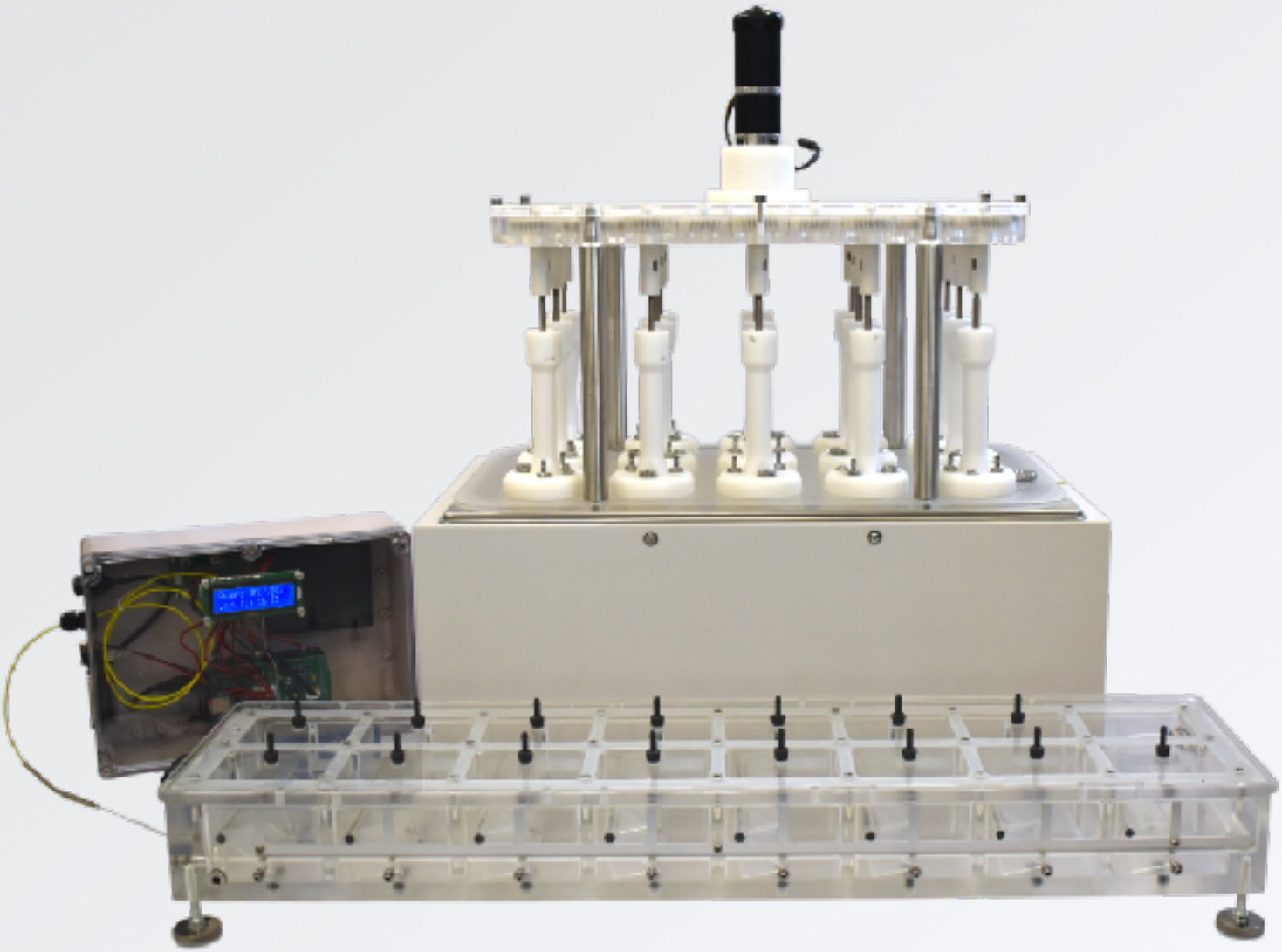
Anaero
Technology

BMP Nautilus™

Batch Fed Digester

A robust environment to experiment with and collect accurate low-flow gas data.



