Ampha X30 - Precision Tools for Real-Time Cell Analysis (Bioprocessing)

Product Information

Reusable chip

- ***Label-free analysis.*** *No need for staining or incubation!*
- *Analyze **any cell type**, from bacteria to large plant cells.*
- ***Count and assess bacteria** in minutes, accurately. **Viability too!***
- *Monitor **apoptosis without staining**. Early v. late apoptotic cells!*
- *Measure **metabolic state** and **production quality** spontaneously!*
- *Handle **turbid, opaque or autofluorescence solutions!** Easy maintenance, and low cost per measurement.*
- ***Reusable chip – up to 1,000 measurements** with different channel diameters to suit a wide range of cell types.*

Ampha X30: Fast, flexible, non-invasive

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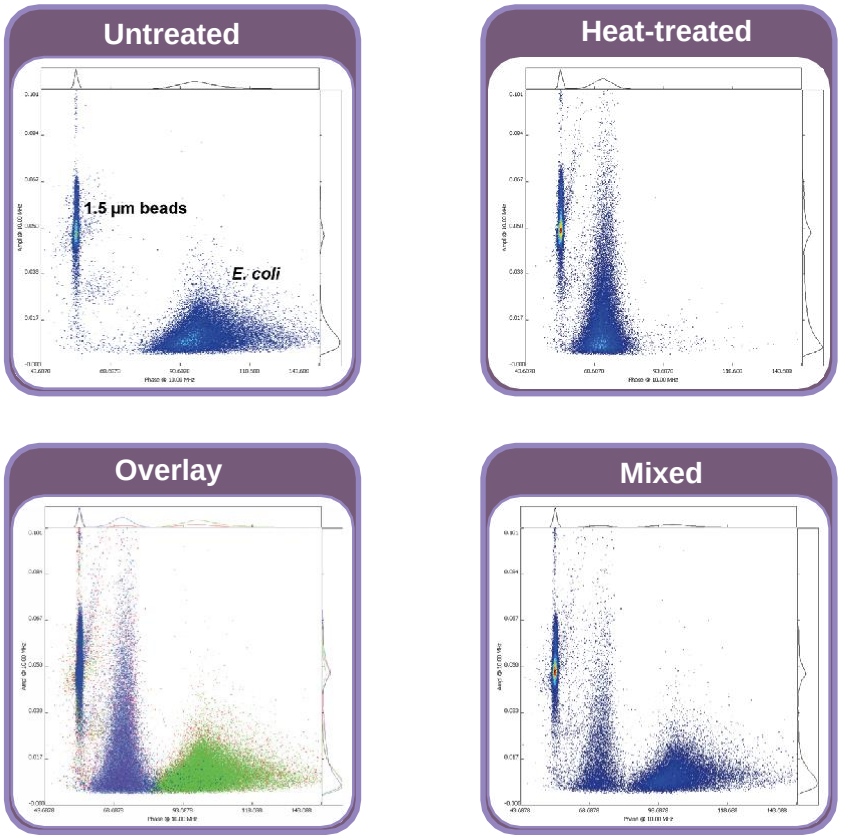
Accurate and Rapid Bacterial Counting and Viability Assessment

Measuring the number and viability of bacterial cells remains a significant challenge due to their microscopic size and biological diversity. Traditional methods, such as viable plate counts, are often time-consuming and may fail to detect all viable cells. While advanced techniques like flow cytometry or molecular assays offer greater precision, they typically require specialized - and often expensive - equipment and expertise.

Accurate bacterial quantification is critical across many fields, and assessing viability is just as important.

Amphasys' technology enables precise bacterial counting and viability assessment within a minute - without the need for calibration or incubation. A true asset, not only for antibiotic research!



The figures present measurements of an overnight *E. coli* culture grown in LB medium, with 1.5 µm reference beads added to each sample. All measurements were performed using Amphasys' proprietary buffer.

The **untreated sample** displays only viable *E. coli* cells. In contrast, **heat treatment** at 99 °C for 30 minutes results in a population consisting exclusively of dead cells. When **untreated and heat-treated samples are mixed in a 1:1 ratio**, the resulting measurement clearly reveals two distinct bacterial populations, corresponding to live and dead cells. This separation is also evident when overlaying scatterplots from the individual untreated and heat-treated samples. Cell count and viability are determined simultaneously and in real time - **without the need for calibration**.

