Introducing a quantitative assay to assess the volatile antimicrobial activities of essential oils and their components

Adam Feyaerts[1,2], Lotte Mathé[1,2], Walter Luyten[3], Patrick Van Dijck[1,2]

[1] *VIB Department of Molecular Microbiology, KU Leuven, 3001, Leuven, BELGIUM*
[2] *Laboratory of Molecular Cell Biology, KU Leuven, 3001, Leuven, BELGIUM*
[3] *Department of Biology, KU Leuven, 3000, Leuven, BELGIUM*
**Corresponding author: Email: adam.feyaerts@mmbio.vib-kuleuven.be*

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Many studies are devoted to the antimicrobial activities (AMAs) of essential oils (EOs). Typically, their minimal inhibitory concentrations (MICs) are reported; indicating the lowest concentration necessary to inhibit microbial growth in a given assay. This has been the gold standard defining the antimicrobial potential of agents against a specific microorganism under specific conditions[1]. For single-compound antimicrobials it is a fixed value. However, antimicrobials such as EOs are highly complex natural mixtures of diverse EO components (EOCs), and hence their MIC value may vary between similar EOs or different batches of the same EO, although the differences generally are within a fairly narrow range. Various MIC-derived parameters have been introduced, for instance, to report the cidal activities of antimicrobials such as the minimal fungicidal activity, or to report the MIC for specific growth conditions of the microorganism such as like sessile MIC (commonly abbreviated as sMIC). Assays to measure a (derived) MIC of an antimicrobial against a specific microorganism have in common that they are all water-based assays and that the component is dissolved or emulsified in the liquid medium. For relatively hydrophobic antimicrobials such as EO(C)s this can be a challenge although different (co-)solvents are available to facilitate dissolution. However, EO(C)s are also volatile and can have biological effects e.g. antimicrobial activity, at a distance. To the best of our knowledge, there is not yet a gold standard assay in place for such effects.

In an attempt to close this knowledge gap, we developed the Distance-Related Effect (DRE) assay. This is the generic name of a novel, relatively inexpensive, easy to handle, quantitative (semi-)high throughput assay to measure the DREs of EO(C)s which, by extension, can be used with any volatile component. When the DRE assay is used to quantitatively measure the volatile MIC (vMIC) of components against planktonic microorganisms, then there is an objective way to compare the volatile AMAs between different antimicrobials. For specific growth conditions like sessile growth e.g. to assess anti- biofilm activity, we also introduce vsMIC.

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References

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