PATENT WO 2015/189577 A1

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BMP Nautilus

The Nautilus set draws on decades of industrial and lab experience to make operation as simple as possible. With hassle-free twist and release gas hose, and an easily removable mixer system, the bioreactors are easily accessible, reducing the downtime between tests. The set consists of 15x1 litre gas-tight bioreactors that are capable of reproducing the perfect conditions for anaerobic biodegradation tests and with additional adjustments, BOD and aerobic tests too.

Your samples will be in the same environment for the most repeatable and reliable results

A Grant™ water bath is used to maintain uniform control of temperature between all the reactors. Within each reactor is a large silicone paddle to mix the feedstock. The large surface area ensures thorough mixing regardless of the thickness of the blend eliminating the possibility for 'dead zones' where microbial activity is limited.

Homogeneity is vital for ensuring representative sampling, accurate kinetic data, and reliable experimental outcomes. This is why each bioreactor is also connected to our patented gearbox system® which guarantees consistent mixing between all the reactors. This eliminates random error from slight differences in mixing speeds between motors and also saves on setup time.

Secure real time monitoring and automatic data collection

The BMP nautilus is connected to our gas flow meter and gas monitoring system, Bittern+, which has been designed to accurately measure and store biogas data without compromising on security. These measurements can then be monitored in real time and extracted for further analysis. An incorporated rechargeable battery pack protects for up to 15 hours against data loss in the event of power loss.

1 Year Warranty Included

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THE NAUTILUS SET

High precision brushless motor module

Patented Gearbox system for homogenous mixing

Gas-tight water bath lid prevents moisture loss

Grant™ water bath for uniform temperature control

Chemically inert 1-litre bioreactors with extra large mixer paddle

15-channel gas flow meter

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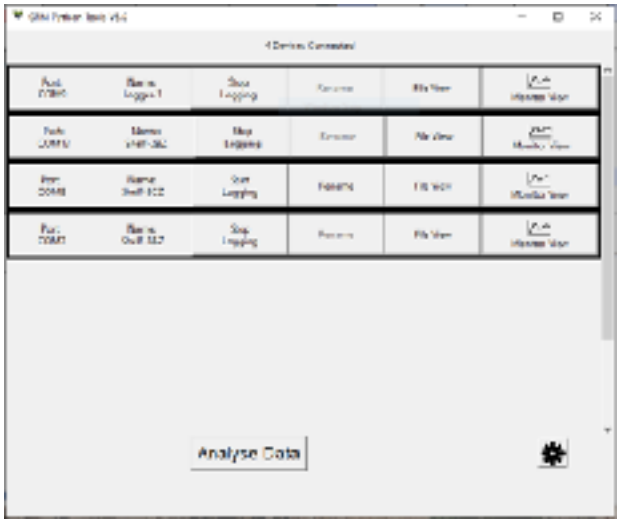
THE NAUTILUS SET

BITTERN+

Gas flow Analysis Software - Ready to go

Granular and clean data

Our Arduino-based system is an open source state-of-the-art data logger . When one of the tumblers in the gas flow meter tips, a magnet attached to it causes the reed switch to close and record the volume in real time. Simultaneously a barometric pressure sensor and a thermocouple capture data which enables all gas flow data to be corrected for pressure and temperature (STP).

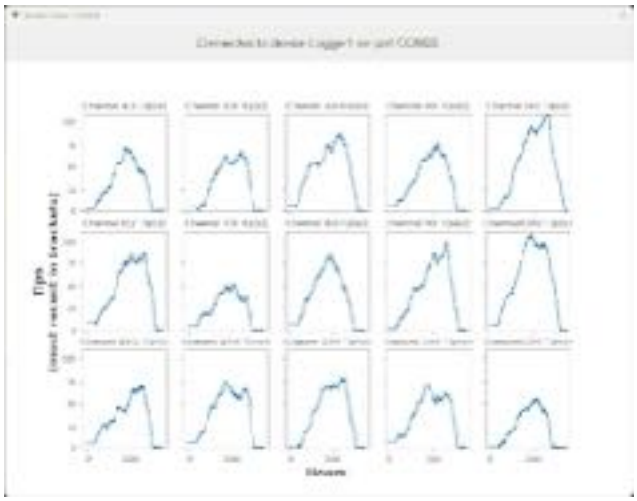


Designed for security and robustness

Our gas monitor system is secure even in the case of a power outage, where a rechargeable battery pack will provide protection for up to 15 hours. The gas flow data is also stored locally in a secure drive.

