BioSpec® VOC

Online VOC Analyzer for Biogas Upgrading Plants

Protect plant uptime and efficiency with real-time measurement of volatile organic compounds, H_2S, NH_3 and other contaminants.

Typical Applications:

- Food waste
- Landfill gas
- Agricultural

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Online monitoring of VOCs enables biogas upgrading plants to improve their operational efficiency and uptime

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BioSpec VOC

- Protect membrane and PSA performance
- Confirm gas quality
- Reduces operational costs for activated carbon
- Increases overall upgrading plant uptime
- Easy and hassle-free to install and operate
- Low cost of ownership with no need for future recalibrations

Overview

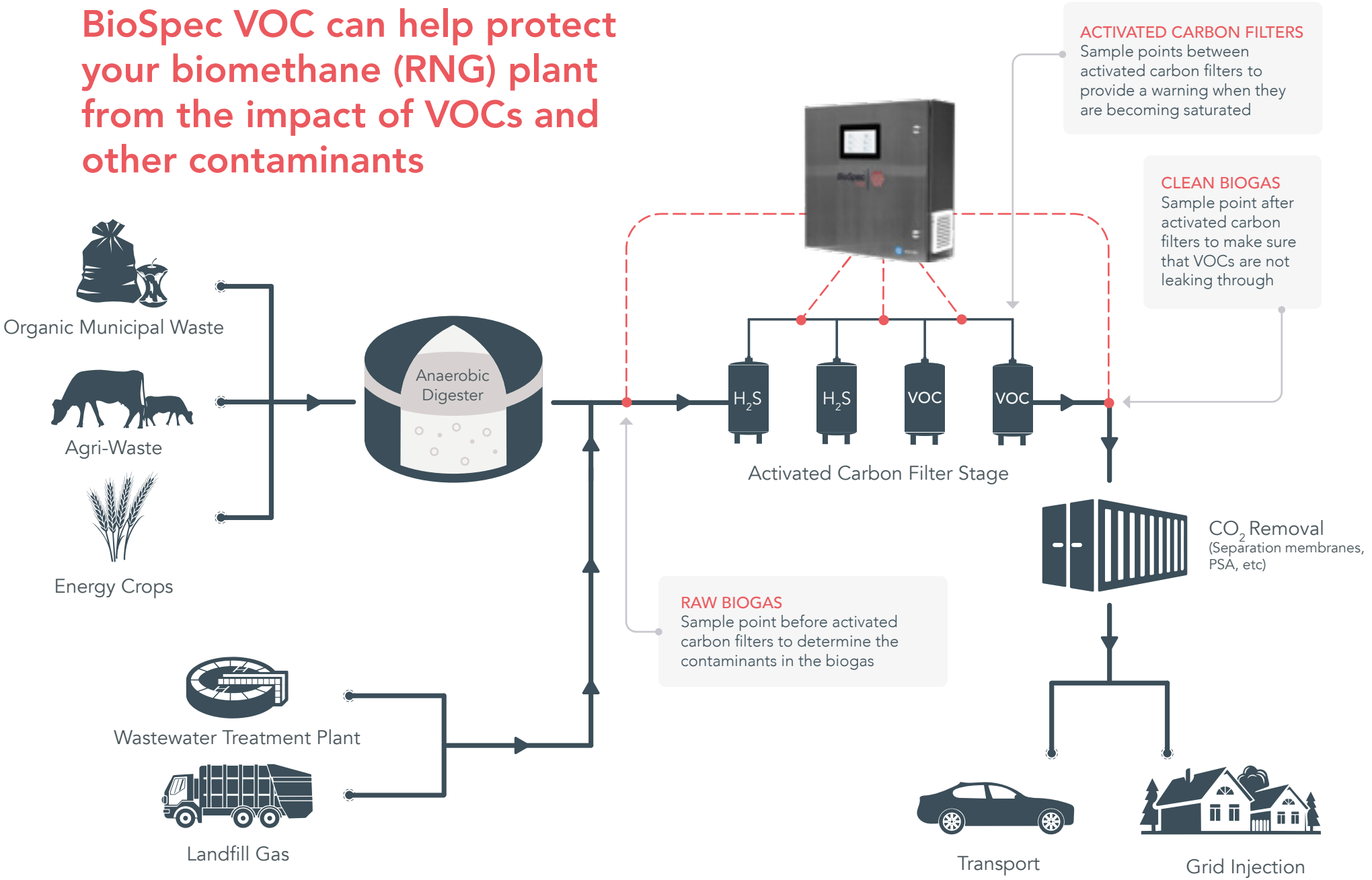
BioSpec VOC is an online analyzer for volatile organic compounds (VOCs), hydrogen sulfide, ammonia and other biogas contaminants. It has been designed specifically for operation in plants upgrading biogas to biomethane (renewable natural gas). Online monitoring of VOCs and other contaminants enables biogas upgrading plants to improve their operational efficiency by:

