

# Rapid cultivation-independent quantification of total and live bacterial cell numbers: Flow cytometry

09/2015

## Technology:

Flow cytometry has undergone a step change in recent years in the area of microbiological water quality assessment. It allows both rapid, accurate quantification of total and live cell numbers and a distinction of different bacterial populations based on their nucleic acid contents. These microbial 'fingerprints' allow conclusions on water treatment efficiency and water ecology under different operational conditions.

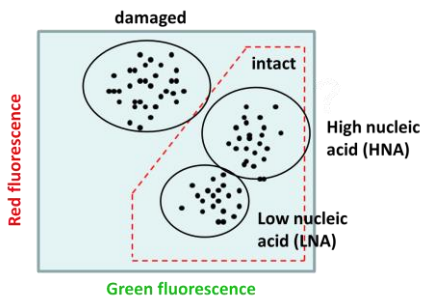


Fig. 1: Schematic presentation of bacterial clusters typically found in water samples.

## Advantages:

- **Rapid:** 90 samples can be analyzed in approx. 2 hours.
- **Cultivation-independent:** Detection is not limited to bacteria that grow on standard growth media. These bacteria often constitute <1% of the total bacterial population.
- **Online analysis within reach:** continuous analysis of bacterial concentrations will soon be possible.

## Background:

Flow cytometry has been successfully validated in ring trials performed by the Swiss Federal Institute of Aquatic Science and Technology (EAWAG). The Swiss Office of Public Health incorporated flow cytometry as a recommended testing method for determining the total count and ratios of high and low nucleic acid content cells in freshwater into the Swiss Food Compendium (method no. 333).

## Applications:

Rapid assessment of microbial cell numbers is ideally suited for:

- detecting changes in bacterial concentrations
- testing raw water quality
- monitoring efficiency of disinfection
- screening microbiological changes in multistep treatment processes
- microbiological mapping in water distribution systems and buildings
- assessing impact of pipe repair
- identifying areas of stagnation and regrowth

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Distinction between live and dead bacteria

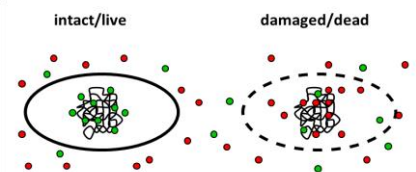


Fig. 2: Accuri C6 flow cytometer and technical basis for distinguishing between live and dead bacterial with the help of fluorescent dyes.

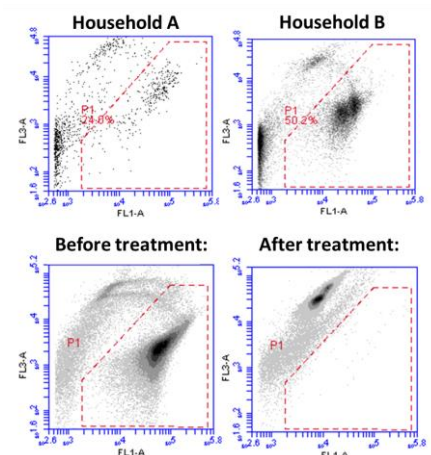


Fig. 3: Comparison of microbial profiles of water from the kitchen taps of two households and water before and after chlorine disinfection. Live cells appear in the gated region, signals of dead cells are outside the gate.