Yeast Fermentation

With only the viability value of 75 %, **you can't determine if the cells are dormant or actively dividing**. Viability tells you they're alive, but **not whether they are metabolically or reproductively active**. You need time-course data or metabolic/activity indicators.

This data and much more can be easily obtained using the **Ampha X30** system.

Figure 1

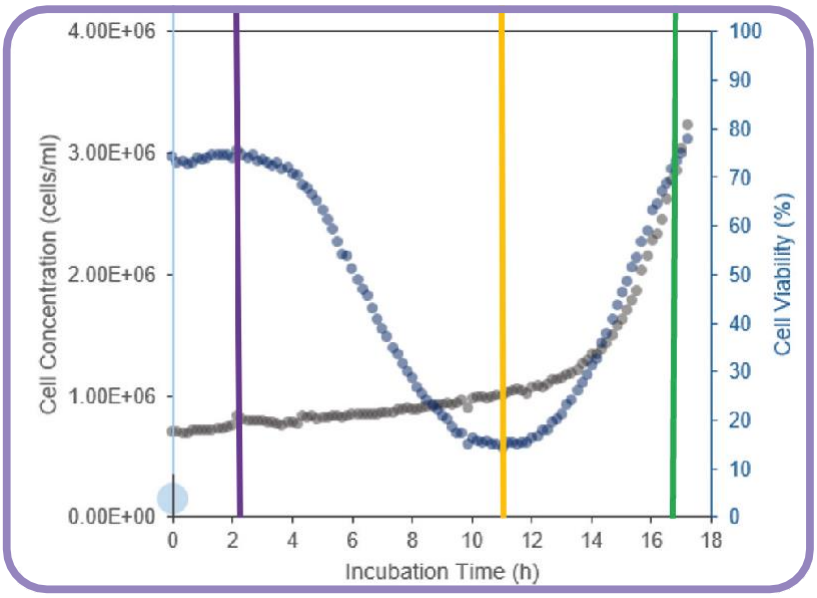


Figure 2a

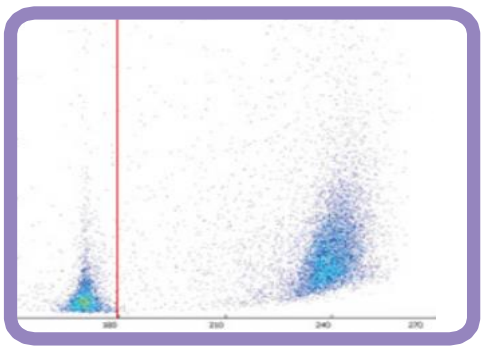


Figure 2b

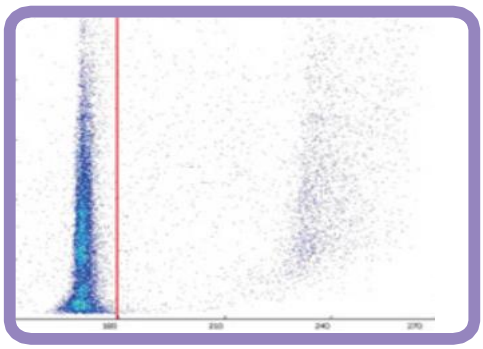


Figure 2c

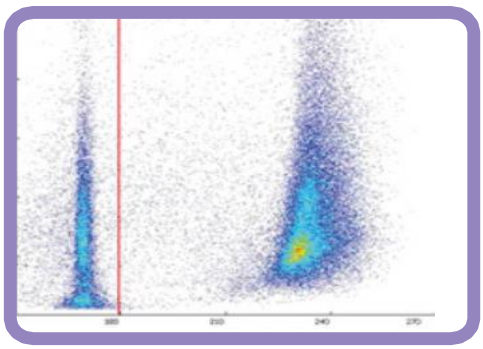


Figure 1 illustrates a time-resolved measurement of yeast cell concentration and viability over 17 hours in an online setup, revealing the behavior of the yeast culture. The grey dotted line represents cell concentration during the lag and early exponential phases, while the blue dotted line shows cell viability.

