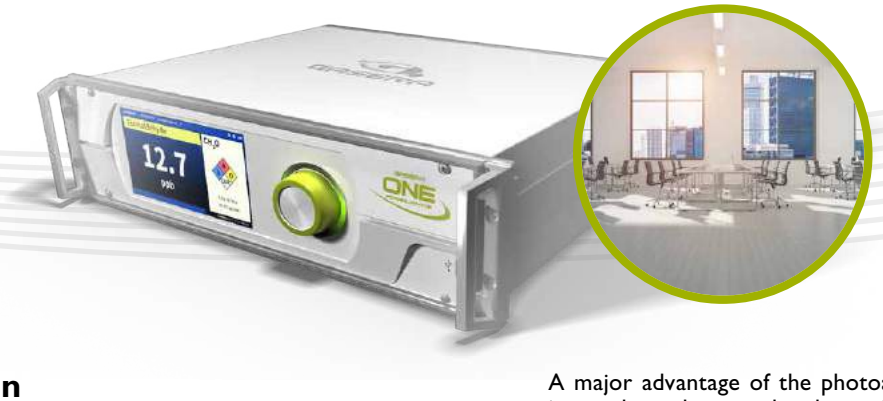
APPLICATION NOTE

GASERA ONE FORMALDEHYDE for indoor air quality monitoring



Application

FORMALDEHYDE is a volatile organic compound (VOC). It is typically present indoors at low levels as the result of formaldehyde-emitting materials and human activities in homes. The indoor formaldehyde level is usually higher than the outdoor level.

Formaldehyde is an ozone precursor and classified as carcinogenic compound even at low level concentrations. In view of its widespread use, toxicity, and volatility, formaldehyde poses a significant danger to human health. Typical outdoor background level is a few ppb. Levels above 100 ppb can cause acute health problems. Many everyday products, such as cosmetics, furniture and detergents contain formaldehyde. High levels of formaldehyde are often found in new homes or renovated homes. The major source of formaldehyde indoor is composite wood products.

Technology

The GASERA ONE FORMALDEHYDE monitor enables selective real-time measurements of formaldehyde. It is based on combining the ultra-sensitive cantilever enhanced photoacoustic detection technology with a Quantum Cascade Laser source operating at a Mid-IR fundamental spectral absorption line for formaldehyde.

A major advantage of the photoacoustic effect is that sensitivity is not dependent on the absorption path length. This allows high sensitivity from a short absorption path length, and a highly linear response over a wide dynamic measurement range, all with very low sample volumes (typically only a few millilitres).

The monitor provides enough sensitivity to reliably measure ambient background levels of formaldehyde in real-time and does not require any consumables. It also gives an exceptionally high level of stability with a re-calibration period longer than one year. Thus it offers a low total cost of ownership. The GASERA ONE FORMALDEHYDE is designed to be used at unmanned sites.

Measurements

The GASERA ONE FORMALDEHYDE monitor was field tested in static and dynamic conditions at a holiday and training center in Southern Finland. The center consists of eight separate wooden houses, built from 1950s to 1990s. The indoor air formaldehyde concentration was recorded in 50 rooms during the testing. Many buildings have particle board walls, floor and roof structures that are a known sources of formaldehyde. The ventilation systems vary from natural ventilation to mechanical intake and exhaust air exchange.

