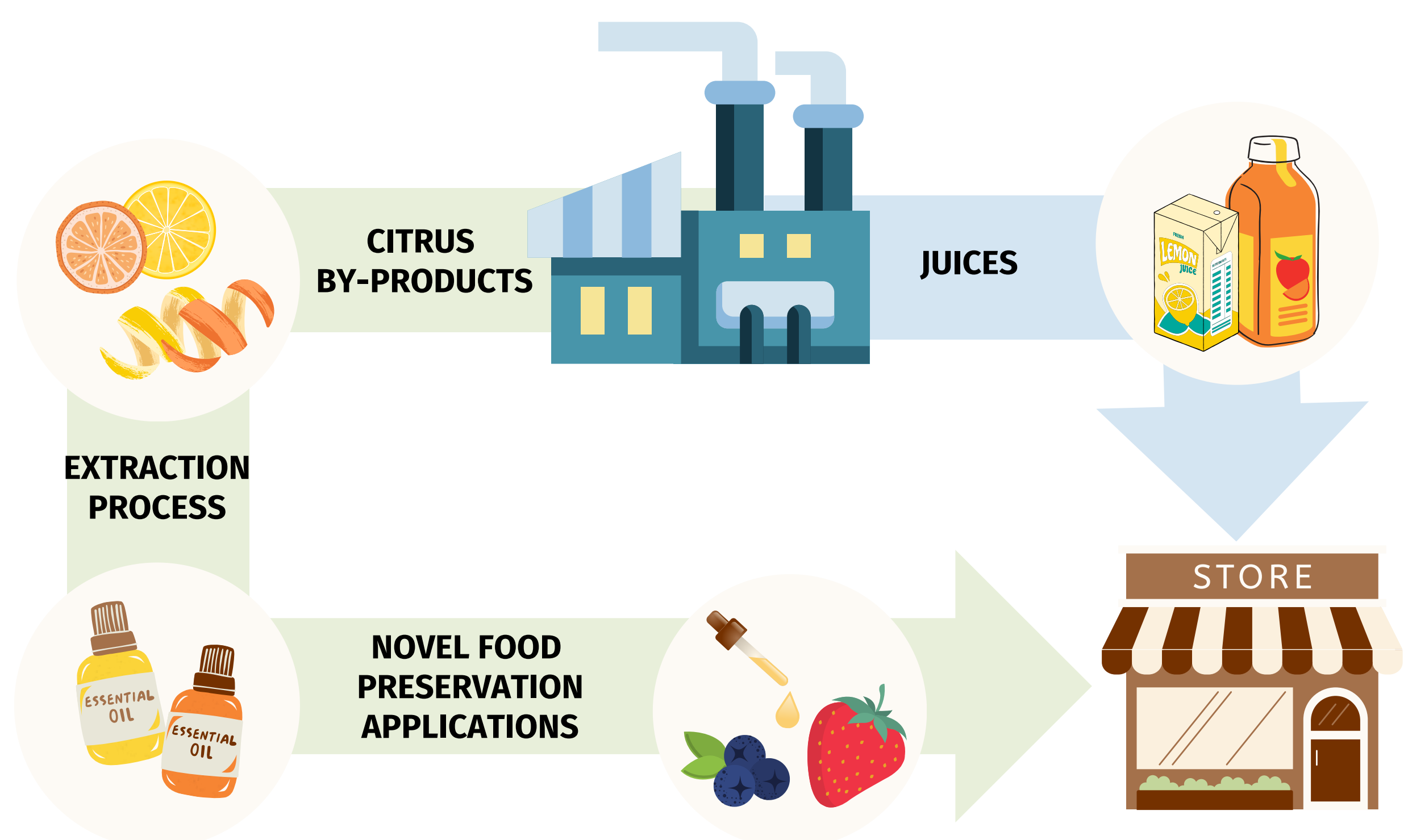


Figure 1. Citrus peel's essential oil obtention process and upcycling diagram.