Figures 2a–c display corresponding scatterplots at 2.5, 11, and 16.5 hours. The red line in each scatterplot separates dead cells (left) from viable cells (right).

While a biomass sensor tracks growth by measuring cell concentration, impedance flow cytometry provides additional, precise information on cell viability and physiological status. **Figure 2a** shows dormant yeast cells at 75 % viability after 2.5 hours. These cells progressively die over the next hours, as seen in **Figure 2b** by the increased dead cell population, leaving only a small viable fraction. By 11 hours, **Figure 2c** shows the start of exponential growth, evidenced by a large viable cell population.

Amphasys' technology delivers far more insight than simple cell counts or viability, supporting the development, optimization, and control of bioprocesses.

Metabolic Status Monitoring

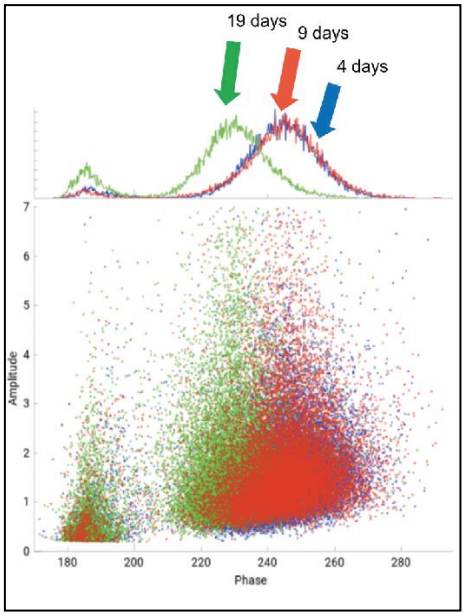
Do you know how your cells are doing?

Your cells are constantly at work, taking in nutrients, generating energy, and maintaining balance. But unless you are doing specific medical tests, you don't directly know how your cells are doing day to day. However, there are some signs, and with our modern technology (Ampha X30), you can gather insights.

The adjacent illustration shows the monitoring of adherent CHO cells over 19 days using three overlaid scatterplots representing day 4 (blue), day 9 (red), and day 19 (green). The red vertical line separates dead cells (left) from viable cell (right).

- **Healthy status** (day 4 & day 9): Cells remain viable with sufficient nutrients. The histogram above the scatterplot shows complete overlap of the blue and red curves, indicating stable cell health.
- **Starving status** (day 19): The green cell population shifts toward the dead-cell region. This is clearly reflected in the histogram by a leftward shift and an increase in the dead cell population.

As nutrients are depleted, cells enter a starvation phase, leading to changes in membrane integrity. Amphasys' technology detects these membrane changes, providing real-time insights into the health status of the cells.



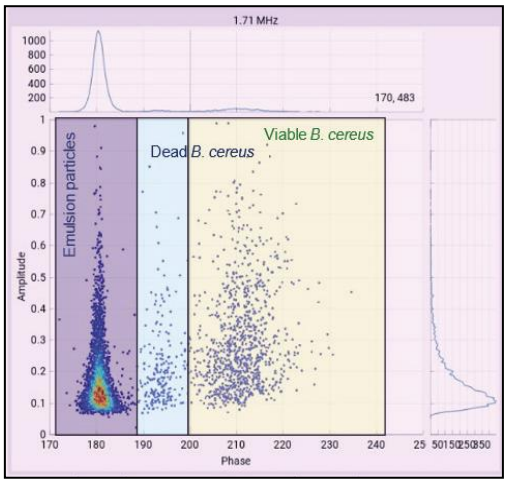
Cell Analysis in Matrices

Turbid, opaque, and fluorescent media pose challenges for systems relying on optical detection. **Impedance Flow Cytometry**, based on electrical detection, is unaffected by the opacity or fluorescence of the medium.

This enables **cell analysis in complex and opaque matrices**, such as milk, polymer emulsions, or autofluorescent media like microalgae cultures.