- continuously monitoring biogas quality pre and post-carbon treatment to pinpoint the precise moment when activated carbon filters begin to saturate allowing site operators to safely maximize the life-span of their carbon media
- alerting of imminent VOC breakthroughs to prevent these contaminants from reaching and harming separation membranes (CO_2 removal stage), thereby avoiding hidden loss of efficiency costs, membrane replacements, plant downtime, and revenue loss
- monitoring VOCs before and after gas scrubber systems and carbon polishers to allow contaminant removal processes to be optimized and to prevent expensive gas-to-grid shutdowns due to VOCs
- identifying changes in the biogas quality and composition, enabling process optimization, tailoring digester feeding, and matching the best carbon media for specific impurities

Industry leading biogas plant operators know the importance of monitoring biogas quality to optimize site performance, discover changes in feedstock, minimize risks, and avoid hidden operating costs. BioSpec VOC is a complete out-of-the-box solution that operators can rely upon to overcome these challenges.

"BioSpec VOC clearly improved the efficiency and return on investment of our biogas upgrading plant!"

BioSpec VOC can help protect your biomethane (RNG) plant from the impact of VOCs and other contaminants



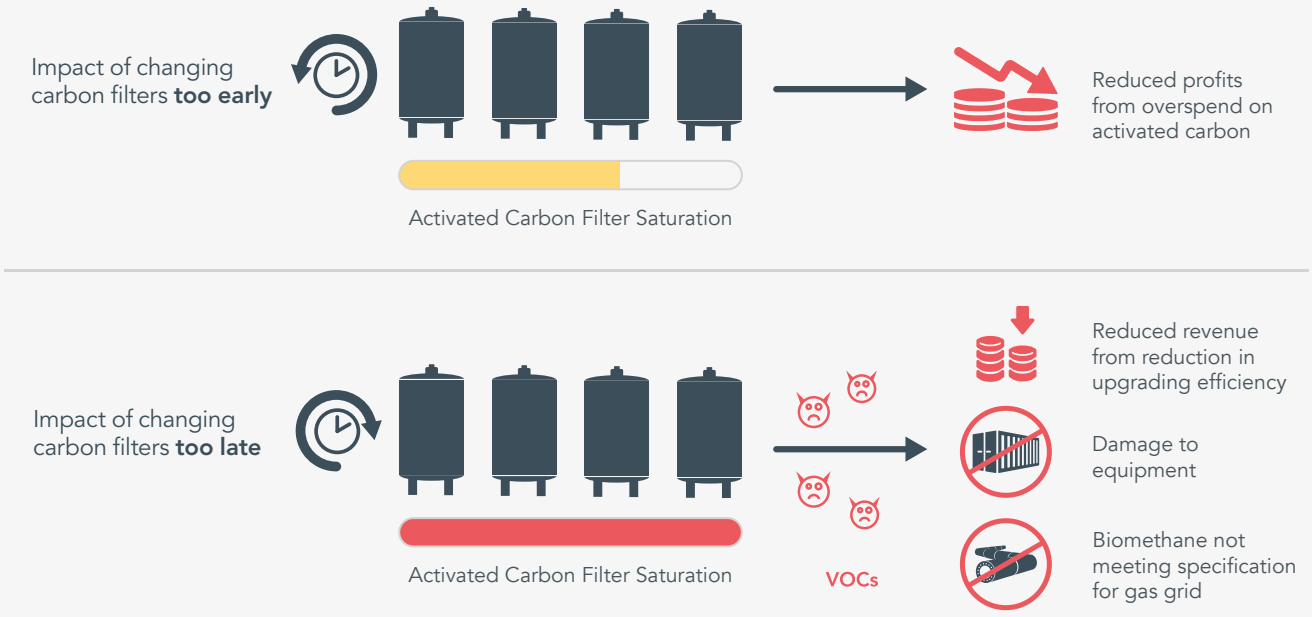
Impacts of not monitoring VOCs

Without monitoring VOCs and other contaminants, it is difficult to understand the effectiveness of the carbon filters and to determine the optimal time for their replacement. Replacing the activated carbon before it has fully saturated results in an increased carbon expenditure.