Real-time monitoring

All tumbler events are written to a log file with raw and processed gas flow data. This real-time data can also be displayed live on a PC, using monitor view within the software. With Bitterns' streamlined design it becomes seamless to set up an experiment, monitor it and collect the data. Enabling no hassle analysis.



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APPLICATIONS (BMP & RBP TESTS)

Bio-methane Potential (BMP) is a biological test to evaluate the economic value of feedstock through its potential for methane/biogas generation. It can also indicate the presence of potentially toxic or inhibitory substances in the feed. An equivalent test, residual biogas potential (RBP), described in WRAP report OFW004-005 is now a UK certified method to assess the quality of AD processing. The test uses batch reactors where a substrate sample is fed to an AD inoculum. Gas is measured and converted to units of ml/gram VS substrate at STP. The kinetics of biogas generation obtained can also provide data on potential sample inhibition, or inoculum degradability.

Real-time data collection provides the granularity required to differentiate the response of microorganisms in the inoculum to the different components of a substrate. Readily degradable components such as sugars result on rapid production of biogas with fast gas depletion. More complex components, such as protein and fat, can have different stages of high gas production (generally slower at the start) and higher final biogas yields. Inhibitory substances will show as –ve RBP values for visualisation. Complex samples can have a period of inhibition while the system acclimatises followed by recovery and high biogas production. On the other hand, toxic substances result in no recovery of biogas production. The availability of this data is a valuable tool to AD operators in fault-finding or for evaluation of the value of potential feedstock.

Possible Applications

Anaerobic/ Aerobic Digestion: Assessing economic value of feedstock, its biodegradability, analysing biogas quality and production, BOD tests*

