

Biological mapping of hemodialysis installation using Clear D-TECT : a new generation quantitative ATP-metry method

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Introduction and Aims

Microbiological control in dialysis fluids is performed using culturing on poor nutrient media such as R2A with incubation time of 7 days at 20° C. Samples should be sent within 72 hours after sampling refrigerated to a laboratory for microbiological testing. Hemodialysis centers in remote regions have difficulty for getting validated microbiological results, as sample transport requires more than 72 hours. Additionally, culturing delays availability of results. Faster on-field methods for assessment of microbial contamination can be useful in hemodialysis centers. Second generation bioluminescence method allows real time surveillance of microbial contamination in water systems. Based on quantification of cellular ATP, Clear D-TECT kit (Luminultra, distributed by Gambro) for ultrapure water analysis, quantifies total living culturable and non culturable microorganisms. The sensitivity of the method provides quantitative results even for ultrapure fluids with undetectable culturable bacteria. Results are obtained in less than 10 minutes on-site.

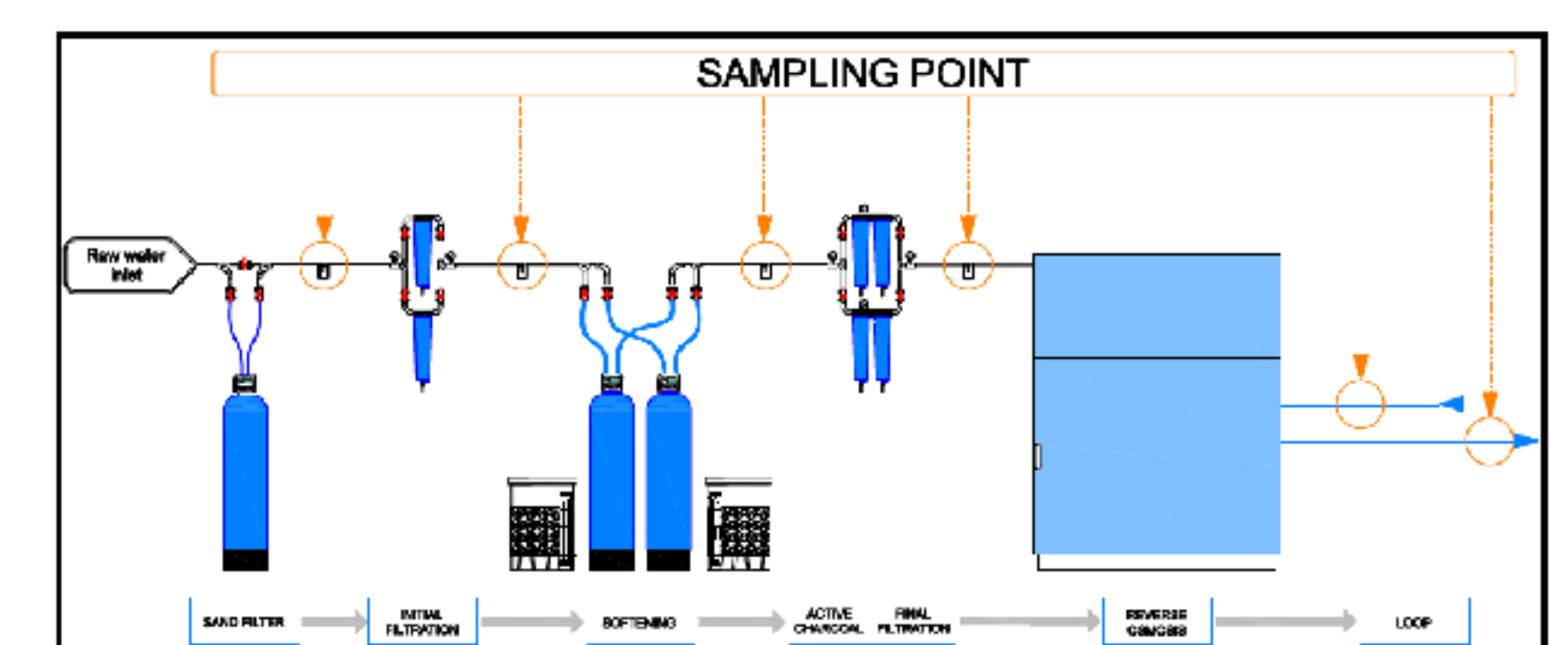
Echo Nantes association supplies medical surveillance by telemedicine to Saint-Pierre & Miquelon dialysis center, as well as technical expertise on existing equipment. Having no possibility to get microbiological results in time for opening the new center, Echo Nantes proposed the use of Clear D-TECT method, tested at the association, for microbial investigation of the dialysis fluids production and distribution. This work presents results from microbiological investigations performed during 4 months using Clear D-TECT method.