Methods

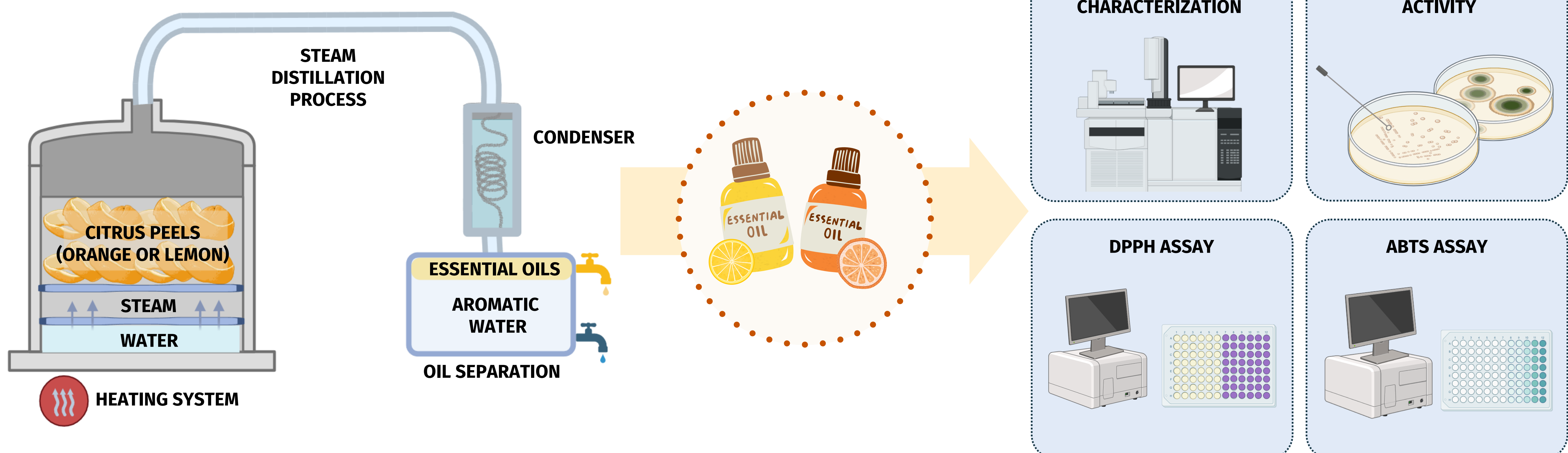


Figure 2. Steam distillation extraction and bioactivities evaluation methodology diagram for the essential oils extraction from citrus' peels. Adapted from Vilas-Boas et al., 2023 [3].

Results & Main Conclusions

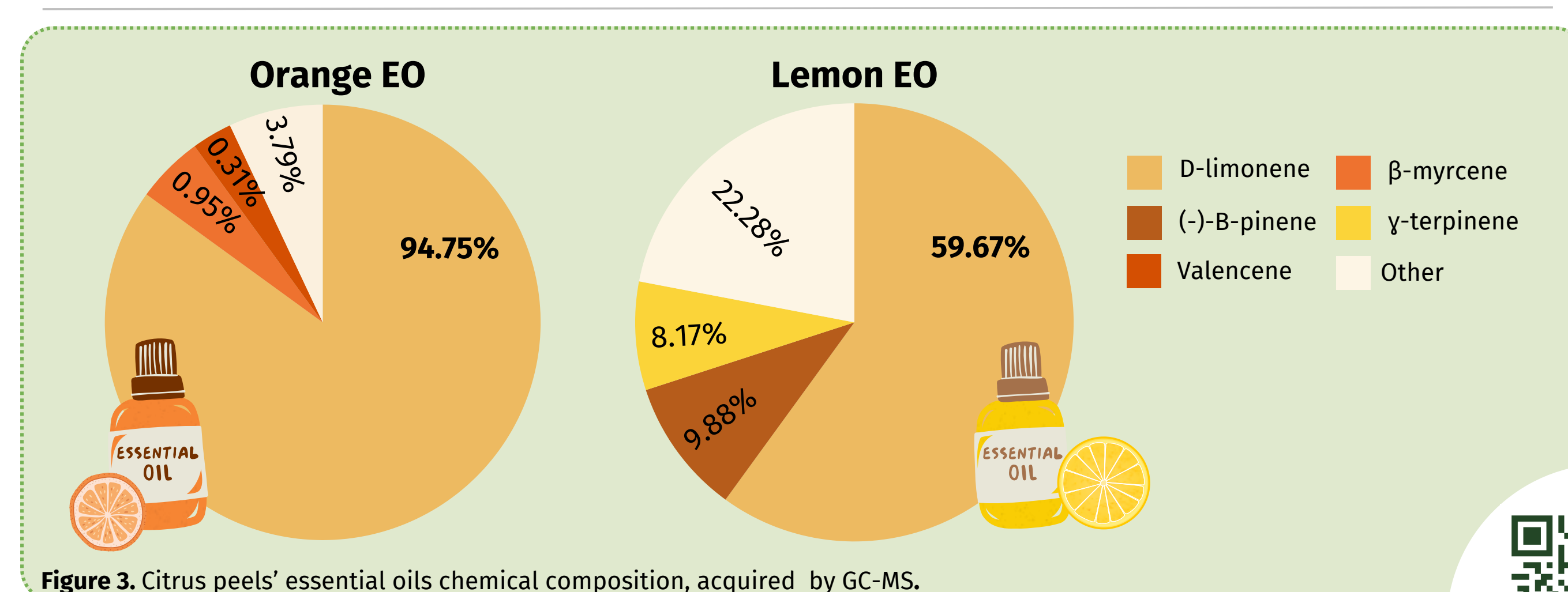


Figure 3. Citrus peels' essential oils chemical composition, acquired by GC-MS.

