AirMonTech

Air Pollution Monitoring Technologies for Urban Areas

Overview of Measurement Technologies for Air Pollutants and Air Quality Metrics

Pollutant Type: Gaseous Pollutant

Pollutant/Metric Name: Nitrogen Dioxide (NO2)

#	Technology	Characteristics and performance	Availability and current use of instruments	Suggested area of application
1	Chemiluminescence combined with metal converter	– European reference method (EN14211; 2005). – Robust instruments available from various manufacturers. Widely used in monitoring networks. – Indirect method. NO2 is calculated as difference of NOx and NO. – Not selective for NO2, because of interferences of other oxides of nitrogen [1]. This is especially important at rural and remote locations. – Precision of typical instruments ±0.4 ppb or ±0.76µg/m^3 (1σ, 60min). Higher sensitivity for remote locations is possible.	Commercial; monitoring networks	Urban
2	Chemiluminescence combined with photolytic converter	– Similar to Technology 1, – but higher selectivity through photolysis of NO2, and – slightly more complicated because correction of measured signal with converter efficiency required. – Application might be difficult in urban environments where temporal variability of NO and NO2 is high (NO2 is determined from the difference of NOx and NO, both measured with a certain time lag).	Commercial; monitoring networks	Rural Remote
3	Chemiluminescence with luminol	– Commercial instruments using this technique are no longer available.	No longer commercially available	
4	Cavity ringdown spectroscopy (CRDS)	– Highly selective and sensitive method – Currently no commercial instruments, only research instruments available [2, 3].	Not commercially available, Research	Urban Rural Remote
5	Cavity enhanced laser absorption spectroscopy	– Highly selective and sensitive method – High precision of around ±0.05 ppb or ±0.1µg/m^3 (1σ, 1sec), very high temporal resolution (e.g. 5Hz).	Commercial; Research; monitoring networks	Urban Rural Remote

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6	Differential optical absorption spectroscopy (DOAS)	– Open-path technology.	Commercial; monitoring networks	Urban Rural Fence line Monitoring
8	Electrochemical Sensor Technology	– Performance and specifications currently not well characterized.	Commercial; Research	Urban Personal Monitoring

References:

[1] Steinbacher, M., C. Zellweger, B. Schwarzenbach, S. Bugmann, B. Buchmann, C. Ordóñez, A. S. H. Prevot, C. Hueglin (2007). Nitrogen oxide measurements at rural sites in Switzerland: Bias of conventional measurement techniques. Journal of Geophysical Research 112: D11307, doi:11310.11029/12006JD007971.

[2] Fuchs, H., W. P. Dube, B. M. Lerner, N. L. Wagner, E. J. Williams, S. S. Brown (2009). A Sensitive and Versatile Detector for Atmospheric NO2 and NOx Based on Blue Diode Laser Cavity Ring-Down Spectroscopy. Environmental Science & Technology 43(20): 7831-7836.

[3] Fuchs, H., S. M. Ball, B. Bohn, T. Brauers, R. C. Cohen, H. P. Dorn, W. P. Dube, J. L. Fry, R. Haseler, U. Heitmann, R. L. Jones, J. Kleffmann, T. F. Mentel, P. Musgen, F. Rohrer, A. W. Rollins, A. A. Ruth, A. Kiendler-Scharr, E. Schlosser, A. J. L. Shillings, R. Tillmann, R. M. Varma, D. S. Venables, G. V. Tapia, A. Wahner, R. Wegener, P. J. Wooldridge, S. S. Brown (2010). Intercomparison of measurements of NO2 concentrations in the atmosphere simulation chamber SAPHIR during the NO3Comp campaign. Atmospheric Measurement Techniques 3(1): 21-37.

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