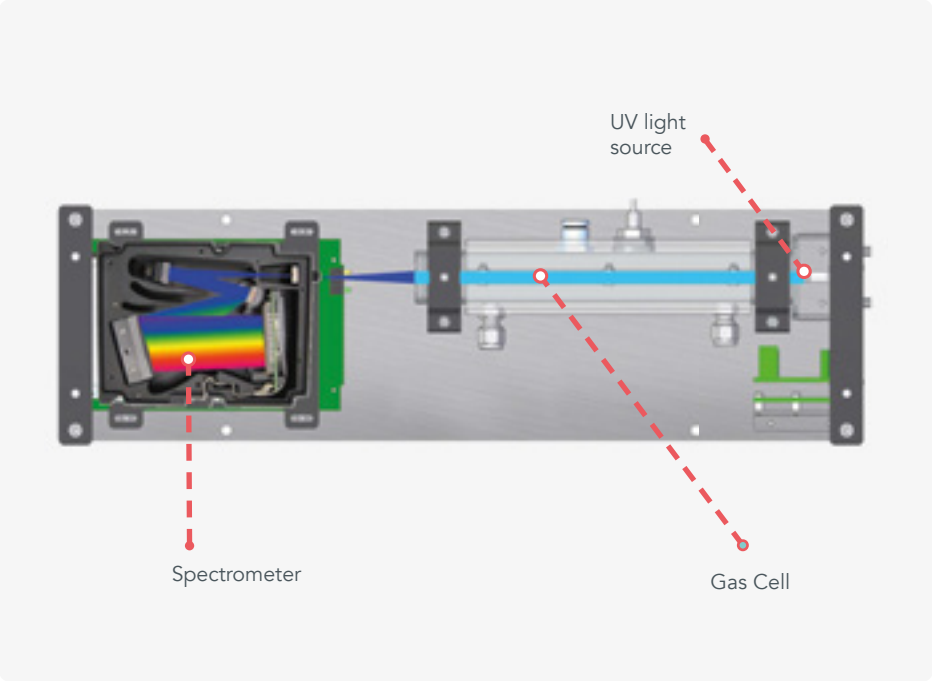
Replacing the carbon too late, when it is no longer filtering out the contaminants, has a highly detrimental and costly effect to the upgrading plant. Harmful VOCs and other contaminants pass through the saturated filters, reducing the efficiency of the plant and damaging expensive upgrading equipment. Furthermore these contaminants could mean that the gas does not meet the required specification for grid injection.

BioSpec VOC solves these problems and allows the plant operator to replace the activated carbon at the optimal time to maximize plant efficiency and operational performance, and reduce unnecessary expenditure, potential plant downtime and lost revenues.

Monitoring VOCs avoids unnecessary costs and mitigates against plant downtime



Gas Measurement Technique



Technology

Optical Absorption Spectroscopy

BioSpec VOC uses a differential optical absorption spectroscopy technique to measure individual VOCs in gas mixtures. Every VOC component has its own unique spectral fingerprint and through optical spectroscopy we can determine the type and concentration of each VOC in the gas sample in a single measurement.

Ultraviolet (UV) light shines through a sample of gas and individual components will preferentially absorb certain wavelengths of the UV light. A spectrometer separates the transmitted light into individual wavelengths and the full UV-spectrum of the gas mixture is obtained. BioSpec VOC is the only VOC monitoring system that uses full spectrum analysis. The observed spectrum is analysed through sophisticated data analysis techniques and individual gas components and their concentrations are extracted and reported.

There is zero sensor drift with this measurement technique and no carrier gases are required for the measurement. Unlike electrochemical sensors, which require periodic recalibration and replacement, the BioSpec VOC technology does not require recalibration and the sensors don't need replaced. This significantly reduces operating costs and simplifies operation of the device.

"BioSpec VOC is the ideal technology to solve the problem of volatile organic compounds and other contaminants in biomethane plants."

Why choose BioSpec VOC?

Reduce operational costs for activated carbon

Safeguard performance and maximize service lifetime of upgrading equipment

Reduce overall biomethane production costs and avoid costly plant shutdowns

Return on investment typically less than one year

BioSpec VOC Technology

- Optical spectroscopy: accurate and repeatable
- Low maintenance: No sensor drift and no recalibration required.
- No calibration or carrier gas consumables needed
- No electrochemical sensors
- Easy to use without expert knowledge
- Measures VOCs and other impurities in raw biogas and clean biomethane
- Instrument can measure at up to 7 sample points
- Full spectrum analysis

BioSpec VOC has become the system of choice for suppliers and operators of biomethane (renewable natural gas) plants to monitor VOCs. Typical applications include organic waste AD and landfill gas upgrading projects.

