A new solution for air pollution monitoring

LSE Monitors has developed a robust and cost-effective analyzer based on photo acoustics with a quantum cascade laser. The concentration of NH$_3$ in sample air is continuously determined with a detection limit of 1 ppb and a time resolution of 2 minutes.

Continuous ammonia measurements in ambient air

Ammonia (NH$_3$) plays an important role in neutralizing atmospheric acids like sulphuric or nitric acid.

Thereby particulate matter is formed, which has a negative impact on human health and contributes to radiative forcing. Excess of NH$_3$ can result in eutrophication, loss of biodiversity and soil acidification in sensitive ecosystems. This is a problem in a growing fraction on our planet.

Agriculture is by far the most dominant contributor to anthropogenic NH$_3$ emissions. The worldwide NH$_3$ emissions will most likely increase in the future. Therefore large scale continuous monitoring of the NH$_3$ concentration will help to determine the effects of measures taken to reduce the ammonia emissions.

- Very low detection limit (ppb range)
- No consumables, turnkey instrument
- Active gas sampling by integrated pump
- Virtually maintenance-free instrument
- User-friendly software
- Large color graphics with touch screen
- CE certified
- Two-year warranty

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LSE monitors
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LSE Monitors

LSE Monitors is a joint venture between Sensor Sense BV in Nijmegen and Synspec BV in Groningen, combining knowledge of laser research, electronic design and analyser production.

Concept of measurement

Infrared light produced by a quantum cascade laser is directed through a measurement cell. This cell is continuously flushed with sample gas. An integrated pump sucks ambient air through the monitor. If ammonia is present in the sample gas, the pressure increases as a result of absorption of the laser light. The laser light intensity is modulated at an acoustic frequency of 1600 Hz and the resulting pressure modulation is measured by small microphones. The amplitude is proportional to the ammonia concentration.

Specifications

<table>
<thead>
<tr>
<th>Noise (1σ, 120 s)</th>
<th>1 ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0 - 8 ppm, on request tuneable to 80 ppm</td>
</tr>
<tr>
<td>Precision</td>
<td>a maximum precision of 2 ppb or 2 % of measured value, whichever is the biggest</td>
</tr>
<tr>
<td>Time resolution</td>
<td>120 s</td>
</tr>
<tr>
<td>Response time (T_{10-90%})</td>
<td>&lt; 10 min</td>
</tr>
<tr>
<td>Linearity</td>
<td>tbd</td>
</tr>
<tr>
<td>Sample flow rate</td>
<td>40 ml/min</td>
</tr>
</tbody>
</table>

Calibration

Interval: we advice every 30 days, at least once every 6 months
Calibration gas: Preferably 5 ppm NH₃ in a mixture of N₂/O₂ in the ratio 4:1

Requirements

Sample temperature: 5 - 30°C
Sample pressure: stable during measurements, 0.7 - 1.0 atm
Sample humidity: non-condensing for T > 25°C and relative humidity between 0 and 90%
Voltage supply: 230 Vac, 110 Vac available on request
Coating of gas connections: we advice PFA or Silcosteel
Tubing material: we advice PFA tubing
Gas connections: Swagelock compatible, 1/8”

Technical data

Dimensions: suited for installation in 19” rack, 3 Standard Height Units (12 cm), depth 37,2 cm
Weight: 8 kg
Power demand: 200 W
Communication connections: 1 x Ethernet, 1 x RS232, 4 x USB
4 x Analogue and 7 x Digital outputs
4 x Analogue and 4 x Digital inputs

Protocols available: Hessen-Bayern

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