

Short-term diffusive sampler for ozone

Health effects

Exposure to ambient ozone concentrations has been linked to increased hospital admissions for respiratory ailments such as asthma. Studies conducted in the United States show that ozone air pollution is associated with 10-20 percent of all respiratory-related hospital admissions in the summer-time.

Repeated exposure to ozone can make people more susceptible to respiratory infection and lung inflammation, and can aggravate existing respiratory diseases such as asthma.

Measurement of ozone

Ozone is normally measured continuously by chemiluminescence monitors. This type of measurement permits the assessment of time series, but is restricted to a few selected sites. Diffusive samplers allow the spatial distribution of air pollutants or even personal exposure on a large scale to be assessed.

Diffusive sampler

The diffusive sampler is based on the diffusion of ozone along a tube to an absorbing medium. The chemisorption of ozone takes place by reaction with 1,2-di(4-pyridyl)-ethylene (DPE); the ozonide formed undergoes cleavage and yields an aldehyde. The amount of aldehyde is finally determined spectrophotometrically by the MBTH method at 442 nm. [1,2].

The passive samplers are constructed with a polypropylene housing with an opening of 20 mm in diameter. To reduce wind disturbance a teflon membrane is attached, supported by a wire net. At the closed end there is a glass fibre filter dipped in a solution of DPE in acetic acid.



protective shelter



clip for personal monitoring

Air quality standards

Limit values and recommendations for ozone vary from country to country:

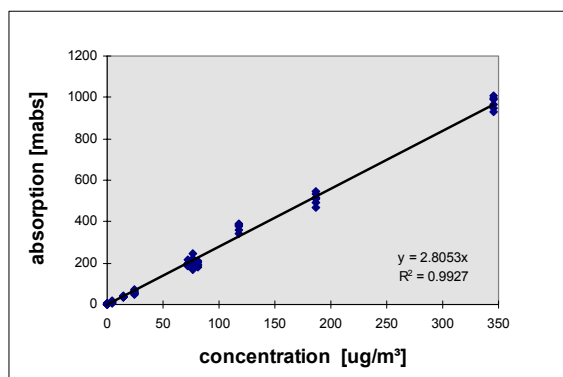
WHO	120 $\mu\text{g}/\text{m}^3$ (8 hours)
EU	120 $\mu\text{g}/\text{m}^3$ (8 hours)
France	110 $\mu\text{g}/\text{m}^3$ (8 hours)
USA	65 $\mu\text{g}/\text{m}^3$ (24 hours) 160 $\mu\text{g}/\text{m}^3$ (8 hours)

The diffusive sampler is suitable for checking compliance with short-term limits for 8 and 24 hours. The uncertainty of measurement was estimated as 10% at 120 $\mu\text{g}/\text{m}^3$ according to the test results. This means that the limit value of 120 is not exceeded if the measured value is below 108 $\mu\text{g}/\text{m}^3$. The pollution level is said to be in the region of the air quality standard if the value is between 108 and 132 $\mu\text{g}/\text{m}^3$ but fails to comply with the standard if it exceeds 128 $\mu\text{g}/\text{m}^3$.

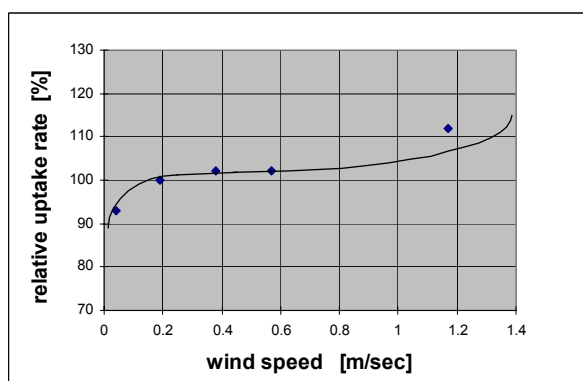
Applications

- Indicative measurement of ozone to identify critical zones.
- Assessment of personal exposure for epidemiological studies

Specifications



The diagram shows the linearity of the calibration function under laboratory conditions.



The influence of wind speed is less than 10 % in the range 0.2 to 1.2 m/sec. In case of strong winds, a protection shelter is recommended.

Calibration function	PS [mabs] = 0.2805 [mg/m ³ · h]	r = 0.992
Working range	15 – 240 µg/m ³	
Sampling time	8 to 24 hours	
Detection limit	12 µg/m ³ for a 8-hours exposure	
External influences:	wind speed	influence of wind speed < 10% up to 2.0 m/sec
	temperature	no influence between 10 to 30°C
	humidity	no influence between 20 to 80%
Storage	before use:	6 months
	after exposure:	4 months
Cross sensitivity	oxidants	
Expanded uncertainty*	17.4 % at concentration levels of 100 µg/m ³	

*according to GUM; subject to change without notice

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References

[1] M. Kirchner, Werner, H. Hangartner, M. Evaluation of Passive Methods for Measuring Ozone in the European Alps. Analyst, Sept. 1996, Vol 121 (1269-1272).

[2] Bernard, N.B. et al.: Ozone Measurement with Passive Samplers: Validation and use for Ozone Pollution Assessment in Montpellier, France. Environmental Science&Technology Vol. 33 No. 2, 1999.

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