Multi-point Sampling

A single BioSpec VOC instrument can be used to measure before, between and after each activated carbon or other biogas treatment stage. Sampling is controlled directly through the instrument, and options for up to seven sample points are available.

Installation and commissioning

The system is designed to be easy to install – once the analyzer is mounted, connect power and sample lines and its ready to go. For the majority of installations, there are no sample conditioning requirements. Indoor and outdoor variants of BioSpec VOC system are available. Camlin can provide remote or onsite commissioning support as required.

Online Measurement

Data from the BioSpec VOC system can be easily integrated into existing SCADA system (Modbus or Profinet Comms options). Furthermore, with Camlin's VOC Dashboard software, the data can be easily trended, analyzed and combined with other production data, for deeper insight and better decision making.

Customer Focus

As well as the technical innovations, Camlin have a flexible and innovative commercial approach giving purchase and rental options with tailored service and support contracts. We partner with our customers to ensure that our technical and commercial offering is fully aligned to our customers needs.

Measured Gases

The main components that can be measured and individually reported by the BioSpec VOC system at sub-ppmv levels are listed below.

- Ketones
  - Acetone
  - 2-Butanone (MEK)
- Terpenes
  - 3-Carene
  - alpha-Pinene
  - beta-Pinene
  - Limonene
  - p-Cymene
- Hydrogen Sulfide (H_2S)
- Ammonia (NH_3)
- Dimethyl Sulfide
- Carbon Disulfide
- Xylenes
  - m-Xylene
  - o-Xylene
  - p-Xylene
- Benzene
- Toluene
- Ethyl Benzene

Individually measuring each component is vital as different components break through the activated carbon filters at different rates. For example, ketone breakthrough gives an early indication of activated carbon filter saturation, as these molecules often break through before larger molecules, such as terpenes. This allows the biogas upgrading plant to completely avoid breakthrough of larger VOC molecules.

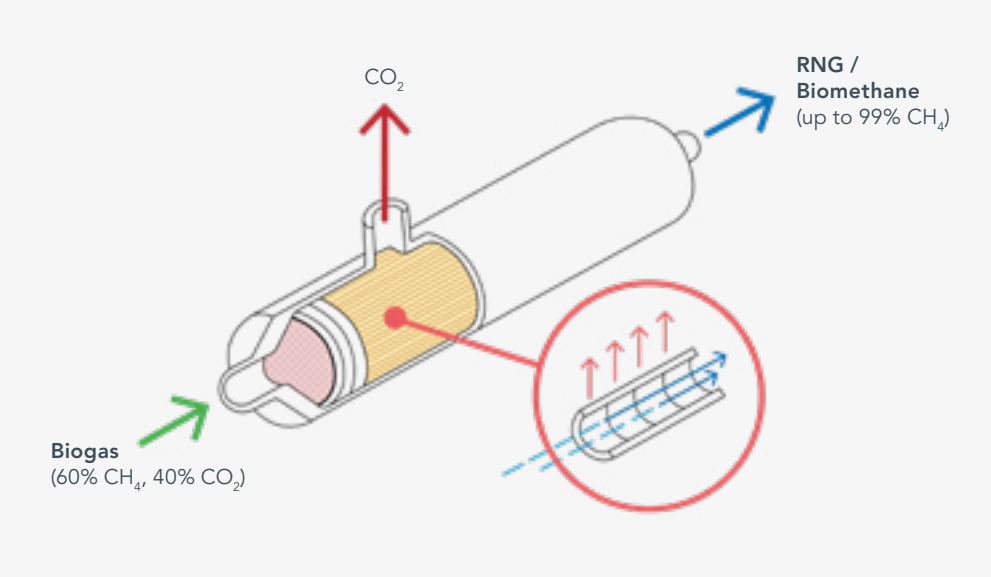
Application examples

Organic municipal waste

VOCs originate in relatively high concentrations in food waste plants. Common VOCs include limonene, cymene, acetone and 2-butanone (MEK), although there can be a wide variety of other VOCs as well as contaminants such as H_2S and ammonia.

BioSpec VOC has become the instrument of choice for online monitoring of VOCs in these projects, especially those using membrane upgrading.

