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1 Application of a Widely Tunable Near-Infrared Laser Instrument for Stable Isotope Ratio Measurements

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In this paper, we report on the development and the application of a widely tunable near-infrared laser spectrometer for trace gas and isotope analysis. The spectrometer was based on fiber-coupled continuous-wave (cw) Telecom external cavity laser (ECDL, Tunics Plus) that is continuously tunable from 1500 to 1640 nm (C and L band) with an output power up to 3 mW and a tuning resolution of 0.001 nm ($\sim 4\times10^{-3}$ cm^{-1}). The effective laser linewidth is less than 1 MHz. A multipass cell (New Focus – model 5612) in Herriott configuration with an optical path of 100 m was used to enhance the detection sensitivity.

The developed instrument has been used for isotopic composition analysis in wood-based combustion emission and in human breath. In a wood-based combustion, the measured $^{13}C/^{12}C$ isotope ratio in CO_2 emission is found to be (1.1011±0.0040) % for the full burn operation regime. The corresponding δ-value relative to PDB standard is (-20.17±3.53) ‰, that is in good agreement with the typical value of (-25±2) ‰ for wood.