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# TOGA: TITRIMETRIC OFF-GAS ANALYSER

With a number of gas flow controls, chemical injectors and a mass spectrometer, the TOGA helps measure and control process reactions such as those that occur in wastewater treatment systems.

TOGA is an instrument that can be used to study, monitor, and control bioprocess systems. The technology involves the physical set-up of hardware in combination with proprietary software to automate operational procedures and integrate signal processing and control. It allows the user to determine biological metabolism under highly controlled conditions. This is achieved by allowing realtime measurement of biological activity and efficiencies/ outputs. Specifically, these measurements relate to the production and utilisation of substrates and metabolites such as oxygen, carbon dioxide, ammonia, hydrogen, dinitrogen, volatile organic compounds, short chain acids, alcohols and methane. Further, the architecture of the TOGA allows integration of new instrumentation and control items into the system.

## KEY TECHNOLOGY BENEFITS

For microbiological processes, TOGA can accurately quantify the substrate requirements and key products of metabolism, and how they change due to environmental changes. Key competitive advantages of this technology over existing instruments include:

- Unique analysis: all signals (including mass spectral outputs) available for real-time integration and feedback control of reactor conditions;
- Powerful software: reaction scheduling, and new signal inputs are easily accommodated;
- Operation across both aerobic and anaerobic conditions;
- Dual mass spectrometry: Gas phase mass balancing and liquid phase concentrations are monitored in real time. Coupling gas and liquid phase analysis into one reactor gives powerful analytical capacity;

- Measurement of CO<sub>2</sub> accumulation in all environments to account for bicarbonate buffer effects.

## APPLICATIONS

TOGA can be used in environmental and industrial biotechnology, ranging from research, through development, optimisation and control. Applications include:

- Biological nutrient removal (BNR), including nitrification/ denitrification;
- Acidogenic and methanogenic fermentation;
- Biological hydrogen production; metabolic analysis and optimisation;
- Biopolymer production: metabolism of polymer-producing organisms;
- Microbial fuel cell research and development;
- Non-biological use in chemical reaction engineering applications.

The TOGA has a proven scientific track record, being utilised in work published in respected peer reviewed publications and multiple postgraduate theses.

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