Comparison of the results of the microbiologic quality of an untreated water sample using conventional culture media and a DNA chip for simultaneous detection of microorganisms

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Consumption of contaminated drinking water heavily contributes to the burden of gastrointestinal waterborne diseases. This is of particular importance in developing countries. Indeed, the World Health Organization (WHO) states that almost one tenth of the global disease burden could be prevented by improving water supply, sanitation, and hygiene and water resources management. The same organization estimates that around 1.5 million deaths per year could be avoided if these measures were implemented [1].

Conventional detection methodologies present several shortcomings, such as representativity of indicator species (on which absence water quality relies), low throughput and increasing resources as more species are to be detected and time consuming. DNA chips have the potential to serve as surveillance systems for the simultaneous detection of pathogens, overcoming these limitations. DNA chips have the advantage of being high throughput (simply to increase the number of testing probes in the chip), quick (does not relay on time consuming bacterial growth) and may detect stressed bacteria (that does not develop in a Petri dishes but still can infect the human host). Considering this we have developed a DNA chip (AQUACHIP®) for simultaneous detection of multiple waterborne pathogens.

Species specific DNA probes were implemented on a microarray, allowing detection of which sample is positive for which microorganism. The selected microorganisms were the Portuguese and European Community mandatory microbiological parameters and indicator parameters required in water intended for human consumption, delivered by public distribution systems, trucks or cistern-ships, or used in the alimentary industry (coliform bacteria group, *Escherichia coli*, Enterococcus and *Clostridium perfringens*, including spores); and a group of non-mandatory microorganisms selected according to their impact on public health [2, 3].

In the present study one untreated water sample was analyzed by conventional methods and by the DNA Chip. The results were concordant for the mandatory organisms using both methods, which reinforces the utility and the proof-of-concept of the DNA chip. However, we have obtained discordant results for *Pseudomonas* spp. and *Salmonella* spp., which can be represent a DNA chip false positive or a conventional method false negative. Indeed, stressed bacteria may be unable to growth using culture media, and DNA probes implemented in the DNA chip for these microorganisms may not be sufficient specific to correctly detect them. For instance, for the *Salmonella* probe, which has 95% homology to *E. coli* DNA, according to BLAST [4] (E-value 3E-28), so a positive signal was expected. In conclusion, the chip appears to be correctly identifying mandatory bacteria, but the probes for some of the non-mandatory microorganisms should be further evaluated. These results should be further confirmed increasing the number of analyzed water samples.

References

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