Biogas Generation

Dependable online, inline, and atline solutions for your waste processing needs.

Metrohm
Process Analytics

Why biogas?

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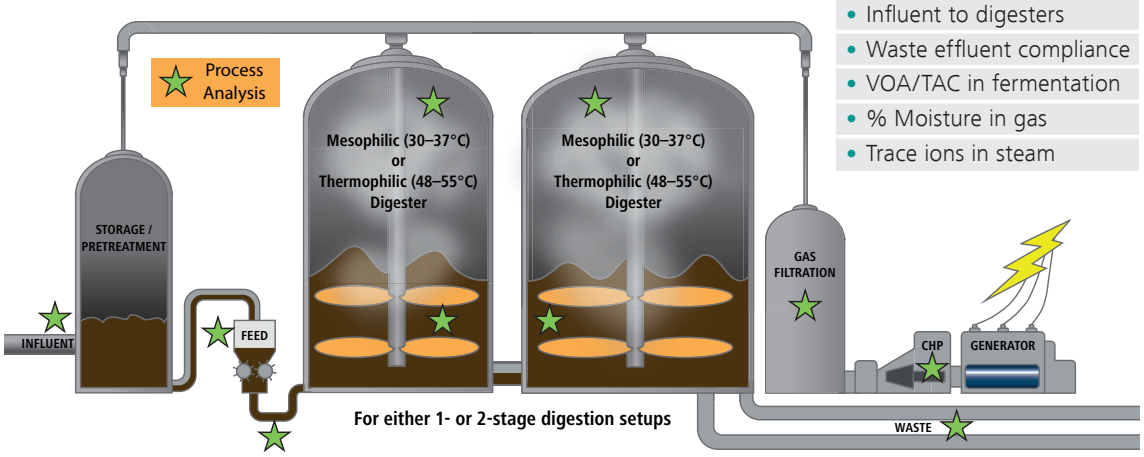
Wastewater must be treated so it can be released back into the environment without adverse effects on an ecosystem. Especially in the food and agricultural sectors, carbohydrates and many other organic compounds are introduced from washing procedures and other processing steps. Discharging this nutrient-rich effluent without sufficient treatment would lead to prolific bacterial growth, deoxygenating the water and killing aquatic life.

Effluent treatment can take place by either aerobic (oxygen-rich) or anaerobic (oxygen-deficient) digestion, or a combination thereof, though anaerobic treatment is reserved for higher concentrations of organics.

Industries which process large volumes of wastewater or even other biomass with a high organic content can choose to reduce costs and have a more positive environmental impact by creating renewable energy: biogas. Waste is treated via anaerobic processes with activated bacterial sludge in digester tanks. Biogas can be processed and used as a utility or even sold and fed back into the power grid. Utilization of a cogeneration plant (CHP) on-site increases energy efficiency by providing heat to the digester(s), thus saving even more.

Process opportunities:

- Nutrient dosing to bacteria
- Influent to digesters
- Waste effluent compliance
- VOA/TAC in fermentation
- % Moisture in gas
- Trace ions in steam



Formation of biogas from waste products

Biogas is created when organic substances are decomposed in a four-step anaerobic digestion process (hydrolysis, acidogenesis, acetogenesis and methanogenesis). Before it is refined, flammable biogas is a water-saturated gas mixture that consists largely of methane (CH_4) and carbon dioxide (CO_2). The CH_4 component is most important in the use of biogas, since the oxidizable compound releases energy when burned.

Issues with high organic loads

Feeding the fermenter with too high of an organic load creates an imbalance between the different types of bacteria, leading to an increase in creation of fatty acids and a lowered pH. The imbalance kills off the other bacteria in the tank and halts methanogenesis.

Metrohm Process Analytics offers several analytical techniques in many different analyzer configurations for any need: titration, photometry, ion chromatography, NIR spectroscopy, and ion-selective measurements. Our online process analyzers and custom sample preconditioning systems are manufactured in the Netherlands and supported by our local service engineers worldwide.

Benefits of online monitoring

A shutdown, cleanup, and replacement of the bacterial sludge is extremely costly, calculated in the hundreds of thousands of euros for even a small overloading event. On the other hand, process optimization can lead to additional income from several areas in the plant, such as the sale of excess sludge or produced heat as a utility. It is therefore extremely important to constantly monitor all processes relevant to the formation of biogas in order to reduce waste and maximize profit in many areas.

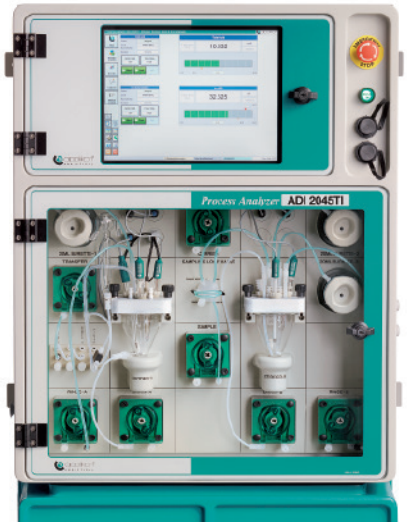
Applications

Monitor fermentation efficiency online with IC

Fermentation produces short-chain fatty acids, hydroxycarboxylic acids, and alcohols. The Process Ion Chromatograph can measure multiple organic acids (and more) in a single, aqueous sample. This analyzer is available with either one or two measurement channels, with many optional inline sample preparation techniques available to simplify online analysis in many areas. A single Process Ion Chromatograph can be configured to monitor up to 20 different sampling points with a wide range of analyte concentrations (ng/L to %).

- Comprehensive organic acid analysis in one run
- Monitor fermentation process with acetic acid: propionic acid ratio
- Trend chart analysis and warning limits to mark fermentation inhibition or overfeeding episodes
- Trace corrosive ions in water-steam circuit (CHP)

Process Ion Chromatograph



Process Analyzer ADI 2045TI

Measuring oxygen demand and more in influent

Many plants still use laboratory-based Chemical Oxygen Demand (COD) measurements to control methanogenesis in the fermenter(s), but the infrequency of analysis (sometimes once per day) easily misses peak concentrations in the influent to the fermenter. This is avoidable with online process analysis. Depending on the expected concentration range of COD, automated redox titration or photometric methods can be used. Many other fermentation-related applications can be performed with the 2045TI, such as the permanganate number or the VOA/TAC (also known as FOS/TAC) ratio.

- Methods conform to ISO 6060, ASTM D 1252, DIN 38409-41 and NEN 6633
- Divert or dilute highly concentrated influent before it reaches the fermenter
- Promote safety by moving COD analysis online

Reagent-free solutions for biogas production

Online near-infrared spectroscopy (NIRS) can improve upon several steps in the biogas production process. This reagent-free technique is non-destructive and allows real-time knowledge of dynamic processes. Process NIRS applications suitable for biofermentation include:

- Monitoring the fermentation process (VOA/TAC) to increase production yield
- Optimization of the bacterial feeding process through quality control of incoming feedstock
- Inspection of fermentation residue (N, P, K)
- % Moisture in gas

NIRS XDS Process Analyzer

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