DIRECT DETECTION OF C_2H_2 IN AIR AND HUMAN BREATH BY CW-CRDS

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Continuous wave cavity ring-down spectroscopy (cw-CRDS) is an established cavity-enhanced absorption technique that can provide the necessary sensitivity, selectivity and fast acquisition time for many applications involving the detection of trace species. We present a simple but highly sensitive cw-CRDS spectrometer based on an external cavity diode laser operating in the near-infrared region. This instrument allows us to directly detect acetylene (C_2H_2) mixing ratios in air with a detection limit of 120 parts per trillion by volume (pptv) measuring on a C_2H_2 absorption line at 6565.620 cm^{-1}. Acetylene is a combustion product that is routinely used in environmental monitoring as a marker for anthropogenic emissions. In a recent work, the spectrometer was employed to measure the level of acetylene in indoor and outdoor air in Helsinki.[a] Continuous flow measurements with high time resolution (one minute) revealed strong fluctuations in the acetylene mixing ratio in outdoor air during daytime.

Due to its non-invasive nature and fast response time, the analysis of exhaled breath for medical diagnostics is an excellent and straightforward alternative to methods using urine or blood samples. In an ongoing study, the cw-CRDS instrument is used to establish the baseline level of acetylene in the breath of the healthy population. An elevated amount of acetylene in breath could indicate exposure to combustion exhausts or other volatile organic compound (VOC) rich sources. The latest results of this investigation will be presented.

[a] F. M. Schmidt, O. Vaittinen, M. Metsälä, P. Kraus and L. Halonen, submitted for publication in Appl. Phys. B.