Methods

Dialysis fluids samples are collected from different points of the water treatment installation and the dialysate after first and second ultrafiltration. Samples are analyzed within the dialysis center immediately after collection using Clear D-TECT kit. The method is based on the measurement of cellular ATP (cATP™) on 50ml of fluid. Microbial investigation was repeated during a 4 months period after starting operation of the dialysis installation for on-site monitoring of dialysis fluids quality.



Clear D-TECT method



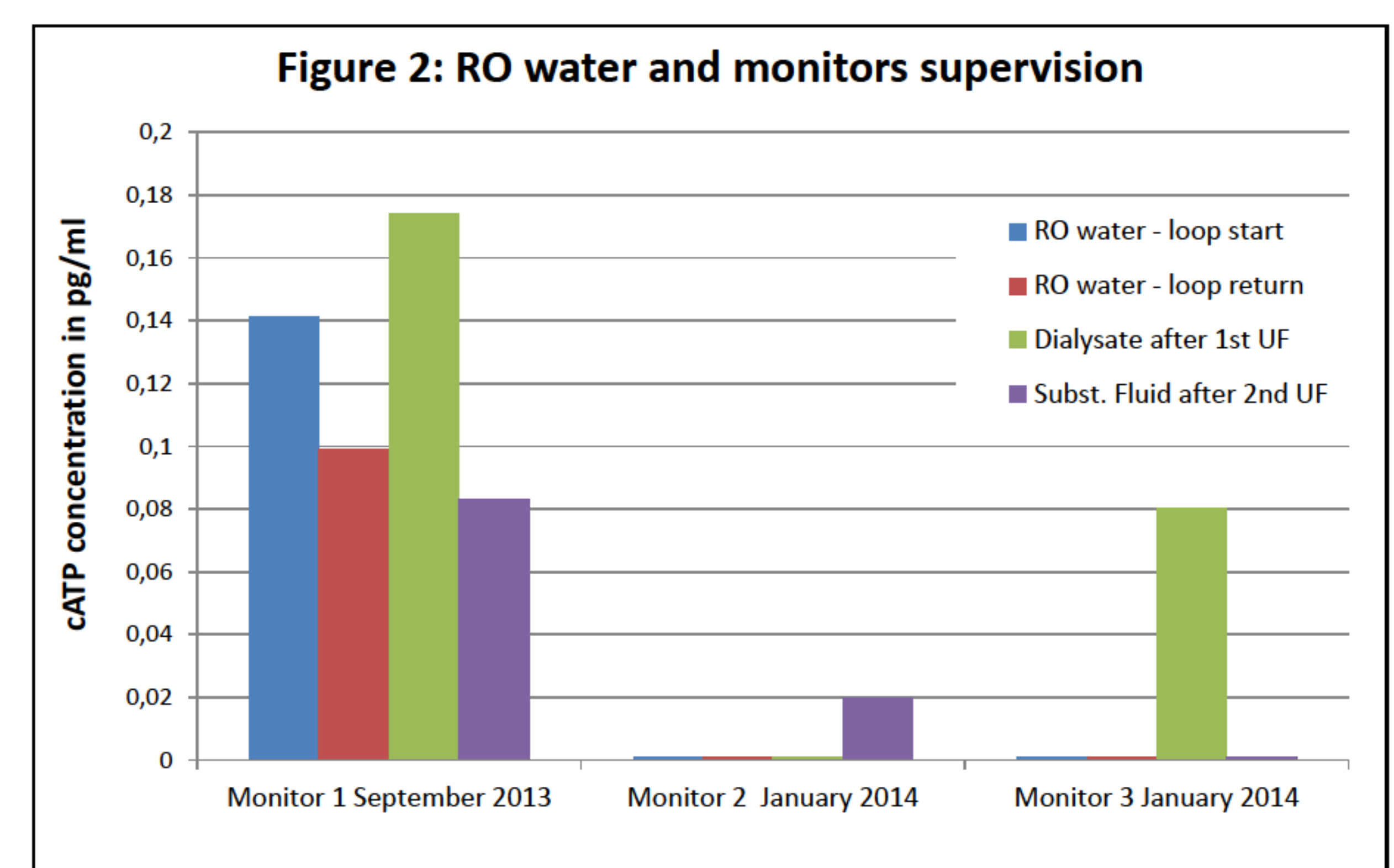
