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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, Tunic 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 ($\sim 4 \times 10^{-3} \text{ cm}^{-1}$). 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 $^{13}\text{C}/^{12}\text{C}$ isotope ratio in CO_2 emission is found to be $(1.1011 \pm 0.0040) \%$ for the full burn operation regime. The corresponding δ -value relative to PDB standard is $(-20.17 \pm 3.53) \%$, that is in good agreement with the typical value of $(-25 \pm 2) \%$, for wood.