Surveillance of the Total Cell Count (TCC) in a groundwater catchment with artificial infiltration

Bank filtration is an often-used process for water treatment. It can take several days for the water to trickle through the sand and gravel layers to the pumping well. This groundwater can be enriched artificially by infiltration basins, then be pumped up and often be used directly as drinking water. Adsorption and biological processes in the filter retain particulate and biodegradable matter as well as microbes. Bank filtration is widely applied due to its efficiency, naturalness and low energy demand.

BactoSense as an early warning system

BactoSense is able to quantify the efficiency of cell retention of the bank filter. It detects over 99% of all microbial cells and provides the results within only 20 minutes. A reduction of biodegradable matter and microbes is essential to produce biologically stable drinking water. The latter ensures grid protection with low chlorine addition. Consequently, it lowers operation costs and has a positive effect on the taste of the drinking water.

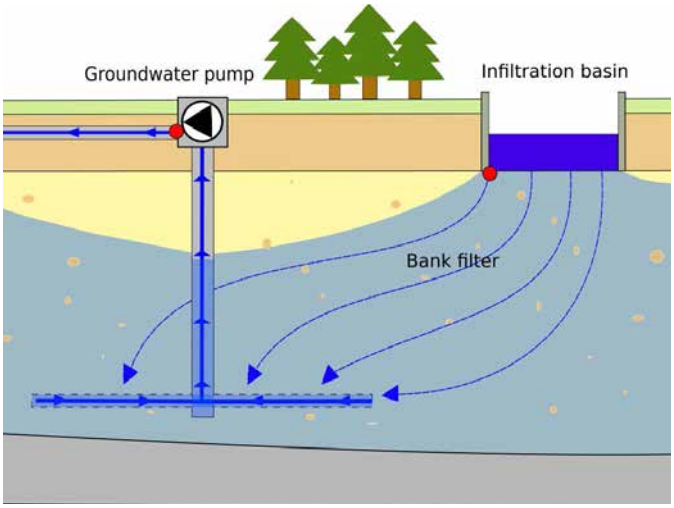

Figure 1: Sketch of a groundwater catchment with an artificial groundwater enrichment. The red points mark the measuring points of the BactoSense.

Typical application

BactoSense delivers exact data of the total cell count (TCC), the high nucleic acid (HNA) and low nucleic acid (LNA) cell counts and ratio. TCC includes all microbial cells (intact and damaged), while HNA and LNA counts are measurements of the amount of DNA, large and small, respectively, contained in each cell. Measuring cell counts with BactoSense before and after a bank filter enables to quantify the efficiency of cell retention. Bank filters are often influenced by different parameters. Pump rates, quality of raw water, heavy rains or flooding, composition of the filter, etc. can strongly affect the efficiency of the filter.

Online flow cytometry measurements with BactoSense facilitate cell counts quantification under different conditions. Data sets of different scenarios can be compared and help to understand, model and optimize the water treatment process. Application of online flow cytometry in water treatment will be a standard procedure in the near future.

Field example

A main goal of the field study at the groundwater pumping well in Zurich Hardhof is to measure the influence of different pumping rates on the cell counts. Figure 2 shows that a fast regrowth of bacteria shortly after pump stop

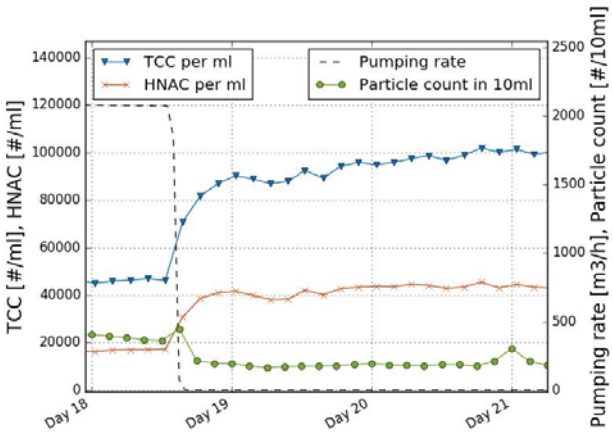

Figure 2: The evolution of the total cell count TCC (TCC: Total Cell Count), HNA-cell count (HNAC: High Nucleic Acid Count) and particle count when the groundwater pump stops working.

was easily detected by BactoSense through the TCC and HNAC values, while the particle counting device failed to detect this event. This demonstrates the high sensitivity of BactoSense.

Figure 3 shows that, when the pump started, an increased cell count in the infiltration basin did not influence the cell counts of the pumped water. Nevertheless, the efficiency of the filter can constantly be affected by many other parameters. For this reason, the surveillance of groundwater pumps should be continuous. This ensures a high drinking water quality.

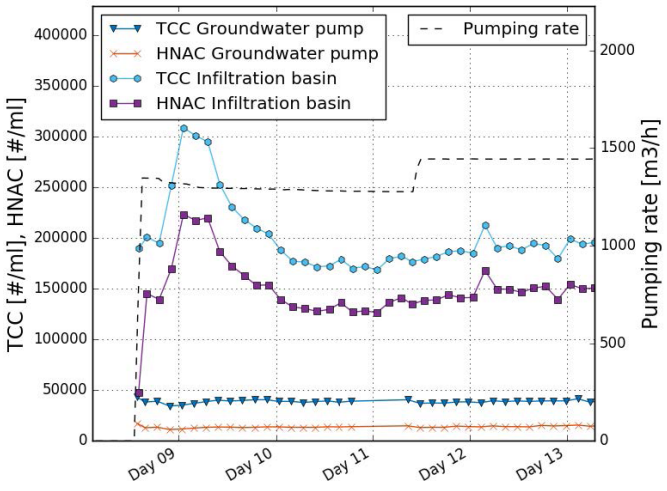

Figure 3: The development of the total cell count (TCC) and HNA cell count in a groundwater pumping well and directly underneath an infiltration basin influenced by the pumping rate.

Figure 4: Simple control of the required water flow rate of 200 to 400 ml/min when continuously measuring with the BactoSense

Figure 5: BactoSense with cartridge

Product and configurations

BactoSense with online-sampler and I/O-Box for the analog outputs (4/20 mA)

Parameter-configurations

Analog output (4/20 mA) settings:
Output 1: Signal source TCC,
value range 4 mA = 0 TCC,
20 mA = 500'000 TCC

Advantages of BactoSense

Customer benefits

- Fully automatic flow cytometer sampling, incubation, analysis and cleaning are carried out automatically
- Results available 20 minutes after sampling
- Easy handling due to safe-to-handle cartridge system. No handling of chemicals and no sample preparation necessary.
- Compact instrument with a small footprint allows various applications and easy transport
- Detection of more than 99% of microbial cells
- Low operation costs
- Easy system integration thanks to multiple interfaces
- User-friendly operation and maintenance concept
- Selectable measuring interval
- Integrated color screen shows results, graphs and hints directly
- Freely selectable gating

30114-01-EN

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