Executive Summary

Introduction
The proportion of waterborne disease outbreaks associated with the distribution system failures has been increasing over the years and both surface and groundwater supplies were implicated in these outbreaks. Most water supplies monitor their drinking water for the absence of indicator organisms in a small volume of water (100-500 ml). However, the probability of detecting fecal contamination according to monitoring program of Water Directive is rather low. The absence of an indicator in 100 ml does not guarantee the safety of the drinking water due to the high detection limit. This is illustrated by the fact that some of the outbreaks have occurred through water which met the *E. coli* standard of absence in 100 ml. Methods of large volume sampling have become available in recent years and it has been shown that increase of the sample volume to 100 liters lowers the detection limit to 0.01 CFU/L or less.

Importance
The traditional methodology for water sampling and analysis is not always able to ensure public safety regarding both (i) the strategy of sampling and (ii) the choice of the detection method. Not only the sampling strategy is limited to sampling a relatively small amount of water, but actually most of the bacteria are attached to the inner surfaces of the pipes forming the biofilm. In addition, the absolute majority of cells in the drinking water are not culturable at all (even though they may be viable) meaning that they will not grow in the culture media. Since culture methods will most likely, not detect all active bacteria, alternatives must be sought. The advantages of such alternative activity measurements are not only detection of non-culturable organisms but also their rapidity as no lengthy incubation is needed.

Approach
The aim of this study was to analyze *E. coli* in the drinking water using a method for concentration of large volumes by ultrafiltration and biofilm sampling. The results were compared to those of grab sampling of 100 ml drinking water. In addition, the analysis were performed using the traditional culture method for coliforms and *E. coli*, performed both *in situ* and in a certified laboratory and FISH, including the viability indicating DVC test.
The sampling sites were source water, drinking water treatment plants and drinking water distribution network in the city A.

Result
The sample concentration technique is a very useful tool for drinking water analyses as it allows the concentration of large water volumes and the analysis data obtained are thus more representative. The biofilm analyses complement the concentration experiments data and are also less costly compared to the concentration method so both sampling techniques are useful and advisable for the general use. The

concentration technique allows for detection of pathogens, such as parasitic protozoa.
E. coli was present in a water distribution network even if water most of the time met EU water quality standards, as checked by plate counting.
Depending on the degree of concentration the FISH/DVC detection limit, using the ultrafiltration of large water volumes was 0.008 cells/ml down to $5*10^{-4}$ cells/ml. In the biofilm the detection limit was from 1.105 to 8.83 cells/cm^2.

More information

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