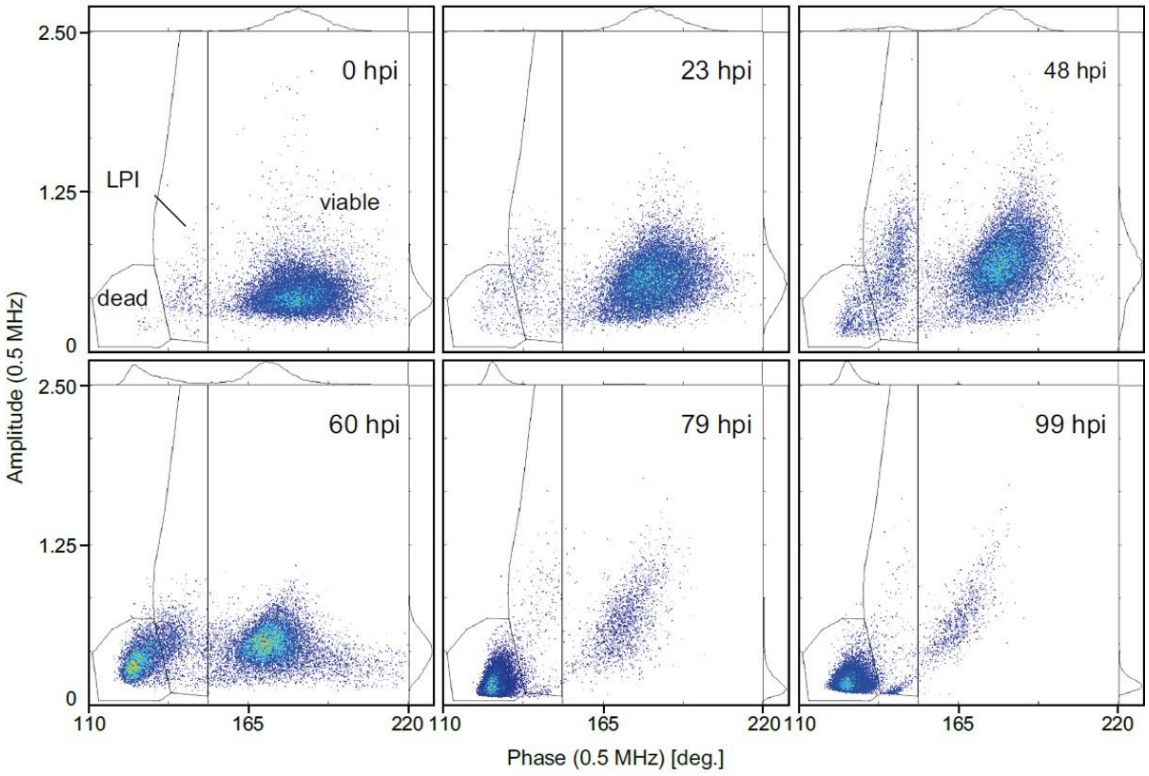
The illustration shows the analysis of a sample containing an aqueous emulsion of a synthetic polymer contaminated with *Bacillus cereus*. The scatterplot displays distinct populations: polymer particles appear on the left, while dead and viable bacterial cells are clearly separated.

Accurate quantification of all particles and cells is provided automatically.



Protein Expression in Insect Cells

Metabolic activity and process control: Impedance Flow Cytometry allows to detect protein expression in cells and to determine the right time for harvesting in the bioprocess.

