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FTIR- and NDIR-Spectroscopy measurements on environmental air. How accurate are 13CO2 isotope ratio and trace gas measurements with an outdoor instrument ?

Frank Jäger, Olaf Gluschke, and Rainer Doll

Delta Analytics OHG, Entwicklung, Bremen, Germany (frank.jaeger@delta-analytics.de, ++49-42189700356)

It has been reported that the infrared techniques NDIR[1] and FTIR[2,3] are capable of measuring low concentrations of CO_2, CH_4, N_2O and CO as well as isotope ratios (especially that of $^{13}CO_2$) in gas samples, which contain concentration levels comparable to environmental air.

Comercial products based on the IR technique which fit the needs of mass spectroscopy users have not been availbale up to now. With a special designed URAS-26 analyser from ABB (*ABB Automation* GmbH, Frankfurt) a prototype was developed, that improved the accuracy and stability of the NDIR instrument for determining $\delta^{13}C$ to the order of 0.2 delta per mil standard deviation ($\delta^{13}C$) over many hours, if 3 – 5 minutes of averaging time are used. The system can be operated together with reference gases (e.g. a working standard) while performing on line measurements. Only a power supply is needed for the operation of the instrument, which opens up the possibility of making on line field studies without the need of collecting gas samples in flasks or bags. In addition an FTIR instrument is presented, that can measure concentrations of trace gases (CH_4, N_2O and CO) and the isotope ratio of $\delta^{13}C$ of CO_2simultaneously. The accuracy and stability of this instrument will be discussed.

1. F. Jäger, G. Wagner, H.A.J. Meijer, and E. Kerstel(2005), Measuring $\delta^{13}C$ of atmospheric air with non-dispersive infrared spectroscopy, IEHS Vol 41. No. 4, pp 373 – 378 (SIRIS special issue).

2. M.B. Esler, D.W.T. Griffith, S.R. Wilson, and L.P. Steele (2000), Precession Trace Gas Analysis by FT-IR Spectroscopy. 1. Simultaneous Analysis of CO_2, CH_4, N_2O, and CO in Air, Analytical Chemistry, Vol. 72, No. 1, pp 206 – 215.

3. M.B. Esler, D.W.T. Griffith, S.R. Wilson, and L.P. Steele (2000), Precession Trace Gas Analysis by FT-IR Spectroscopy. 2. The $^{13}C/^{12}C$ Iostope Ratio of CO_2, Vol. 72, No. 1, pp 216 – 221.