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148. Harren, F.J.M.; Berkelmans, R.; Kuiper, K.; te Lintel Hekkert, S.; Scheepers, P.; Dekhuijzen, R.; Hollander, P.; Parker, D.H. On-line laser photoacoustic detection of ethene in exhaled air as biomarker of ultraviolet radiation damage of the human skin. *Appl. Phys. Lett.* **1999**, *74*, 1761–1763.
149. Stolik, S.; Ramon-Gallegos, E.; Pacheco, M.; Tomas, S.A.; Cruz-Orea, A.; Perez-Zapata, A.J.; Gaebler, R.; Sanchez-Sinencio, F. Photoacoustic measurement of ethylene as a real time biomarker of lipid peroxidation processes in mice. *Anal. Sci.* **2001**, *17*, s365–s367.
150. Wehinger, A.; Schmid, A.; Mechtcheriakov, S.; Ledochowski, M.; Grabmer, C.; Guenther A. Gastl, G.A.; Amann, A. Lung cancer detection by proton transfer reaction mass-spectrometric analysis of human breath gas. *Int. J. Mass Spectrom.* **2007**, *265*, 49–59.
151. Koletzko, B.; Sauerwald, T.; Demmelair, H. Safety of stable isotope use. *Eur. J. Pediatr.* **1997**, *156*, S12–S17.
152. Davies, S.; Spanel, P.; Smith, D. Rapid measurement of deuterium content of breath following oral ingestion to determine body water. *Physiol. Meas.* **2001**, *22*, 651–659.
153. Le Marchand, L.; Wilkens, L.R.; Harwood, P.; Cooney, R.V. Use of breath hydrogen and methane as markers of colonic fermentation in epidemiologic studies: circadian patterns of excretion. *Environ. Health Perspect.* **1992**, *98*, 199–202.
154. Scotoni, M.; Rossi, A.; Bassi, D.; Buffa, R.; Iannotta, S.; Boschetti, A. Simultaneous detection of ammonia, methane and ethylene at 1.63  $\mu\text{m}$  with diode laser photoacoustic spectroscopy. *Appl. Phys. B: Lasers Opt.* **2006**, *82*, 495–500.
155. Grossel, A.; Zeninari, V.; Joly, L.; Parvitte, B.; Courtois, D.; Durry, G. New improvements in methane detection using a Helmholtz resonant photoacoustic laser sensor: A comparison between near-IR diode lasers and mid-IR quantum cascade lasers. *Spectrochim. Acta, Part A.* **2006**, *63*, 1021–1028.
156. Stry, S.; Hering, P.; Murtz, M. Portable difference-frequency laser-based cavity leak-out spectrometer for trace-gas analysis. *Appl. Phys. B: Lasers Opt.* **2002**, *75*, 297–303.
157. Hennig, O.; Strzoda, R.; Magori, E.; Chemisky, E.; Tump, C.; Fleischer, M.; Meixner, H.; Eisele, I. Hand-held unit for simultaneous detection of methane and ethane based on NIR-absorption spectroscopy. *Sens. Actuators, B.* **2003**, *95*, 151–156.
158. Cristescu, S.M.; Persijn, S.T.; Hekkert, S.T.L.; Harren, F.J.M. Laser-based systems for trace gas detection in life sciences. *Appl. Phys. B: Lasers Opt.* **2008**, *92*, 343–349.
159. Welzel, S.; Lombardi, G.; Davies, P.B.; Engeln, R.; Schram, D.C.; Ropcke, J. Trace gas measurements using optically resonant cavities and quantum cascade lasers operating at room temperature. *J. Appl. Phys.* **2008**, *104*, 093115/1–15.
160. Wang, C.; Srivastava, N.; Jones, B.A.; Reese, R.B. A novel multiple species ringdown spectrometer for in situ measurements of methane, carbon dioxide, and carbon isotope. *Appl. Phys. B: Lasers Opt.* **2008**, *92*, 259–270.
161. Kharitonov, S.A.; Barnes, P.J. Nitric oxide in exhaled air is a new marker of airway inflammation. *Monaldi Arch. Chest Dis.* **1996**, *51*, 533–537.



162. McCluskie, K.; Birrell, M.A.; Wong, S.; Belvisi, M.G. Nitric oxide as a noninvasive biomarker of lipopolysaccharide-induced airway inflammation: possible role in lung neutrophilia. *J. Pharmacol. Exp. Ther.* **2004**, *311*, 625–633.
163. Birrell, M.A.; McCluskie, K.; Hardaker, E.; Knowles, R.; Belvisi, M.G. Utility of exhaled nitric oxide as a noninvasive biomarker of lung inflammation in a disease model. *Eur. Respir. J.* **2006**, *28*, 1236–1244.
164. *Breathmeter*; Available online: <http://www.ekipstech.com/pages/homepage/breathmeter/webpage/category.xml> (accessed October 16, 2009).
165. *Gas Sensors*; Available online: <http://www.pranalytica.com/technology-gas-sensors.html> (accessed October 16, 2009).
166. Lewicki, R.; Wysocki, G.; Kosterev, A.A.; Tittel, F.K. QEPAS based detection of broadband absorbing molecules using a widely tunable, cw quantum cascade laser at 8.4  $\mu\text{m}$ . *Opt. Express.* **2007**, *15*, 7357–7366.
167. ATS/ERS recommendations for standardized procedures for the online and offline measurement of exhaled lower respiratory nitric oxide and nasal nitric oxide, 2005. *Am. J. Respir. Crit. Care Med.* **2005**, *171*, 912–930 (This Joint Statement of the American Thoracic Society (ATS) and the European Respiratory Society (ERS) was adopted by the ATS Board of Directors, December 2004, and by the ERS Executive Committee, June 2004).

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