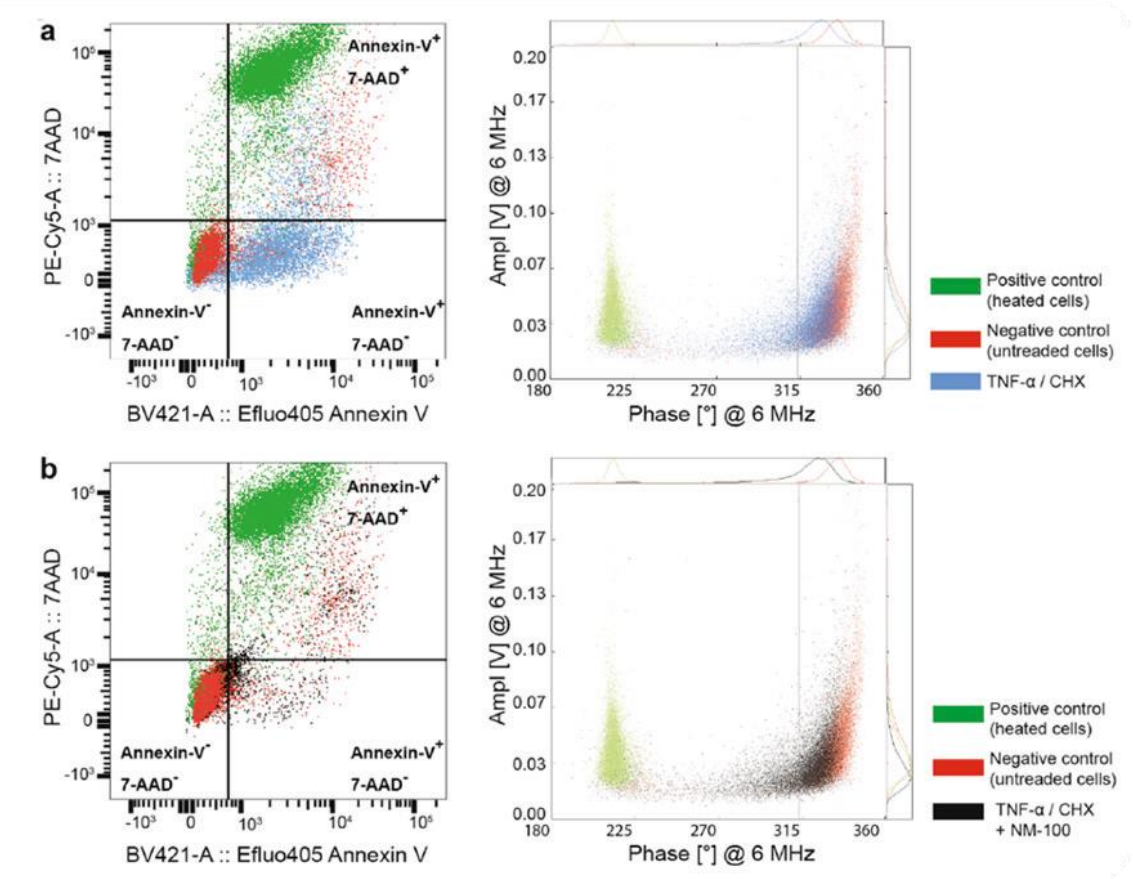


The scatterplots above illustrate protein expression over time in **Sf9 cells infected with Baculovirus**.

- **Viable Population**: During the first 48 hours post-infection, the viable cell population shifts toward the upper right of the scatterplot. This indicates an increase in cell size due to viral load. At later stages, this population nearly disappears, reflecting extensive cell death.
- **Dead Population**: The number of dead cells steadily increases, with a marked rise beginning around 60 hours post-infection.
- **LPI Population (Late Phase of Infection)**: A third population emerges between 48- and 60-hours post-infection, representing cells in the late phase of infection. The abundance of this population correlates with increasing protein concentration. By 79 hours, the disappearance of this population indicates complete cell lysis and the release of recombinant protein into the supernatant.

Amphasys' technology enables real-time monitoring of cellular metabolic activity, providing a powerful tool for effective **bioprocess control and optimization**.

Nanotoxicity Monitoring



The Advantage of Label-Free Cell Analysis

This comparative study highlights the benefit of label-free cell analysis, particularly in scenarios where nanoparticles hinder marker adhesion to the cell membrane. The figure contrasts conventional flow cytometry (left) with impedance flow cytometry (right), using U937 human lymphoma cells treated with TNF/CHX to induce apoptosis - both in the absence (top row) and presence (bottom row) of TiO_2 nanoparticles.

- **Without Nanoparticles:** Red (viable), green (dead), and blue (apoptotic) cells are clearly distinguished in both conventional (left) and impedance-based (right) cytometry.
- **With Nanoparticles:** In the presence of TiO_2 nanoparticles, apoptotic cells are no longer detectable by conventional flow cytometry (bottom left), as the particles interfere with marker binding. In contrast, impedance flow cytometry (bottom right) successfully identifies apoptotic cells (shown in black) without relying on labeling.

