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A compact breath acetone analyser based on an ultraviolet light emitting diode

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Highlights

- A breath acetone analyser has been demonstrated based on measurement of the absorption of UV wavelengths near 285 nm emitted from a LED source in a compact multipass cell.
- The acetone analyser provides 3σ precision of ± 0.4 ppmv, lower limit of detection of 0.7 ppmv and residual errors of no more than ± 0.2 ppmv for acetone concentrations up to 5 ppmv in synthetic gas mixtures.
- When applied to human breath, the analyser provides residual errors below ± 0.3 ppmv for acetone concentrations up to 3.9 ppmv, and reveals an acetone concentration as high as 8 ppm in breath of a subject after fasting.
- The breath analyser concept has great potential to meet the sensitivity and accuracy requirements for lifestyle monitoring and medical screening applications.

Abstract

A gas analyser for acetone based on measurement of the absorption of ultraviolet wavelengths near 285 nm in a compact multipass cell has been demonstrated. The analyser has a robust, compact and low-cost configuration which includes a light emitting diode (LED) light source, silicon photodiode light detection and does not require optical cavity enhancement. The analyser has been tested in various configurations for synthetic gas mixtures and breath samples from several human subjects. The analyser provides a lower limit of detection of 0.7 ppmv acetone, precision of 0.4 ppmv (3σ) and has worst-case residual errors of ± 0.2 ppmv (up to 5 ppmv) and ± 0.3 ppmv (up to 3.9 ppmv) for synthetic gas mixtures and human breath, respectively. These results indicate that this analyser concept has excellent potential to meet the requirements for making breath acetone measurements for lifestyle monitoring and medical screening applications.

Keywords

Breath analyser; Acetone; Human breath; LED; Ultra-violet

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