New Microbiological Techniques for Monitoring the Microbiological Quality of Drinking Water

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Introduction

- Monitoring microorganisms in drinking water is undertaken for the purposes of:
  - Ensuring regulatory compliance
  - Operational activities to support risk assessment and risk management practices
- Principles and practices of monitoring were covered in my previous SWIG presentation*

*What is the future for new microbiological techniques in drinking water monitoring? (2015)

Indicator Bacteria - Regulatory

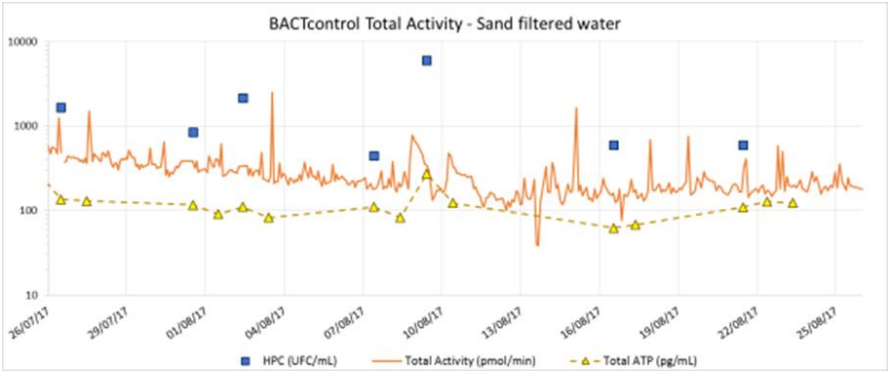
- For regulatory compliance, there has been a progression from:
  - Selective media and confirmation
  - Enzymatic detection and chromogenic agars or MPN (e.g. Colilert) but loss of specificity
  - Molecular techniques – however - not currently acceptable Article 7.5(b) of the DWD)
- MALDI-TOF for identification

Indicator bacteria - Operational

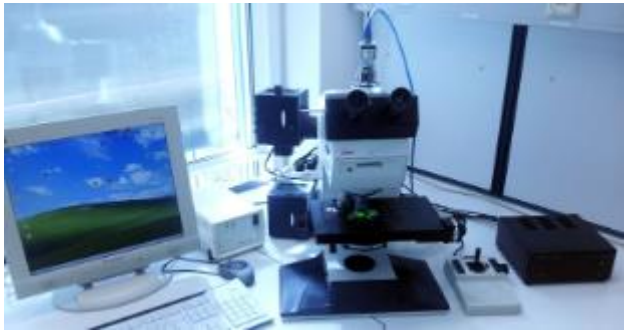
- For operational purposes, a wide range of tools and techniques are available:
  - Flow cytometry for total and physiologically active bacterial cells
  - Instruments for automatic on-line detection of *E. coli* / coliforms / enterococci
  - Measurement of ATP

