

Ozone Sensors: A Miniaturisation Alternative for Ozone Measurement in Laboratory Experiment and Air-quality Monitoring

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Abstract

Ozone (O₃) sensors (OXB421, Alphasense) were employed in the development of a miniaturised O₃ measurement device combined with LabJack and Labview data acquisition (DAQ). The device requires a power supply of 5 volts with a total power consumption of approximately 5 W. Its total weight is less than 0.5 Kg, which is portable for *in-situ* field deployment. The electrochemical O₃ sensors respond to O₃ producing a voltage signal positively proportional to the O₃ concentration within a linear range of 0 to 10 ppm. The performances of different sensors are consistent to each other after the sensors were calibrated. The O₃ sensors were calibrated under various relative humidities (%RH) and gas flow rates. The sensitivities of each individual sensor correlated well ($R^2 = 0.9995$). Sensor response can be affected by the %RH. During periods of rapid %RH change (such as the decrease from 80 % to 15 % and the increase from 15 % to 75 % in one minute) a significant and instant increase or decrease on sensor signal was observed which would consistently take up to 40 min to return to its original value. Slower changes in %RH (60 % to 30 % in 7 hours) had little effect on sensor signal. The O₃ sensors were employed on (i) laboratory experiments to measure O₃ loss by seawater uptake and (ii) air quality monitoring for over a period of 18 days. It was found the ozone uptake by seawater was linear to the volume of linoleic acid on sea surface microlayer and the calculated uptake coefficients were close to the data from previous studies. For the 18-day-period of air quality monitoring the corrected data from O₃ sensor were in a good agreement with those obtained by conventional UV O₃ analyser with the r^2 of 0.83 ($n = 8502$). This study demonstrates the suitability of O₃ sensors for low cost, low power-consuming O₃ measurements in both laboratory and ambient air quality monitoring.

References

(1) Lewis, A. C.; Lee, J.; Edwards, M. P.; Shaw, D. M.; Evans, J. M.; Moller, J. S.; Smith, K.; Ellis, M.; Gillott, S.; White A.; Buckley J.W. Faraday Discuss., **2015**, DOI: 10.1039/C5FD00201J.