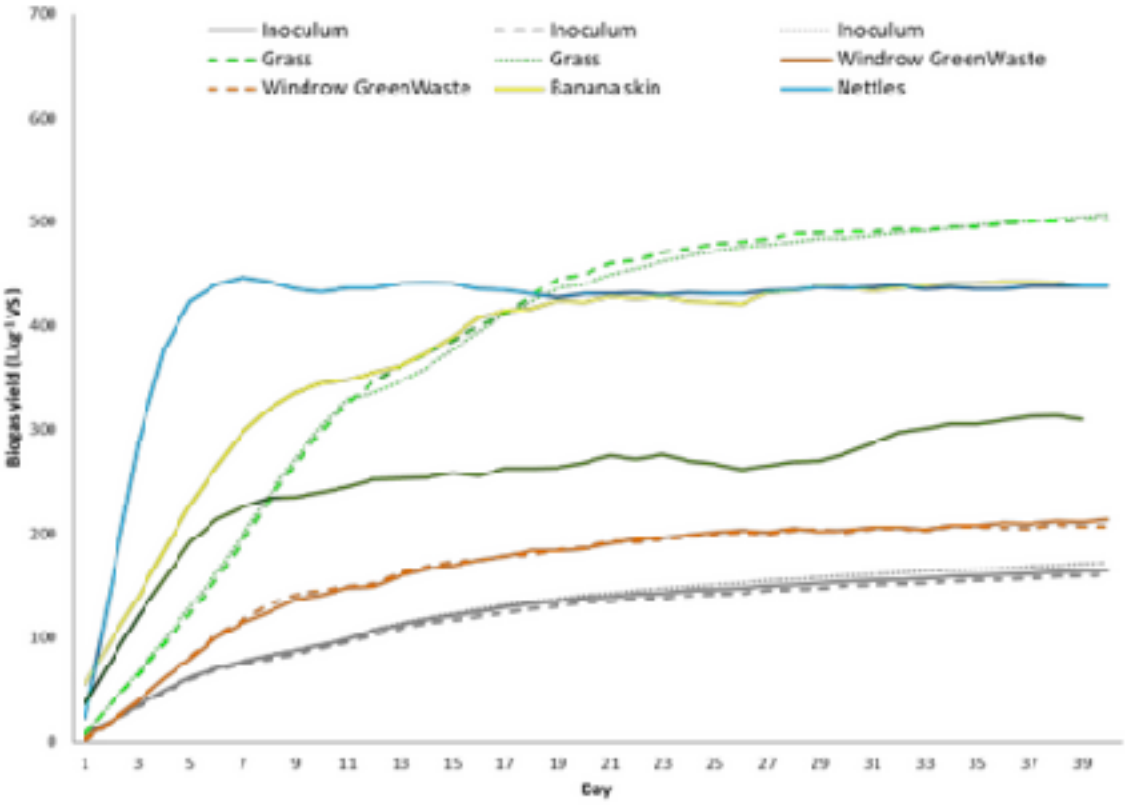

Figure 2. Biogas yield from arable by-products using Anaero Nautilus model

Industrial: Enabling testing of fermentation processes and wastewater analysis.

Environmental: Evaluating microbial activity and assessing digestibility.

** With additional adjustments*

THE NAUTILUS SET

TECHNICAL SPECIFICATIONS

Component	Specification
Water bath	• Voltage: 240v/110v • Capacity: 26L • Base tray: Polycarbonate • External dimension (WxLxH): 335x590x420mm • Internal dimension (WxL): 278x480mm • Drainage outlet: Yes • Temperature range: ambient +5 to 95°C (±0.5°C) (requires high temp lid) • Water bath lid: Custom lid to prevent moisture loss
Bioreactors	• Quantity: 15 wide mouth bottles for ease of test preparation • Material: HDPE or glass option • Capacity: 1L • Extra large paddle: Yes • Gas ports: 2 • Configurable ports: 2
Gear box	• Enables uniform mixing speed among 15 reactors
Mixer motor module	• Power supply: 12v • Speed: 20rpm brushless motor (more options available)
Gas flow meter	• Independent channels: 15 • Resolution: ~10ml (calibrated for precise values) • Gas inlet and outlet port: 15 of each • Drainage outlet: Yes
Logger box	• Power supply: 9v • Battery backup: 6x AA rechargeable batteries (not provided) for up to 15h protection • Local Storage: 32gb (more options available) • LED screen for basic visual feedback • USB-B port for connection to PC
Hose	• Length: 20m to connect reactors to flow meter • Material: Soft Polyurethane • Outer diameter: 6mm • Inner diameter: 4mm • Operating temperature: -20°C to 60°C
Luer connectors	• For easy connection/disconnection of gas hose • 30 male and 15 female luer connectors • 15 luer stoppers
Gas Bags (not included in base package)	• Inlet and outlet valve • Wide range of volumes available
Access tube (not included in base package)	• Installed into configurable port 1/8” BSP port on all reactor • Enables sampling and manual feeding during operation • Gas tight: Yes • Material: Stainless Steel

As valued customers, you will be provided with technical support, regardless of whether your warranty has expired. We want your instruments constantly running and collecting data.

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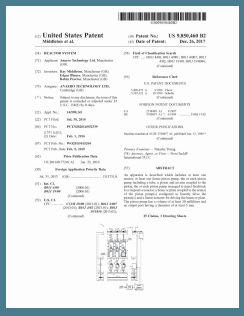
Our Mission

Anaero technology is built on decades of experience in the wastewater and AD Industry. The founder Edgar Blanco has almost 3 decades experience working with academic institutions in the UK and the EU on anaerobic digestion and sludge treatment, translating academic research into industrial practice for maximum economic and environmental benefit. From work on anaerobic biofilm reactors for abattoir wastewater treatment to activated sludge optimisation, odour control, agricultural use of biosolids to collaborating on UK standards development for industrial food waste AD (PAS110). We are determined to help promote the link between academia and industry.

