Protea
technology leadership
in measurement solutions

Accurate Continuous Formaldehyde Measurement
In emissions and ambient air applications

Formaldehyde (HCHO) is the simplest aldehyde species and is present, or generated by, many sources (both natural and industrial). It is classed as a substance that is toxic and harmful to human health.

Naturally, HCHO is emitted to the atmosphere from biogenic sources such as forest fires and the breakdown of organic materials. Industry has added to this and HCHO is found in emissions to atmosphere from gas engines burning natural gas, due to incomplete combustion. Materials used in the construction industry are a major source of ambient formaldehyde levels in the air. Wood based products used in domestic and commercial buildings, such as insulation materials manufactured with urea-formaldehyde, and melamine-formaldehyde resins used on wood panels, chipboard, medium density fibreboard and laminate materials, all give rise to HCHO emissions. The industries producing these materials will be major sources of environmental emissions and as such need to be able to measure and control their HCHO emissions.

The use of HCHO containing products in the wider world has given rise to high background levels of HCHO in indoor ambient air too. While not always at levels that will pose a health issue for the population, levels of HCHO can have a detrimental effect to museum artefacts for example and so the monitoring and control of ambient HCHO is crucial.

For many years, phenol-formaldehyde has been used as an embalming fluid in hospital and medical research laboratories. Persons working in such close proximity to the HCHO emissions need to be protected from high levels of HCHO and so workplaces have a duty to monitor and ideally control the ambient air to reduce HCHO to safe levels.
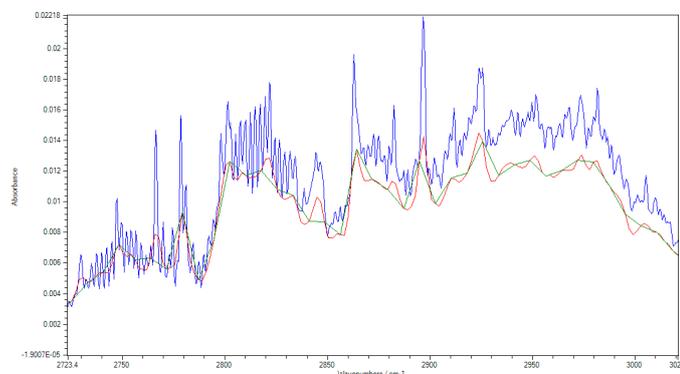
atmosFIR Platform

Protea's latest atmosFIR product line of FTIR gas analysers is ideal for accurate quantitative continuous formaldehyde monitoring, both in industrial emissions and ambient air applications. The atmosFIR analyser range is an extractive gas analyser platform where the gas sample to be measured is sampled through the analyser gas cell continually. By measuring the full infrared spectrum in real-time, we can identify and quantify the absorption peaks due to HCHO.

The atmosFIR product range is a high resolution FTIR analyser. It runs at a resolution of up to 0.7cm-1 as standard, with a 0.5cm-1 version available as an option. Compared to lower resolution techniques, this means that the absorption peaks due to HCHO can clearly be identified, at a higher intensity than lower resolution, meaning that **lower detectable limits** of HCHO are possible. See Figure 1 which compares HCHO spectra at different resolutions. Even in cross-interfering backgrounds of other gases the detectable limits of HCHO can be low enough to meet the requirements of legislative reporting.

Industrial Emissions

The atmosFIR AFS model offers a complete continuous emissions measurement system in a single analyser. As such it can measure a suite of combustion gases from emissions sources, including formaldehyde. For incineration plants and natural gas engines having to control and report HCHO levels it is the ideal tool for periodic or continuous measurements.

Figure 1 - HCHO calibration spectra at 1cm-1, 4cm-1 and 8cm-1 resolutions. 1cm-1 can clearly be seen to have sharper and high absorption peaks, making identification and measurement of low HCHO concentrations possible.

Figure 2 - atmosFIR AFS analyser for HCHO measurement in emissions monitoring applications.

Low Level Ambient Air Platform

The atmosFIR AFA model uses a uniquely designed sample gas cell of high throughput and large pathlength. This pathlength enables very low detectable limits to be made, ideal for ambient air applications in the parts per billion (ppb) range. The AFA analyser runs at ambient sample temperatures and can be used in fixed application or mobile.
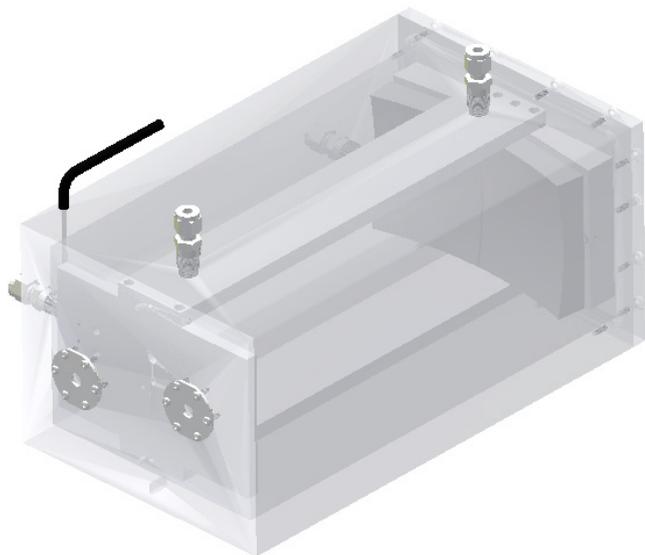

Figure 3 - tUnique High Pathlength Gas Cell for ppb level measurements.

HCHO Validation

Accurate HCHO calibrations are important for any measurement system. Being able to generate reliable calibration standards for analyser validation is an important part of any analyser product from Protea.

The benefit of atmosFIR analysers is that lack of drift in measured response to HCHO. The FTIR absorption spectrum is a function of the analyser's well controlled parameters. This means the HCHO response is incredibly repeatable. Not only on a single instrument over time, but also instrument-to-instrument calibrations are transferable. There is no need for regular span adjustment of the analyser, only regular re-zeroing is required, which is carried out automatically on either Nitrogen or instrument air.

Any analyser that is produced for an HCHO measurement application is calibrated in house for the gas. To this end, we have a number of reliable calibration methodologies that we use in the manufacturing process. For low level measurements of <20ppm, we have worked with gas suppliers to produce repeatable HCHO gas standards. For levels up to 100ppm, where cylinders cannot be used due to stability issues, we use permeation tubes to generate the calibration gas. Above 100ppm, Protea uses our propriety algorithms to generate synthetic data from the HITRAN atmospheric line data. These algorithms enable us to generate spectra for given instrument parameters, include background gases (such as HCHO in high H_2, not just N_2 background).

atmosFIR Model	Gas Cell Pathlength and Volume	HCHO Lower Limit of Detection	Applications
AFS	4.2m 300ml	0.05 ppm (40°C) 0.2 ppm (180°C)	Continuous Emissions Measurements >0.2ppm ambient air
AFA	20.0m 4.8litres	15 ppb	Very low ambient air measurements

Figure 4 - Measurement capabilities of atmosFIR models AFS and AFA.

Supplier:

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