Division Diagnostics at a glance

We provide R&D for microfluidic-based analysis systems with applications in life sciences, medical research and diagnostics, food safety or biotechnolgy.

Our microsolutions enable the analysis and monitoring of biological parameters such as proteins, ions, small molecules, RNA, DNA or pathogenic organisms.

The key enabler for fully automated point-of-care systems is our extensive experience in the miniaturization of lab preparation methods, their integration with microsystems, including measurement methods for sample analysis, such as PCR, nucleic acid extraction and purification, immunoassays or ELISAs or flow cytometry.

Our partners benefit from

- low cost consumables (disposable)
- minimized reagent consumption for monitoring purposes
- minimal hands-on time or full automation

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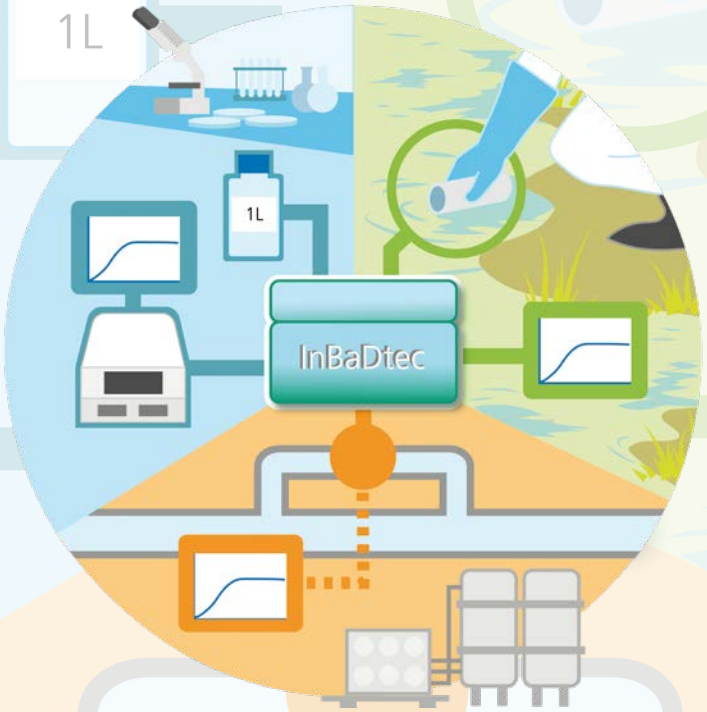

InBaDtec

Fast and fully-automatic detection of microorganisms in industrial fluids

Culture-based methods, the gold standard for the identification of microorganisms, need long-term and labor-intensive protocols and require complicated logistics.

PCR – An emerging promising alternative

Compared to culturing, Polymerase Chain Reaction (PCR) is a faster and reliable method for microbial detection and quantification. However, for the detection of microorganisms in industrial water, before PCR is carried out, the water samples always need complex pretreatment procedures to purify and concentrate the microorganism targets, and this process is still manual or semi-manual in the laboratory.

Point-of-use water analysis

The Fraunhofer IMM is developing a miniaturized point-of-use device called "InBaDtec", which aims at the fully automatic preparation of water samples before using the qPCR analysis. It allows the direct on-site detection of pathogens from large amounts of water sample (one liter or more) in as fast as one hour.

This device basically contains:

- a cleaning module to first remove excess dirt
- a two-step concentration module to reduce the water sample volume from liter to micro-liter level that can be used for PCR, while maximizing bacteria concentration efficiency
- a lysis module to break apart the microorganisms allowing the release of its genetic material which is then mixed with pre-loaded lyophilized PCR reagents
- a miniaturized ultra-fast PCR module previously developed at IMM

These processes are all completed automatically, thus enabling point-of-use detection. The "InBaDtec" system can be self-cleaned and re-used.

» Pathogenic microorganisms detection is the key to ensure water biosafety and quality.«

InBaDtec prototype

Application scenarios

- Each functional module in this system can be used in the laboratory as a stand-alone device.
- By using integrated and miniaturized techniques, the system could also be combined to enable direct detection following bacterial concentration for point-of-use water analysis.
- In addition, it is also possible to integrate the concentration/detection device directly into a water distribution network via fluidic connections and valves for on-line detection, which would enable continuous water monitoring.

The preliminary application for InBaDtec is the detection of *Legionella* in cooling water.

Other potential applications include microorganisms monitoring in:

- drinking water
- waste water
- swimming and bathing water
- bioreactors
- food and beverage industry
- pharmaceutical industry

Publication tip: Carreira et al, Aufkonzentrieren für die Analytik von Bakterien in Wasser - LABO ONLINE, June 2022