usePAT

sonicwipe
taking care of the cleanness
by usePAT

sonicclean
cleaning sensors in liquids
by usePAT

ACCURATE MEASURING SOLUTIONS

ultrasound technology to enhance processes and improve measurements

The need for in-line data measurement – paving the way for industry 4.0

Industry 4.0 aims to enable end-to-end automation and process optimization. The generation of qualified data directly from the process, providing precise information about the product, is the basis for implementing data-driven production. The status of a medium during the manufacturing process can be determined by Process Analytical Technology, to acquire the necessary in-line data of interest and use it for effective process control in real-time. However, measurements in liquids are often not possible directly during process execution, calling for off-line sampling. Moreover, even when using in-line PAT probes, they often suffer performance loss due to insensitivity or contaminations, rendering their delivered data inconclusive.

usePAT improves your process by pushing stability and optimization of:

- process control and execution
- detecting irregularities already during the ongoing (production) process
- time
- quality and yield
- preventing production loss
- resource conservation & energy saving
- safety and security

Deep process insights

Some established in-line measurement technology already exists. The focus needs to be on improving their performance and making them fit for long-running industrial in-line application. usePAT uses ultrasound technology in the enhancements “sonic**catch**”, “sonic**wipe**” and “sonic**clean**” for various PAT sensors to deliver exact measurements in industrial liquids by improving the signal intensity and keeping them continuously accurate and clean. In-line measurement techniques such as Raman-spectroscopy, Process-microscopy, NIR spectroscopy, ATR-IR absorption- spectroscopy, particle size & concentration measurement systems (e.g., FBRM), and turbidity, pH, Oxygen-sensors, etc. have been successfully applied with an enhancement. The accurate real-time data generated due to these new acquisition capabilities allows permanent control over the process and enables its optimization in numerous industrial areas, such as pharmaceutical, biotech, wastewater, chemical and petrochemical industries, as well as industrial R&D facilities.

soniccatch
trapping of particles in liquids
by USEPAT

In-line detection of suspended particles with sonic**catch**

Ultrasound fields are used to catch (sonic**catch**) particles like cells, solids, bubbles, oil-droplets, microplastics, etc. directly at the focal point of a PAT probe, acting as an in-situ sample preparation and enabling the sensitive measurement of the microorganisms and other particles in the process media. Virtual sample-volumes form within seconds – the signal quality is comparable to the one of a sediment, even in streaming liquids.
Furthermore, particles or bubbles hindering the measurement can also be kept away from the probe, no longer affecting the measurement to deliver accurate results.

sonic**catch improves measurement`s**

- **sensitivity**: improved orders of magnitude
- **selectivity**: independent measurement of particles and liquid, respectively
- **stability**: probe stays in place, no cleaning measures necessary, no off-line sampling

sonic**catch** & Raman: more signal

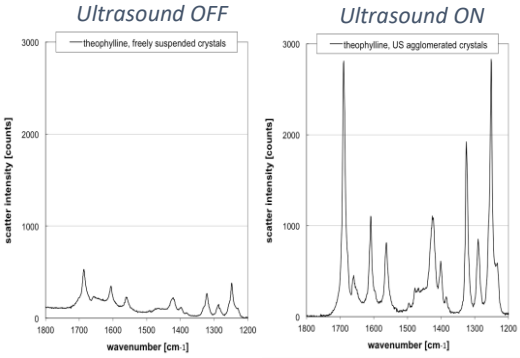
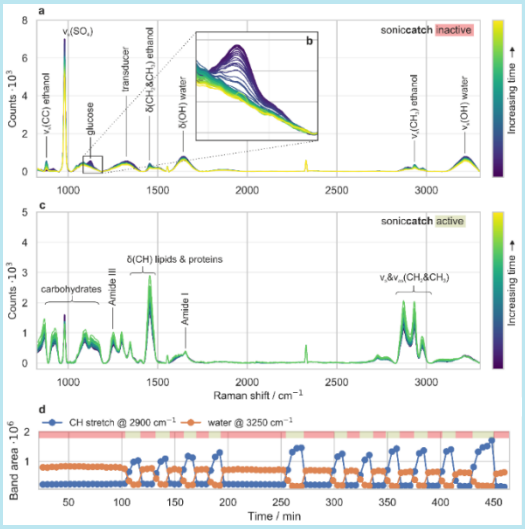


Figure 3: Theophylline crystals. Raman- Signal enhanced with ultrasound particle agglomeration, also see figure 4

