Microspectroscopic Raman Imaging of Cucumber Plant Tissues

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Raman spectroscopy is a powerful tool to obtain a whole fingerprint of biological tissues and cells for chemical, structural and environmental analysis. Combining Raman with scanning microscopy applications we observe molecular and spatial resolved images at nanometer or micrometer scale that can reveal structural information of a multidimensional sample.[1., 2.] An even more important advantage is the possibility of using signal processing and multivariate techniques to extend the capabilities for systematic and automated analysis of complex samples such as plant sections.[1.]
Here, we used this microspectroscopic technique for a systematic analysis of the tissues in different organs of cucumber (*Cucumis sativus*) plants: leaves, stems and roots. Cross sections were cut with a vibratome without embedding, on the one hand to accelerate the sample preparation, but most important to prevent contamination of the sample by embedding media. To observe the spectral fingerprint of cucumber cells, we used a confocal Raman microscope with visible laser excitation. The spectral images were acquired with 1 µm step size point by point for 1 s per spectrum. Comparing the Raman maps, the xylem cell walls can be subdivided based on their chemical composition. In dependence on the organ, the substructure of the cell walls varies. The different layers, that is, secondary wall, compound middle lamella and cell corner, respectively, can be defined according to lignin and cellulose amounts.
The new compositional and morphological information about the different cucumber tissues can contribute to better understand the influence of specific growth conditions on the structure of complex plant tissues.

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References

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