

Conventional microbiological cultivation techniques are under close scrutiny - Can all these techniques be applied in microcalorimetry?

Abstract:

All living organisms evolving heat as a by-product of the complex metabolic reaction network. A single bacterial cell, e.g. *Staphylococcus aureus* produces a heat flow in a range of 1.5 - 2 pW[1] and this tiny heat quantity is obviously not perceptible to us humans. Modern isothermal microcalorimeters (IMC), are able to recognize the smallest traces of microbial contaminations in food[2], in tap water[3] or on medical devices[4]. Often is the detection much faster and more reliable as with conventional techniques[3]. However, the transferability of standardized and well-established microbiological cultivation techniques on IMC and the influence of the cultivation techniques on the heat signal are the key points for the success of the new calorimetry application. Therefore, we investigated two different microorganisms: *Lactobacillus plantarum* and *Pseudomonas putida* as a representative for anaerobic and aerobic bacteria, respectively. We used common microbiological cultivation techniques like direct growth on solid (GS) or on liquid media (GL) as well as growth onto membrane filter (GF) as an enrichment step for the sample and compared these different techniques in the context of detection speed and reliability of the calorimetric signals. Our data demonstrate that all kinds of cultivation techniques are applicable in IMC and can be incorporated into one single device. The concentration-dependent measurements showed a strong correlation between the logarithm of the initial number of bacteria and the time required to reach a certain heat flow value. This approach might be the key to the application of real-time monitoring of contaminations in different materials like water, food or medications.

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