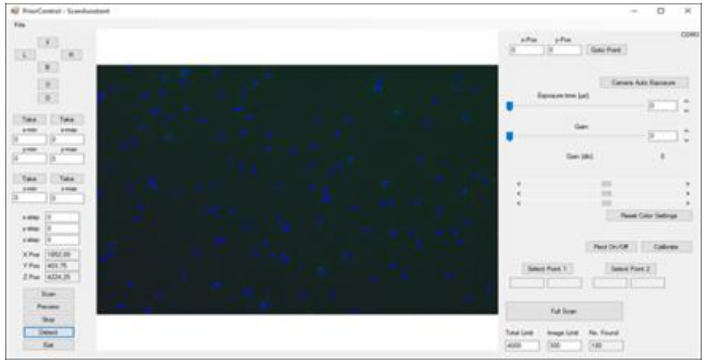
Automated Techniques

- Online detection of coliforms and *E. coli*



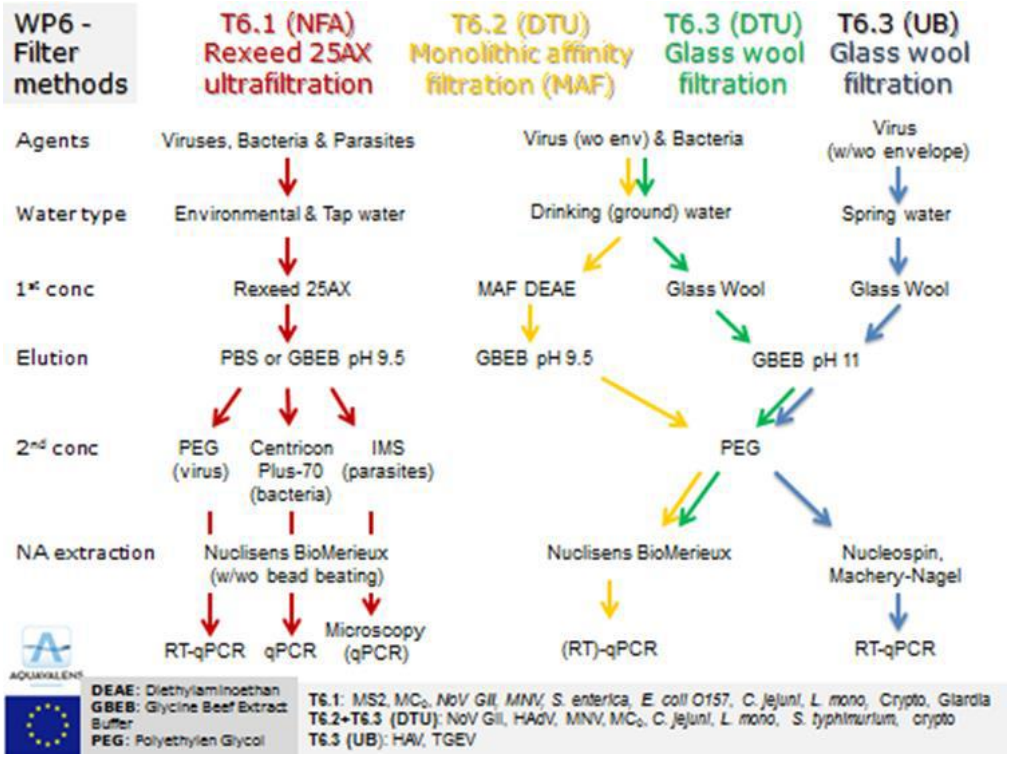
- Solid-phase cytometry (FISH system for automated cell detection and counting by scanning)





Pathogen Recovery - Procedures

- Regardless of the detection technique, pathogen recovery requires the processing of large volumes (>10L)



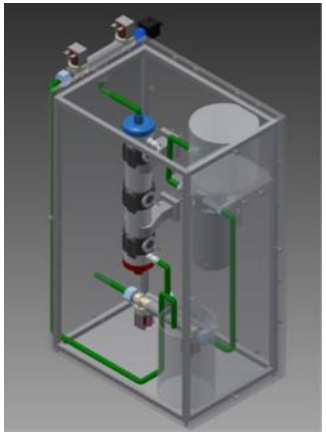
Pathogens - Recovery

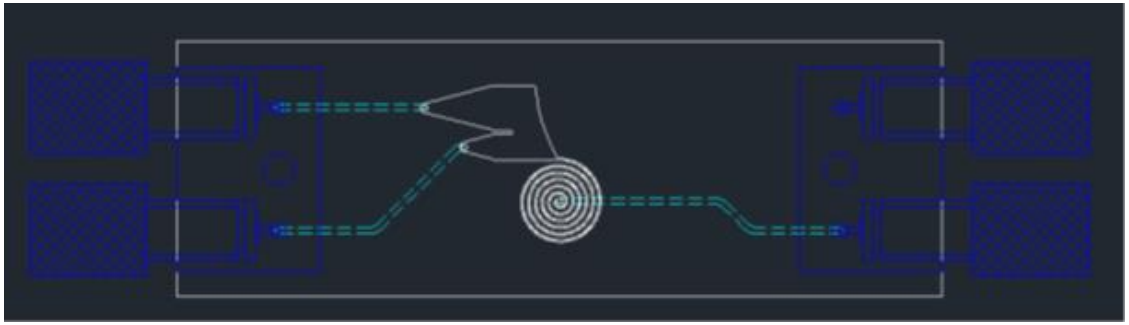
- For the EC Aquavalens project, a dead-end hollow-fibre ultra-filter emerged as the most effective for all pathogen types

- Further processing necessary to extract target organism from interfering materials

Pathogens - Integrated recovery

- Filtration combined with megasonic elution which is better for preserving cell viability
- Microfluidics for pathogen recovery was effective under ideal conditions





Pathogens - Detection

- Molecular techniques are becoming widely accepted.
  - Specificity for species identification and strain genotyping
  - Detect organisms that cannot be cultured or propagated
  - Quantitative and qualitative
  - However, do not provide a measure of infectivity

Pathogens - Implementation

- Adoption of pathogen monitoring is valid in principle but requires knowledge of volume processed on recovery efficiency (cf. standard methods)
- Procedures require specialist expertise and equipment so not yet a tool for routine application

Concluding remarks

- New tools and techniques have the potential for improving water quality but must offer benefits over existing methods.
- Do not ignore the value of simple tests, for example using turbidity and chlorine residuals for process control rather than microbiological monitoring.

Thank you

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This presentation was prepared using output from work undertaken on the European Commission's Aquavalens project and for UKWIR