



$^{13}\text{CO}_2/^{12}\text{CO}_2$ isotope ratio analysis in human breath using a 2 μm diode laser

Mingguo Sun (1), Zhensong Cao (1), Kun Liu (1), Guishi Wang (1), Tu Tan (1), Xiaoming Gao (1), Weidong Chen (2), Huang Yinbo (1), and Rao Ruizhong (1)

(1) Anhui Institute of Optics & Fine Mechanics, Chinese Academy of Sciences, Hefei 230031, China (xmgao@aiofm.ac.cn),

(2) Laboratoire de Physicochimie de l'Atmosphère, Université du Littoral Côte d'Opale, 189A, Av, Maurice Schumann, 59140 Dunkerque, France(chen@univ-littoral.fr)

The bacterium *H. pylori* is believed to cause peptic ulcer. *H. pylori* infection in the human stomach can be diagnosed through a CO_2 isotope ratio measure in exhaled breath. A laser spectrometer based on a distributed-feedback semiconductor diode laser at 2 μm is developed to measure the changes of $^{13}\text{CO}_2/^{12}\text{CO}_2$ isotope ratio in exhaled breath sample with the CO_2 concentration of $\sim 4\%$. It is characterized by a simplified optical layout, in which a single detector and associated electronics are used to probe CO_2 spectrum. A new type multi-passes cell with 12 cm long base length, 29 m optical path length in total and 280 cm^3 volume is used in this work. The temperature and pressure are well controlled at 301.15 K and 6.66 kPa with fluctuation amplitude of 25 mK and 6.7 Pa, respectively. The best 13δ precision of 0.06‰ was achieved by using wavelet denoising and Kalman filter. The application of denoising and Kalman filter not only improved the signal to noise ratio, but also shorten the system response time.