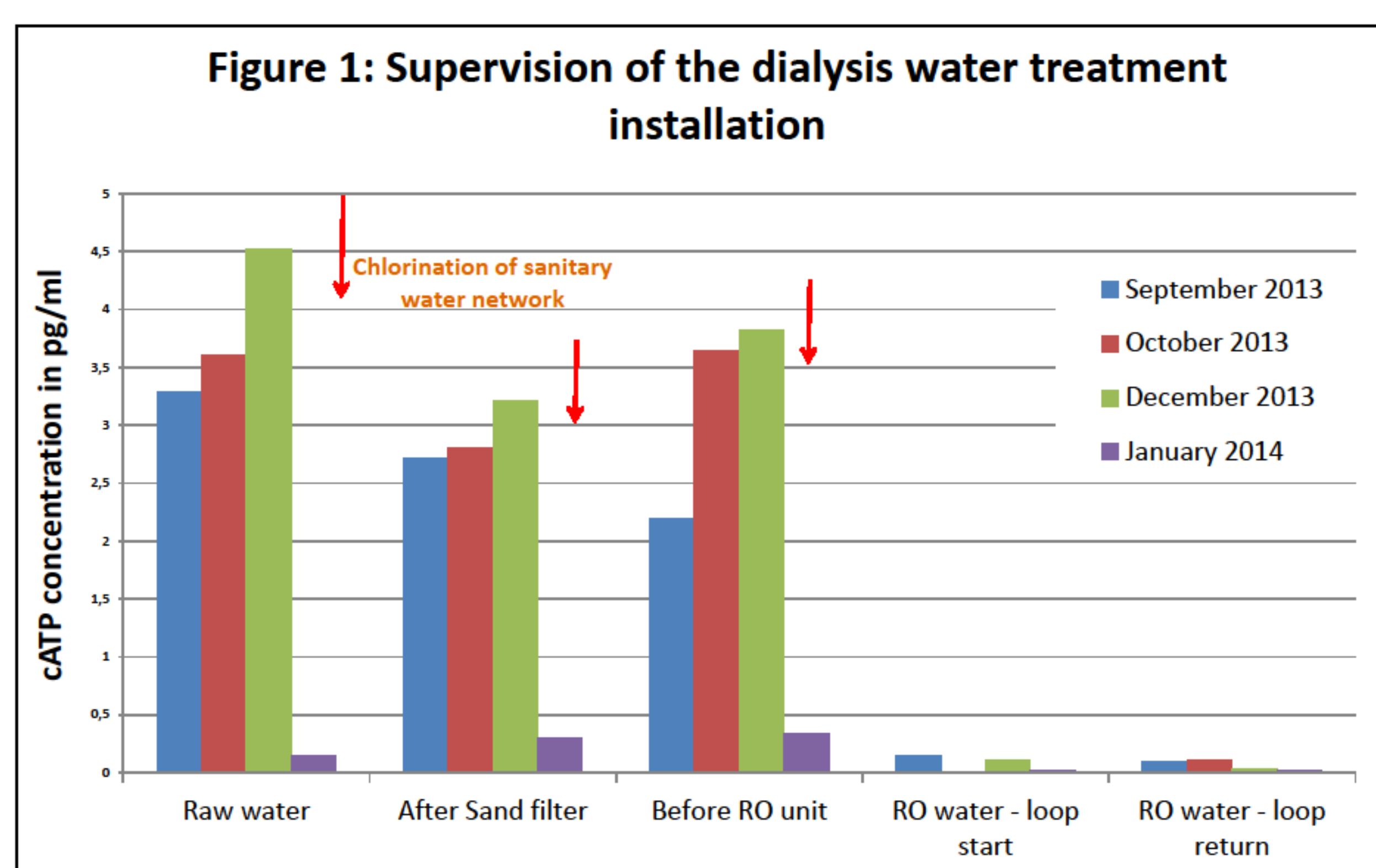
Saint- Pierre & Miquelon water treatment installation

Results

Results showed logic evolution of microbial flora within the dialysis production and distribution chain with significant microbial content in the pretreatment. Repeatability of results was observed during the surveillance. Introduction of chlorination of the hospital water network introduced a 1 logarithm reduction in the microbial load in the pretreatment (Table 1 and Figure 1). A quantifiable decrease in the dialysate after first and second ultrafiltration could be observed (Figure 2).

