The molecular detection for the viability of *Yersinia* cells during shock chlorination – a pilot scale study

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Category: How do we assess and manage the risks

Poster presentation

Efficient decontamination of pipeline system is an essential action in situations where the drinking water distribution system is contaminated and it is suspected that public health is endangered. The chlorination is the one of the most frequently used cleaning method for drinking water distribution networks. During the decontamination is also important to detect pathogenic bacteria from water and biofilm samples as fast and efficiently as possible. The rapid and specific detection techniques of pathogenic bacteria could save priceless time and illness cases during an emergency situation. It also enables the verification of the success in the cleaning procedure.

The aim of the study was the test decontamination of pathogen microbial agents from a large scale pilot distribution system (400 m) by shock-chlorination. The quality of water and growth of biofilms (heterotrophic plate count, pH, Iron, temperature, turbidity, chlorine) was followed a period of one month prior the contamination phase. The progress of decontamination of microbial agents was followed by molecular biology techniques enabling determination of viability of test bacteria. The experiments were carried out using the closest relative surrogate bacteria *Yersinia pseudotuberculosis* strain for high human pathogen *Yersinia pestis* bacteria.

The new applications for detection of viable *Yersinia* cells have been development during SecurEau project and those techniques were used in the pilot scale study. The new techniques allow detection of viability of target pathogens as combination of Propidium monoazide (PMA) treatment with quantitative polymerase chain reaction (qPCR) and Direct Viable count (DVC) enrichment with Peptide Nucleic Acid Fluorescence in situ Hybridization (PNA-FISH). In addition the selective culture and DAPI staining methods were used next to the new molecular biological techniques.

The large scale pipeline network was decontaminated by shock-chlorination (10 mg Cl_2/l). The concentration and viability state of *Yersinia pseudotuberculosis* cells decreased quick in water and biofilm samples after of start of chlorination. The new PCR and FISH techniques were able to detect *Yersinia* cells while the selective culture method could not. In addition, the progress of decontamination was followed with the chlorine concentration and heterotrophic plate counts (CFU/ml).

It can be concluded that the shock-chlorination is effective technique for cleaning drinking water distribution system after a bacterial contamination. The new viability detection techniques are usable for detection of known bacterial agents.