



Microbiological (online) monitoring methods for water quality control

Challenges for monitoring microbiological parameters

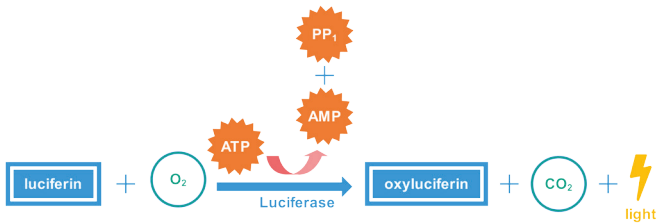
- » conventional microbial culture methods for monitoring water quality are very time consuming
- » various microbiological online devices available but further development and testing is needed

Demonstrated solution and aim of the study

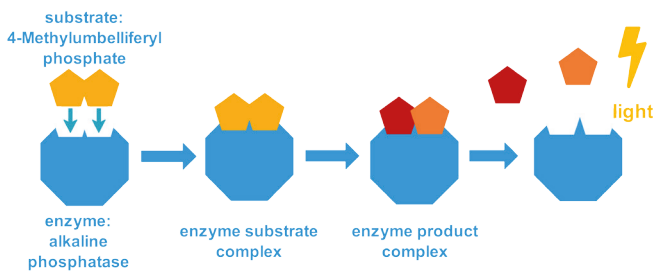
- » monitoring and characterization of microorganisms
- » applying and combining various methods
- » establish, test and compare rapid operating online monitoring methods

Methodology

parameter	ATP _{free} , ATP _{bound}	Coliforms, <i>E. coli</i>	number of cells	total activity
unit	RLU	MPN/100 mL	TCC/mL	pmol/min
measured variable	fluorescence emitted light	number of positive wells	forward/side scattered light, fluorescence emitted light	fluorescence emitted light
device / company	ATP-meter/ 3M	Colilert/ IDEXX	BactoSense/ Sigrist	BACTControl/ microLAN
online operation	no	no	yes	yes

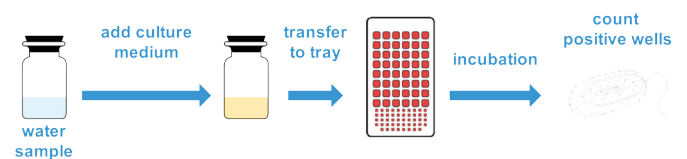


Coliform and *E. coli* via Most Probable Number (MPN) method: dilution method to determine number of bacteria in water sample

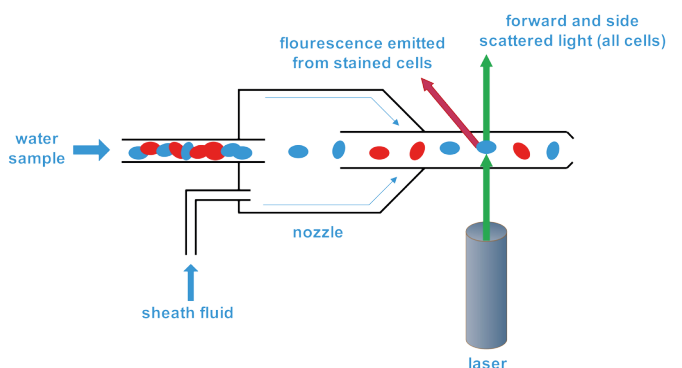


Number of cells via flow cytometry (FCM): sheath fluid focuses cells, causing cells to pass through laser beam one cell at a time, forward/side scattered light and fluorescence is detected

ATP via enzymatic method: reaction between two proteins derived from fireflies, luciferin (substrate) and luciferase (enzyme) occurring in the presence of ATP



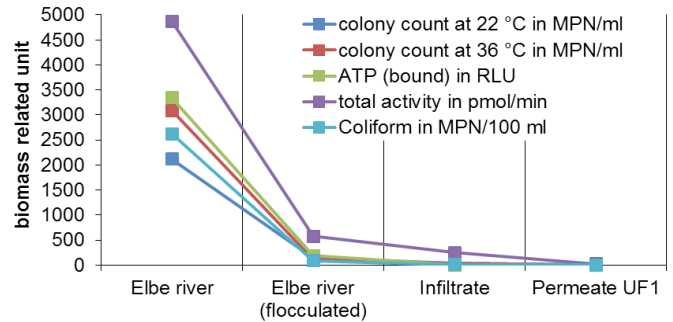
Total activity via enzymatic method: reaction between fluorescence marked substrate with specific enzyme





Performance and results

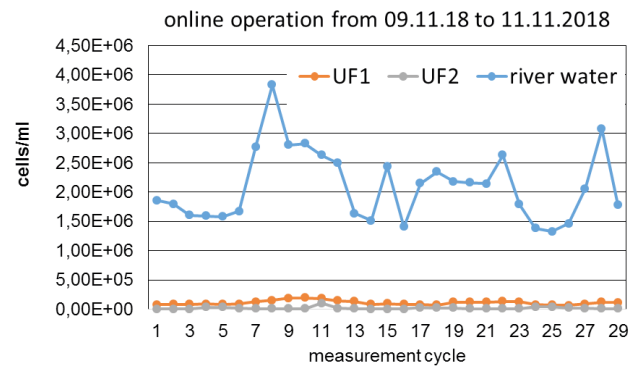
- » all methods indicating microbiological removal and removal of coliform and *E. coli* bacteria in various water treatment steps
- » good correlation with common plate counting methods (colony count at 22 °C and 36 °C)



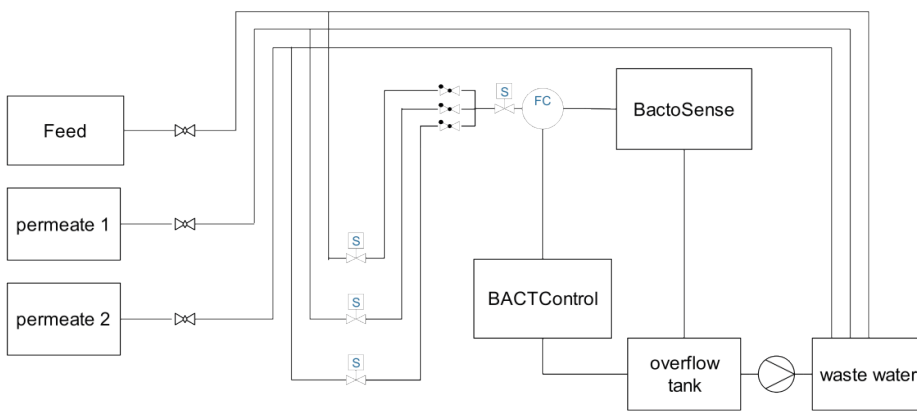
Comparison of conventional microbial culture methods with applied methods

Benefits and performance of microbiological online-methods

- » speed-up detectability of incidents (rapid analysis, higher sample frequency) compared to common methods (e. g. plate counting methods) which impair microbiological water quality and safety
- » more rapid detection of microbial water-quality problems
- » more rapid determination of whether the water is safe again



Example of FCM online-measurement at UF pilot plant



Schematic structure of an automatic online sampling system at an UF pilot plant

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