Monitoring the gas quality before the membranes, helps plants to avoid damaging membranes, reducing their throughput, and impairing the efficiency of CO_2 removal.



Agricultural projects

For grass silage and cattle or swine manure projects, H_2S is usually the contaminant of most focus. BioSpec VOC has been deployed in farm projects to help optimize the dosing of digester to reduce H_2S levels, and to then monitor the effectiveness of H_2S removal.

Furthermore, whilst VOCs are expected to be at low levels in farm projects, VOCs can be present and, by monitoring for them, they can be identified before they damage the upgrading equipment or cause out-of-specification gas to be injected to the gas grid.

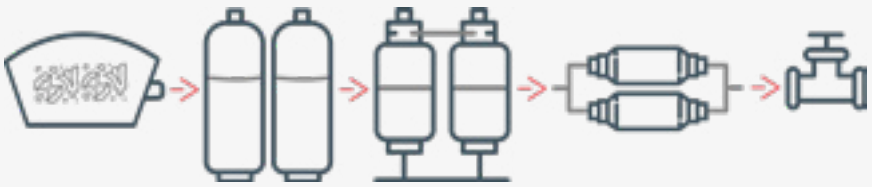
Landfill gas

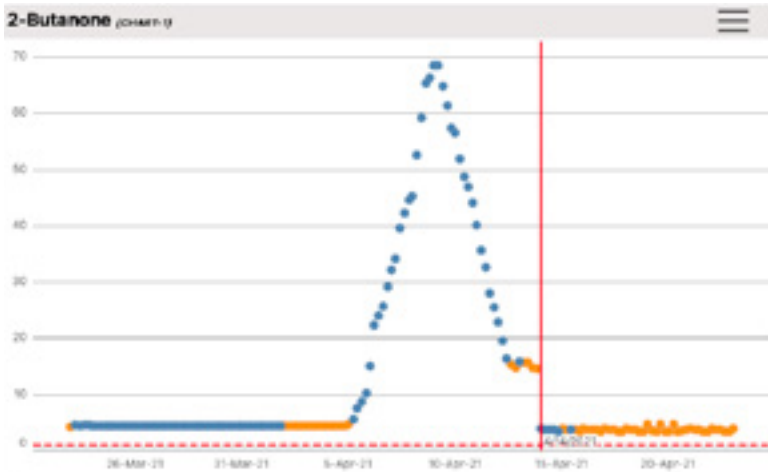
Landfill gas contains many different types of contaminants. Activated carbon is often a key pre-treatment stage for contaminant removal.

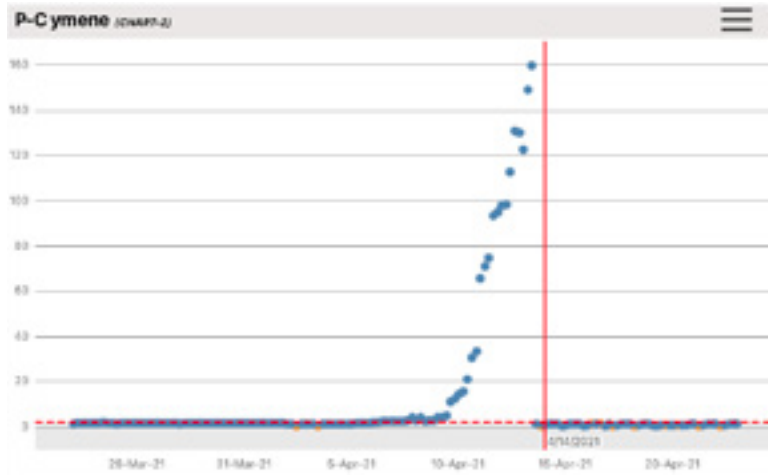
Different VOCs breakthrough at different stages. The lighter ketones such as acetone and 2-butanone (MEK) breakthrough the carbon first, and, during saturation, larger terpene and xylene molecules force previously adsorbed ketones out of the carbon.

As BioSpec VOC measurements a multitude of different VOC components individually, it provides the earliest indication of carbon saturation. By continuously monitoring the performance of the carbon, its replacement interval can be maximized, whilst ensuring compliance with upgrading plant gas quality specifications.

Example landfill to RNG/biomethane upgrading plant







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Global Presence
Local Support

Camlin Energy is part of the Camlin Group, and we support our customers around the globe to build greater reliability and resilience into energy plants and networks. We have a worldwide presence with facilities in 21 cities across 17 countries, enabling us to provide local support to our customers.

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