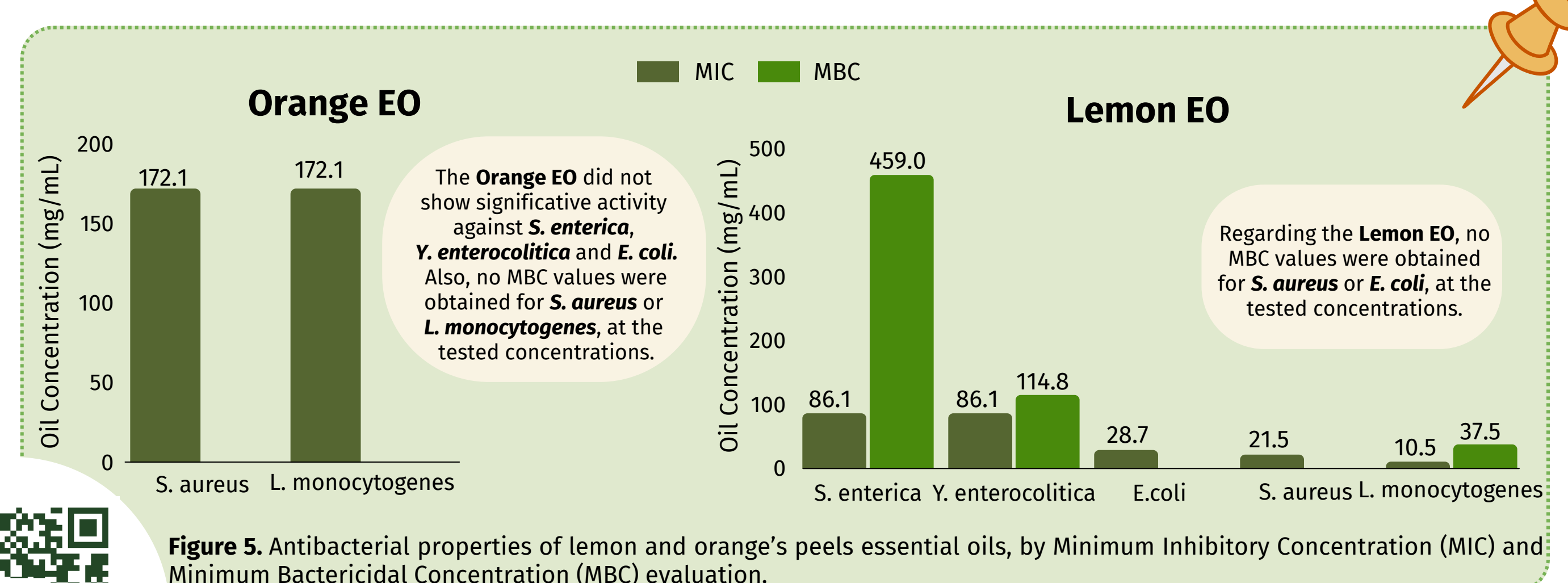


Figure 5. Antibacterial properties of lemon and orange's peels essential oils, by Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) evaluation.

