Can measuring microbial growth optimise fermentation processes and improve the economics of environmental biotechnology?

Microorganisms possess amazingly diverse metabolic activity that makes them fascinating candidates as biochemical factories. Their ability to produce gases and acids, metabolise waste, degrade chemicals, produce enzymes and proteins and catalyse reactions can help unlock advanced industrial, biochemical and chemical treatments. Their productivity is affected by a number of different factors and understanding how these factors affect microbial dynamics is a route to optimising their benefits.

Since digestion and fermentation are affected by a variety of factors it is important to understand microbial growth dynamics with accurate and continuous measurement. It is also important to understand how growth dynamics affect the productivity and economics of cultures such as input costs relative to production or digestion outputs. Does the environmental biotechnology industry understand the optimum point where input costs maximise production returns, whether returns are financial or bio-remediation and environmental benefits? Does the industry understand the optimal microbial conditions that maximise their environmental benefits?

Microbial growth is affected by a number of factors such as: nutrients, oxygen, temperature, toxins, contaminants and competition to name a few. These factors and their influences on microbial productivity are important uncertainties to unravel so as to maximise environmental benefits.

Experimenting and developing an understanding of the dynamics of microbial growth helps to reduce cost by optimising growth conditions and improving productivity. It could also help isolate the key microbe(s) most important to optimal digestion and eliminate competition within complex cultures or develop an understanding of contaminants and how to filter them out to optimise the culture's productivity. Experimenting with microbial growth factors and conditions such as nutrients, oxygen, temperature, toxins, contaminants and competition can help to optimise yields, biomass production and understand the optimal input demands to output ratio and therefore the economics of fermentation processes.

We believe that by measuring microbial growth dynamics under different conditions it is possible to determine the factors that improve fermentation productivity, reduce production costs and improve the economics of environmental biotechnology.

Studying anaerobic microbial physiology is very challenging experimentally. There are few devices capable of measuring anaerobic growth rates over extended periods at high resolution with non-disruptive data capture techniques at an affordable cost.

Growth measurement devices need to provide comparable measurements, be reproducible and permit standardised methods across devices. Data must be obtained with a high enough resolution and low enough variability to allow for mathematical modelling and statistical analysis. A big challenge is for devices to operate within the more extreme conditions of anaerobic and thermophilic microbial growth; from obligate anaerobes through to obligate aerobes, chemotrophs and thermophiles.

The ***MicrobeMeter*** series provide continuous microbial growth data for **anaerobes and aerobes and thermophiles**. One version called ***MicrobeMeter HighTemperature*** provides continuous microbial growth measurement **of thermophiles** at up to 85 deg C ! This device can support the

continuous microbial growth measurement **of thermophilic anaerobes.** Could it be the only device capable of measuring continuous thermophilic anaerobic growth?

Both ***MicrobeMeter*** and ***MicrobeMeter HighTemperature*** provide publication ready, high-resolution data for understanding microbial physiology under different conditions whether that be under aerobic or anaerobic conditions, temperature sensitivity, response to nutrients, chemical tolerance, respiration, sensitivity to anti-microbials, oxygen, biomass production, nutrient absorption, tolerance to complex cultures and chemical degradation to name a few.

The MicrobeMeter series:

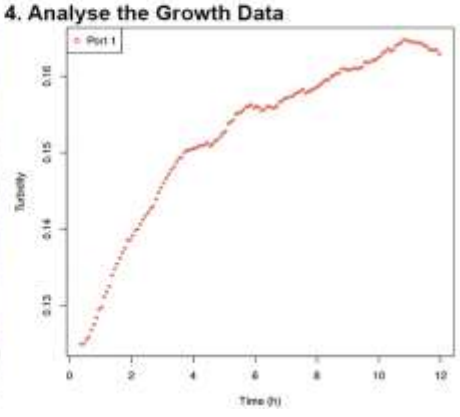
- Can measure growth of **anaerobes or aerobes, thermophiles or mesophiles**.
- Has a **small footprint** and may be able to replace the role of a spectrophotometer or plate reader to collect reliable growth measurements for as long as **800 hours**.
- Measures growth in **real-time**, has **low variability** and **high reproducibility**.
- Transmits data to **any Mac, Windows or Linux computer** via Bluetooth, at intervals as low as every 6 seconds. Users can also programme and set their own measurement routines.
- Can be used in **temperature-controlled incubators, shakers** or even **out in-the-field**.
- Options include a battery version or a wall adapter version.

1. Prepare Microbial Samples
(3 Samples + 1 Control/Blank)

2. Grow the Microbes Using MicrobeMeter
in a Shaking Incubator

3. Wirelessly Record the Growth Data

4. Analyse the Growth Data



MicrobeMeter is used worldwide by life science researchers and educators.
For more information visit us at: ***https://humanetechnologies.co.uk***

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