Antibacterial efficacy of essential oils and its major components against planktonic and biofilm cultures of *E. coli* and *S. aureus*

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Microorganisms attach readily to surfaces and if they are left undisturbed biofilms may form. Biofilm cells normally display an altered phenotype that is believed to be responsible for the less susceptibility to antimicrobials. Moreover, biofilm-growing cells are protected by the self-produced matrix that acts as a shield against external pressures. Thus, pathogens embedded in a biofilm can be harder to remove than the planktonic counterparts. Microorganisms may also acquire a resistant phenotype due to intensive use and misuse of conventional antimicrobials. The development of resistance has been calling attention to discover novel antimicrobials with new mechanisms of actions. Currently, there has been a widespread interest in the study of plant-derived compounds as alternative disinfectants and sanitizers. Previous studies have been showing that there is a great diversity of plants that produce antimicrobial metabolites, including essential oils which have considerable antimicrobial activity. However, there are few data regarding the use of those plant extracts and/or their major components on biofilm control.

In this work, essential oils (EO) from three plants (cinnamon, palmarosa, green tea) were tested in-vitro against planktonic and sessile *Escherichia coli* and *Staphylococcus aureus*, two well-known food-borne pathogens. The essential oils showed very interesting antimicrobial and anti-biofilm features against the two food-associated pathogens. They also revealed promising biofilm removal characteristics. EO were further fully characterized by GC-MS, after dilution on dichloromethane, and the major volatile compounds (cinnamon – eugenol; palmarosa – geraniol; green tea – terpinen-4-ol) were essayed against the same bacteria, in planktonic and in sessile communities. However, these major components did not have similar antimicrobial effects against the biofilms.

These results suggested that the antibacterial features of the EO are the sum of the bioactivity of more than one of the principal compounds. These promising antimicrobial properties highlighted the importance of testing and further including plant-derived compounds and its principal bioactive components, alone or in synergistic combinations, in newer biocontrol and biofilm removal strategies in food-processing environments.