Executive Summary

Background

Waterborne infections due to the consumption of contaminated drinking water are estimated to cause around one billion cases of disease and account for more than three million deaths worldwide each year (OECD, 2003). The majority of these occur in developing countries, but both the health and economic effects associated with waterborne disease are also considerable for industrialised societies (Payment, 1997). It is therefore of crucial importance to understand the behaviour of pathogenic bacteria in drinking water. Most studies focused on the survival of pathogenic bacteria and only little information on their ability to grow in drinking water is available. We could recently show that next to the so-called "environmental pathogens" like *Pseudomonas aeruginosa* or *Legionella pneumophilia* also enteric pathogens such as *Escherichia coli* or *Vibrio cholerae* are able to multiply in freshwater at low nutrient concentrations (Vital *et al.,* 2007, 2008). The concentration as well as the quality of nutrients can, however, greatly vary between different waters and it is at the moment not possible to estimate the pathogenic growth in a given water samples using conventional parameters. We therefore developed a bioassay, presented in this deliverable, which yields information on the pathogen growth potential of a given water sample (PGP assay). The assay should advance the risk assessment associated with growth of pathogenic bacteria in drinking water to limit and prevent waterborne diseases.

Approach

The principle is based on the Eawag assimilable organic carbon (AOC) assay presented earlier in the Techneau project (Deliverable 3. 3. 1.) and, as an enhancement, specially focuses on the growth potential of pathogenic bacteria. *In short:* A water sample is sterilized, aliquoted into 20 mL vials and inoculated separately with three different pathogens, *E. coli* O157, *V. cholerae* and *P. aeruginosa,* at low cell concentrations. The vials are incubated at 30 °C for four to seven days until the bacteria reached stationary phase. Final bacterial cell concentrations are enumerated using nucleic acid staining in combination with flow cytometry.

In the beginning several preexperiments with the individual pathogens using river water as well as LB medium were performed. Then a drinking water treatment pilot plant was sampled at different stages and analyzed using the developed PGP assay.

Result

With the presented assay it was possible to detect differences in the growth potential of the three pathogens between different waters. Furthermore, it was shown that the AOC assay which targets the general growth potential of all microorganisms in a given sample can not adequately describe the growth

behavior of the tested pathogens. Thus, there is a need for individual testing.

References

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More information

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