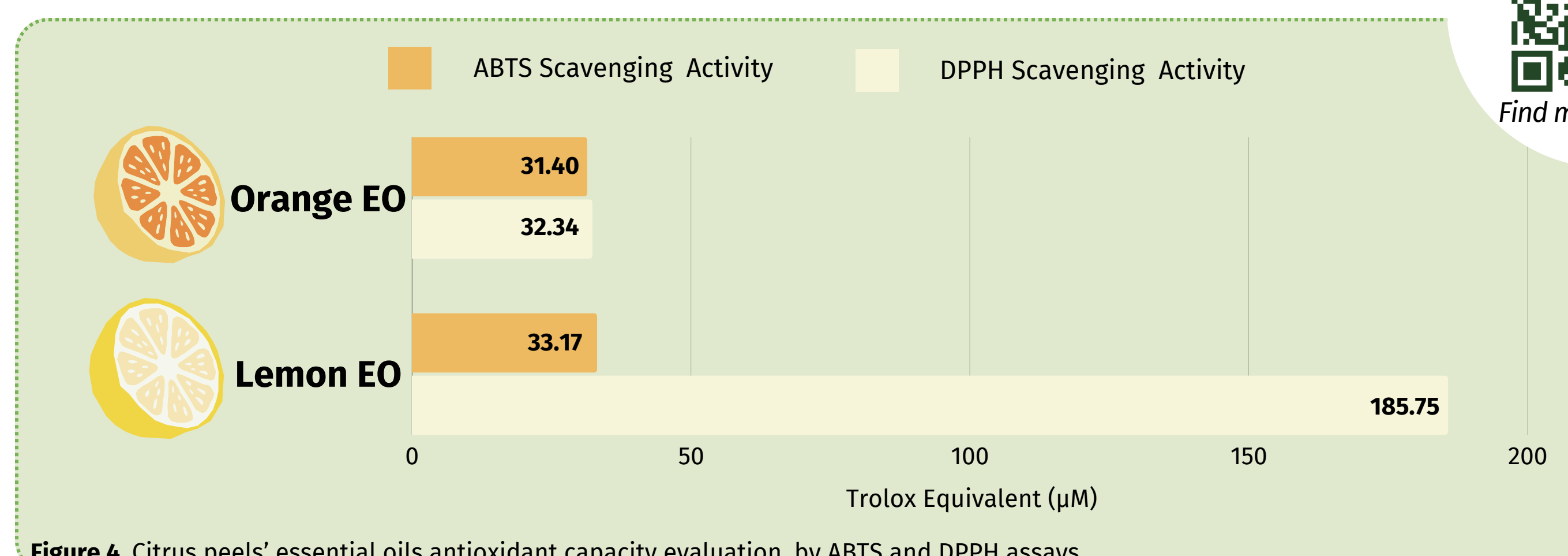


Figure 4. Citrus peels' essential oils antioxidant capacity evaluation, by ABTS and DPPH assays.

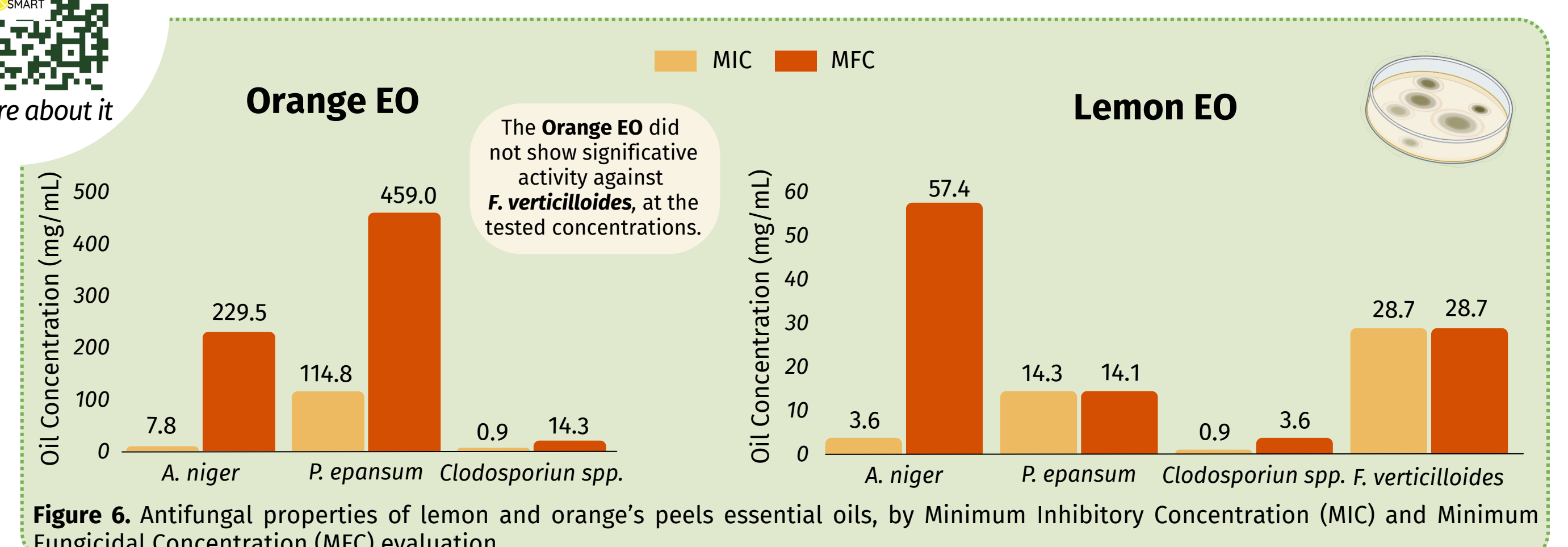


Figure 6. Antifungal properties of lemon and orange's peels essential oils, by Minimum Inhibitory Concentration (MIC) and Minimum Fungicidal Concentration (MFC) evaluation.

Overall, the valorization of citrus processing by-products, exemplified by the essential oils from Algarve's PGI citrus peels, not only offers promising ways for sustainable food preservation solutions, but also underlines the importance of turning waste into valuable resources in the global citrus industry, as a circular economy approach.

References

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