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Multiscale Chemical Mapping of *Lactuca sativa* Leaf Surfaces by Raman, SERS and AFM

The leaf surface is a chemically and structurally heterogeneous interface that plays a key role in plant-environment interactions. To characterize this heterogeneity in *Lactuca sativa*, confocal Raman spectroscopy, Raman mapping, surface-enhanced Raman spectroscopy (SERS), and atomic force microscopy (AFM) were combined, with particular attention to stomatal regions. Raman Analysis revealed a spectral response dominated by characteristic carotenoid bands around 1005, 1150-1155, and 1518 cm^{-1} . Raman mapping resolved their spatial distribution and revealed local variations between epidermal and stomatal regions, as well as differences between the adaxial and abaxial leaf surfaces. To extend sensitivity toward lower-abundance surface components, approximately 20 nm Ag nanoparticles were employed as a SERS substrate, revealing additional spectral features that were weakly resolved by conventional Raman spectroscopy. Co-localized AFM-Raman measurements linked nanoscale surface morphology with the local chemical response of the same stomatal region, revealing spatially couple variations between surface structure and molecular composition. This research offers a multiscale strategy for studying complex biological interfaces and lays the experimental groundwork for future TERS measurements, in which chemical information could be explored directly at the nanoscale.

References

- [1] David I. Ellis, David P. Cowcher, Lorna Ashton, Steve O'Hagan, Royston Goodacre; Illuminating disease and enlightening biomedicine: Raman spectroscopy as a diagnostic tool. *Analyst* 2013; 138 (14): 3871–3884.
- [2] Ninkuu V, Zhang L, Yan J, Fu Z, Yang T, Zeng H. Biochemistry of Terpenes and Recent Advances in Plant Protection. *Int J Mol Sci.* 2021 May 27;22(11):5710.

Figures

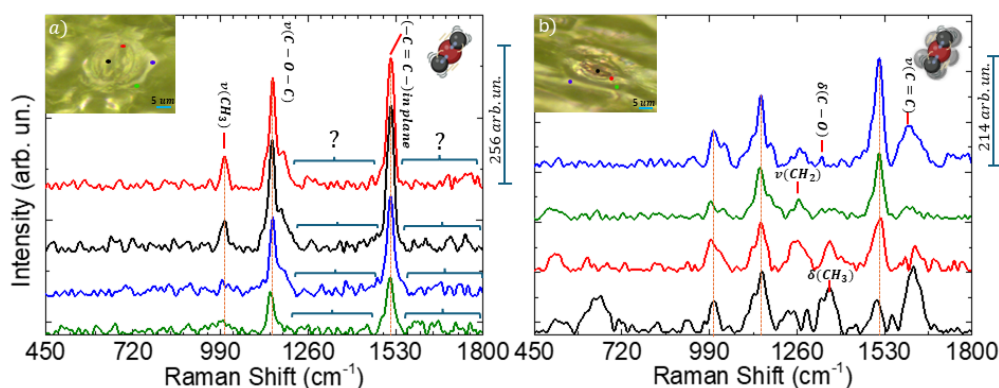


Figure 1: Raman spectra from four stomatal positions: a) without and b) with AgNPs.