*Figure 1: sonic**catch** is an ultrasonic add-on for in-line sensors, enhancing their performance in terms of signal intensity, sensitivity and selectivity.*

sonic**catch** & Raman: yeast cells

Figure 2: Knowledge of the composition of fermenter broth and the content of cells helps to improve the fermentation processes and leads to better and more efficient process control.



sonic**catch** & Microscopy: Crystallization

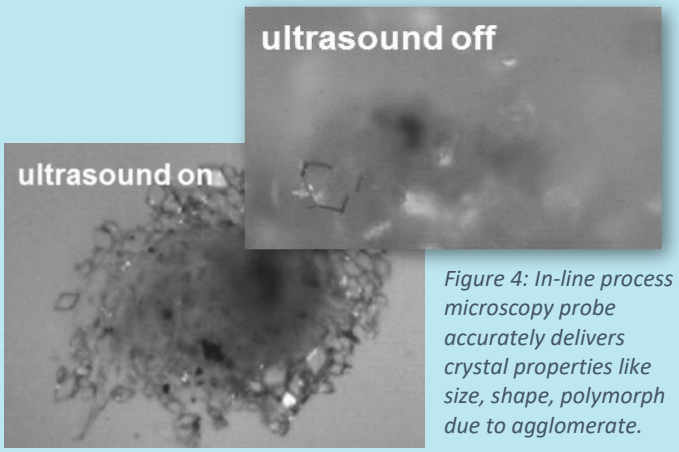


Figure 4: In-line process microscopy probe accurately delivers crystal properties like size, shape, polymorph due to agglomerate.

sonic**catch** & ATR-IR: Cyanobacteria produce PHB (bioplastics)

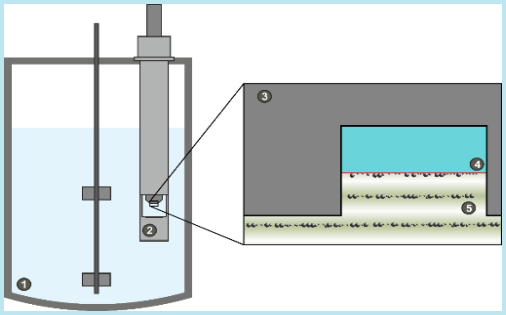


Figure 5: Cyanos produce PHB through sunlight and CO2 in a 5 l bioreactor (1), PHB is accumulated inside the cell.

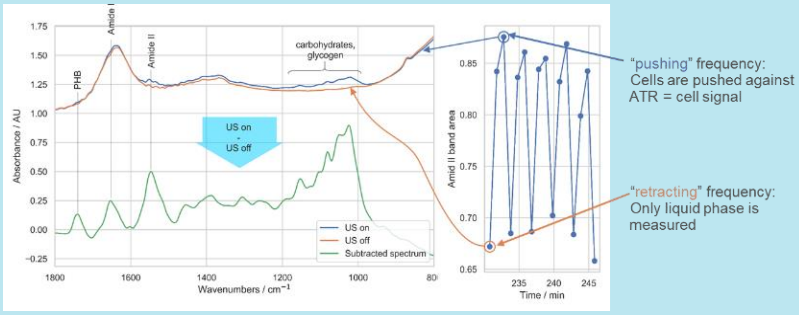


*Figure 6: Selective measurement of the bacteria and the carrier liquid by sonic**catch** (2) and an ATR-FTIR probe (3): the cells, producing PHB (5) are pressed to the ATR-Element (4) respectively.*

sonicwipe taking care of the cleanness by USEPAT sonicclean cleaning sensors in liquids by USEPAT

Ultrasonic cleaning of in-line sensors by sonic**wipe** & sonic**clean**

When sensors become polluted, they run the risk of delivering distorted measurement data.

sonic**wipe** and sonic**clean** are ultrasonic cleaning systems that ensure the cleanliness of probes and sensors, thus preventing falsified measurements. The resulting measurement drift due to contaminations is difficult to distinguish from process-related changes. Hence, the process control system records the falsified information and draws sub-optimal conclusions based on this, leading to energy consumption and process-technological difficulties.
Fouling can occur very quickly, which means that sometimes out of schedule maintenance is required. A clean sensor assures the delivery of accurate, reliable, and continuous process information in real-time.

sonic**wipe &** sonic**clean improve sensor's stability**

- sensor remains in the process, enabling continuous process control
- no time-consuming costly maintenance necessary, no production downtime
- the ultrasonic field acts on the contamination, no danger of sensor damage
- no influence of the ultrasound field on the measured values

*Figure 7: ultrasonic cleaning armature sonic**wipe** is placed opposite of the sensor, keeping it free from contaminations by running customized ultrasound cleaning protocols or via a process control system.*

sonic**wipe** & FBRM: fouling

*Figure 8: A biofilm formed on a Focused Beam Reflectance-probe due to fermenting yeast cells was removed by sonic**wipe** (fouling index 0%). Fouling index gives the degree of contamination on the window.*

