Vibrational spectroscopic characterization and identification of pollen

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The Raman or infrared spectrum of a complex biological sample is brought about by spectral contributions from all Raman or IR-active molecular groups contained in the sample and hence can serve as a fingerprint-like identifier for a specific biomaterial. The vibrational spectroscopic investigation of pollen has been reported in a few studies [1-3], but so far no systematic work has been carried out regarding the application of Raman and FTIR for identification purposes and the investigation of allergologic mechanisms. We have been working towards the goal of a spectroscopy-based characterization of natural bioaerosols, and in particular the identification of pollen contained therein, a matter of increasing interest not only to people suffering from allergies.

In microspectroscopic approaches we investigated pollen of several plant species, such as willow, birch, hazel and many others. Raman microspectra were obtained under a variety of sampling conditions and with different excitation wavelengths. We also compared the results of different sample preparation procedures, and conclude that in order to develop a fast automated identification method, these parameters will need to be observed. As complementary method to Raman spectroscopy, synchrotron FTIR microspectroscopy is employed, which permits the acquisition of high-quality spectra from very small sample volumes containing very few or even single pollen grains. Apart from the application of multivariate data analysis methods for the identification of species-specific spectral signatures, we also collected spectra from purified pollen compounds, such as sporopollenin, the major constituent of the pollen outer wall (exine). By closer examining pollen fractions, we hope to learn more about the main contributors to a complex spectral fingerprint of pollen and their fragments. Vibrational spectroscopy on purified pollen compounds permits an investigation of molecular alteration due to changes in the ambient conditions (e.g. of water content or presence of trace gases) and will hopefully improve our understanding of important allergologic mechanisms.