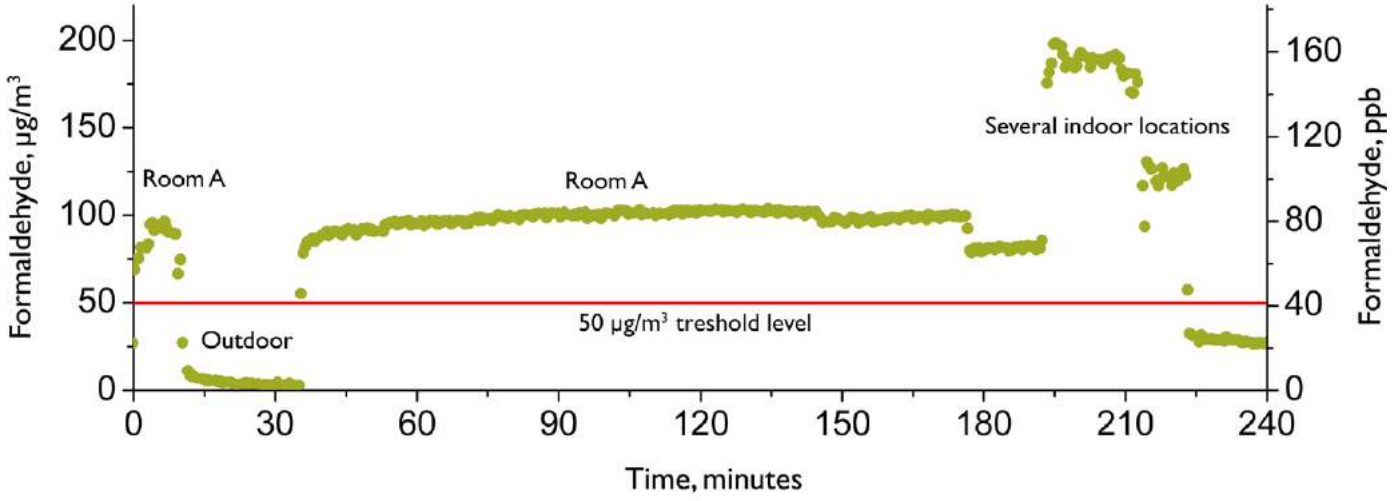


Figure 1. shows the GASERA ONE FORMALDEHYDE testing data. Measurements were conducted indoor and outdoor.

The formaldehyde concentration in different rooms varied from 4 to 200 µg/m³. The highest formaldehyde concentrations were measured in rooms where 1970s particle board was abundantly used in combination with poor ventilation. The average indoor air formaldehyde concentration clearly exceeded the annual average value of 50 µg/m³ (decreed by the Finnish regulation) in two buildings from the 1970s. The measurement data from one of the aforementioned buildings is shown in figure 1.

The measurement unit was placed in a hallway close to two rooms. A short PTFE tubing was used to sample air from various locations. Up until the 150-minute mark, the sample was taken from one room except for the 25-minute outdoor measurement right after the start. The outdoor air showed approximately 2,5 µg/m³ of formaldehyde.

Five separate rooms and areas were sampled after the 150-minute mark. Especially the second room had high formaldehyde levels of approximately 200 µg/m³. The hallway of the building had a relatively low formaldehyde level of 25 µg/m³ due to better ventilation and less use of particle board.

The measurement results of the GASERA ONE FORMALDEHYDE were compared to the measurement results of the more traditional DNPH (2 4-dinitrophenylhydrazine) method based on cartridge sampling and liquid chromatographic laboratory analysis. The results agree well considering that the reference method has an uncertainty of 15 % and a minimum detectable formaldehyde level of 5 µg/m³.

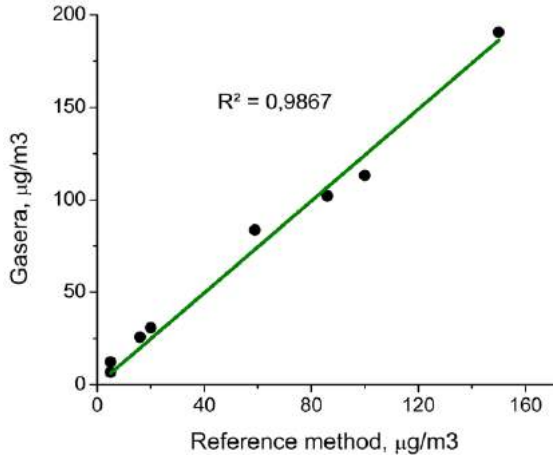


Figure 2. shows data points measured with the GASERA ONE FORMALDEHYDE and with an analyser using the conventional DNPH cartridge method.

Figure 3. Dr. Olavi Vaittinen from Inspector Sec is testing the GASERA ONE FORMALDEHYDE in Finland, in October 2017.

Conclusions

The field measurements of the GASERA ONE FORMALDEHYDE is a large public building as well as residential homes were verified in the laboratory with good results. The monitor is sensitive, linear and it has a fast response time to ambient and indoor formaldehyde concentrations changes. Measurements carried out in buildings showed clear differences in measured formaldehyde levels based on the building type. It also gives an exceptionally high level of stability with a re-calibration period more than one year and thus it offers a low total cost of ownership.

GASERA ONE FORMALDEHYDE

- High sensitivity enabling the measurement of the lowest formaldehyde concentrations
- Dynamic range: over 5 orders of magnitude (i.e. 100 000 times the detection limit)
- Repeatability: less than 1 % of measured value in operational conditions at the calibration concentration
- Instrument automation enabling unattended measurements
- Calibration and maintenance enabling long unmanned online measurements: no consumables, long time between calibrations
- Temperature and pressure stability: changes in ambient temperature or pressure will not cause drift

”The GASERA ONE FORMALDEHYDE monitor enables reliable real time indoor measurements of formaldehyde. Unlike the conventional DNPH cartridge method, the GASERA ONE FORMALDEHYDE provides measurement data on the screen in less than a minute enabling the study of static and dynamic indoor air quality conditions possible on site.

- Dr. Olavi Vaittinen