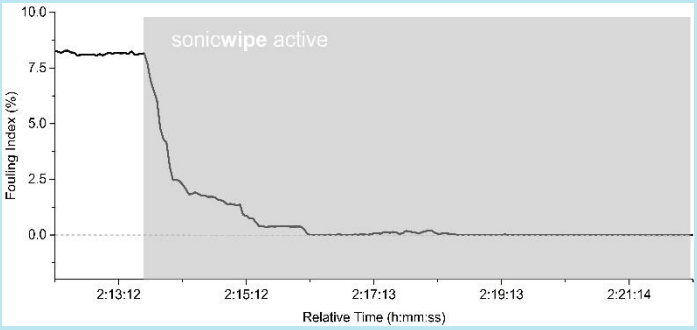
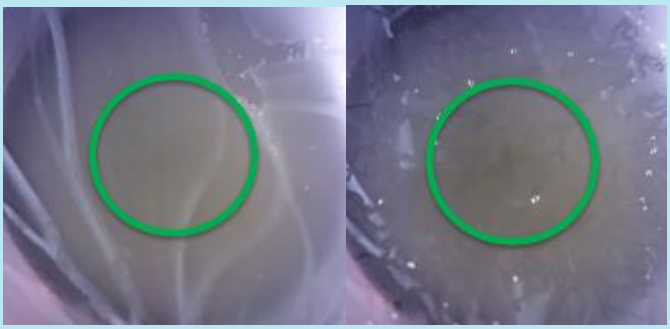


Figure 9: Removal of a biofilm (fermenting yeast cells) from an in-line sensor's window by applying ultrasound (left without and right with ultrasound).



sonic**clean** & O_2: wastewater aeration

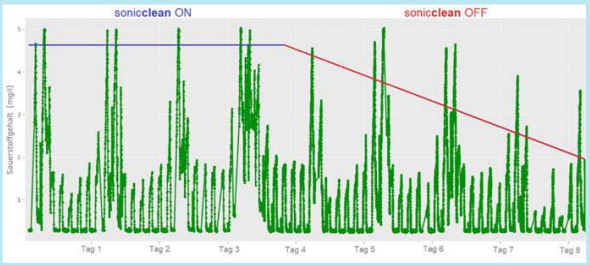


*Figure 10: sonic**clean** keeps the O2-levels stable, as the sensor is not affected by layers. The aeration is otherwise activated too often due to falsified O2-levels, causing unnecessary energy loss and process technological difficulties.*

*Figure 11: ultrasound cleaning armature sonic**clean** keeps the sensor clean by applying cleaning intervals and protocols as a stand-alone device.*

sonic**clean** & pH: organic & inorganic layer

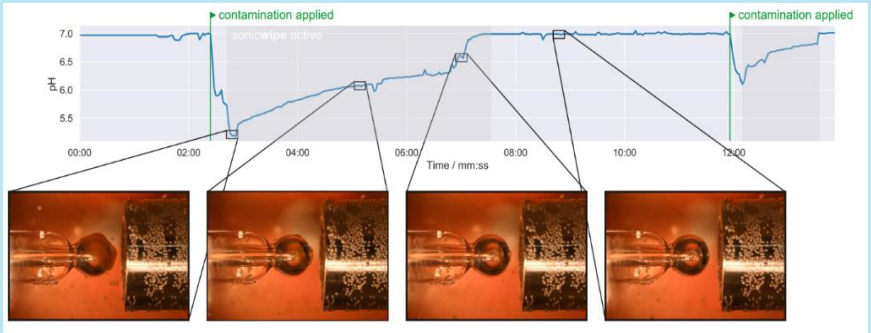


Figure 12: Ultrasound removing a contamination from the pH-probe. Right inorganic. Upper organic. The measurement is not affected by the ultrasound, the sensitive glass tip not

datasheet

Dimensions
lengths adaptable.
outer diameter 25mm.
e.g. DN25/ Ingold port process connection

Current product standard
combinable with probes up to 19mm diameter with standard product, customizable

Materials
materials FDA compatible.
1.4404 stainless / 316 L, Hastelloy X or C276

Max. T: 170°C
Max. p: tested: 3 bar @ 130°C for 30min

autoclavable

CIP/SIP

Compatibility
Successful application with: Raman, midIR ATR, FBRM, in-line microscopy, pH, O2, UV-Vis,…

combinable with various measurement systems. Can be applied in pipes as well as in tanks

affiliates

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