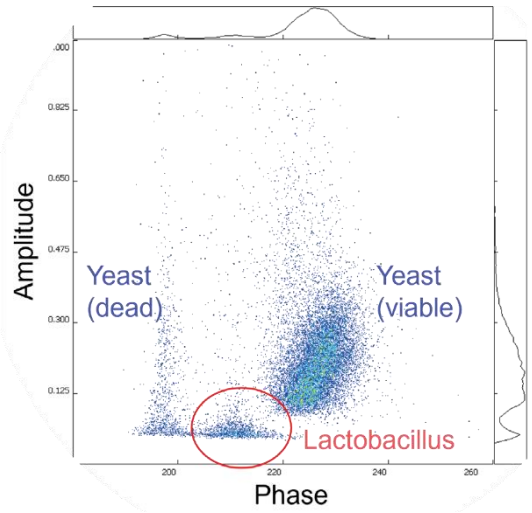
Label-free impedance flow cytometry is a powerful alternative in situations where marker adhesion is impaired or suitable markers are unavailable, **enabling robust and reliable cell analysis under challenging conditions.**

Contamination:
Measurement of Two Cell Types in Parallel

Impedance Flow Cytometry requires no labels or markers, and sample preparation is as simple as dilution and filtration. This streamlined approach enables the detection of contaminating cell types - even those of similar or smaller size - without the need for complex staining protocols.

The figure illustrates a yeast culture separated into viable and dead populations. Additionally, a contamination of smaller, viable *Lactobacillus* cells is detected.

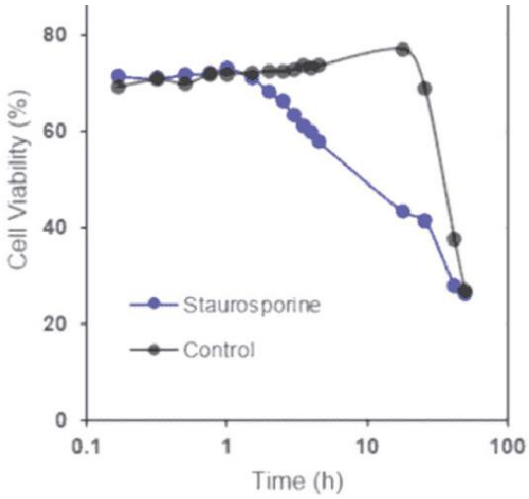
Amphasys' impedance-based technology enables simultaneous measurement of cells and particles of similar size, benefiting from the advantage that no specific markers or labels are required.



Apoptosis Measurement

Amphasys' impedance flow cytometry offers a rapid method for cell characterization. Sample preparation requires minimal time, and measurements are completed within seconds. Since no incubation is needed, results are available in real-time.

The illustartion shows time-resolved viability measurements of Burkitt lymphoma cells after treatment with staurosporine (blue line). Cell viabilities of an untreated reference sample (black line) were measured in parallel.



The decline in viability of the treated sample can be observed in real-time, without any delay, and as early as one hour after the treatment the decline in viability already starts (note: logarithmic scale). Similar measurements were done to show the efficacy of antibiotic treatments on bacteria.

New Era of Cell Analysis
Ampha X30

Experience simultaneous, label-free measurement of cell count, viability, and metabolic activity. Assess the whole range of cells: bacteria, algae, yeast, human and animal cells without the need for markers, dyes, incubation, or calibration.

Powered by Impedance Flow Cytometry, the **Ampha X30** is the universal benchtop instrument for cell analysis of any organism. Sophisticated software facilitates to uncover the hidden secrets.

Label-Free Analysis
No staining, no markers, no apoptosis kits necessary. No incubation nor calibration.

Difficult Media
Unaffected by turbidity, opacity, or autofluorescence. Detects somatic cells in milk and cell-type contaminations.

Comprehensive Analysis
All cell types from 1 to 50 µm. Cell count and viability simultaneously. Cell health status and metabolism as a bonus.

Cost-Effective and fast
Low operational and investment costs. Very short sample preparation and measurement times.

Ready To Elevate Your Research?

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