It's our privilege to work alongside brilliant people and scientists from around the world. We will maintain confidentiality of our customers and share our experience freely as we are committed to spreading our knowledge and ensuring you have the best data available.

Anaero Technology sponsors several PhD and Masters

3 Patents have been granted



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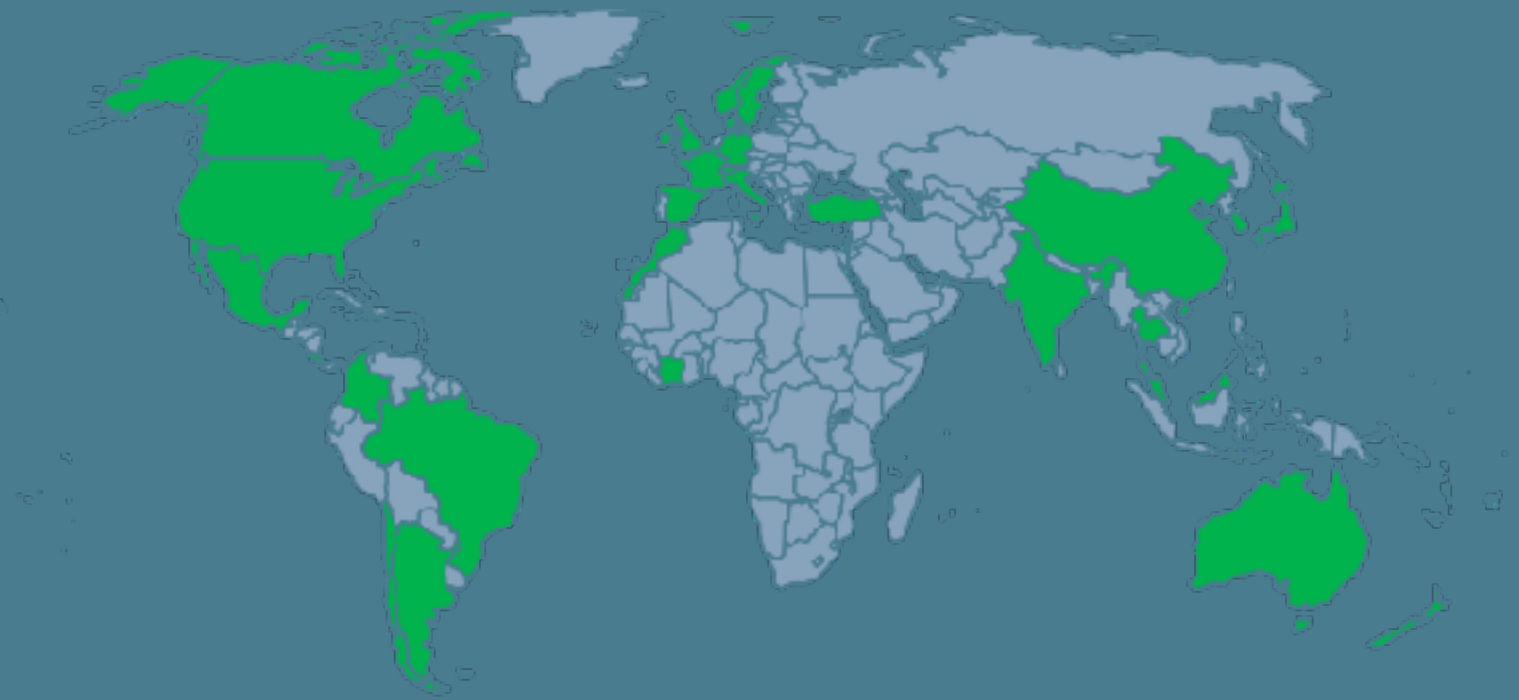
Built And Designed by Researchers

Founded in 2013 from our need for equipment capable of accurately evaluating the biogas processed in full-scale AD plants. With environmental sustainability and scientific advancement always in mind, improvements were (and are) constantly being innovated, meaning our machines benefit from a forward thinking and evolving attitude. Holding **3 patents** and clients from 32 countries globally. Our instruments are used in:

100+ publications

50+ academic institutions

20+ commercial labs



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