



## **Characterization of greenhouse soils using mid-infrared photoacoustic**

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Fourier transform mid-infrared photoacoustic spectroscopy (FTIR-PAS) is a novel technique and was firstly applied in the characterization of greenhouse soils. 235 soil samples were obtained from different greenhouses in China, in which the soil had been exposed to high organic and inorganic fertilizer input; the counterpart open field soils were

also sampled for comparison. The soil PAS spectra were recorded with the wavenumber range of 600-4000  $\text{cm}^{-1}$ , and clear differences were observed between the PAS spectra of greenhouse soil and counterpart open field soil. High fertilizer input posed strong effects on the soil PAS spectra, and partial least square (PLS) regression methods coupled to optimized spectral pretreatment were used to analyse relationships between the soil PAS spectra and the soil properties derived from the conventional analyses. PAS spectra were highly related to soil organic matter content ( $R^2 = 0.94$ ) and soil total nitrogen content ( $R^2 = 0.90$ ), and the RPD values were more than 2. For the other soil properties, such as the content of exchangeable P, K, Fe, Cu et al., the calibration results were very good or acceptable. These results suggest that FTIR-PAS could be used to predict most of soil properties. Since technique of FTIR-PAS is rapid and inexpensive, and requires no sample pretreatment and little sample mass (0.2 g or less), it could be used in situ characterization of greenhouse soil, which provides promising method for the greenhouse soil management.