Table 1: Biological mapping of the installation using Clear D-TECT method (cATP values in pg/ml)

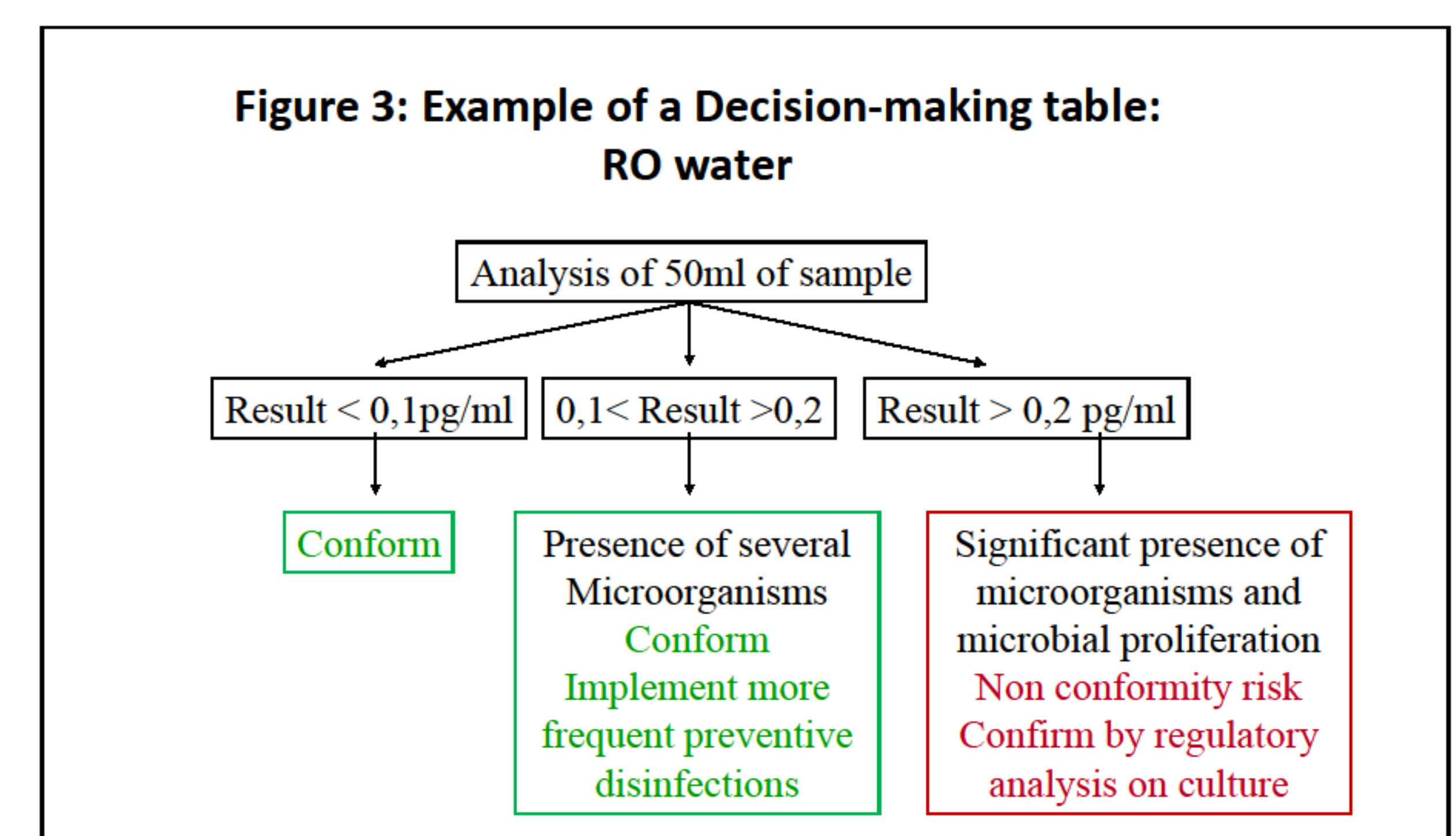
Sample	September 2013	October 2013	December 2013	January 2014 (after chlorination of the water network)
Raw water	3,29	3,61	4,52	0,15
After sand filter	2,72	2,80	3,22	0,30
Before RO unit	2,20	3,65	3,82	0,34
RO water - loop start	0,14	0,01	0,11	0,00
RO water - loop return	0,10	0,11	0,03	0,00



Discussion

The Clear D-TECT method was very easy to use by the dialysis center and presents the advantage of providing fast (10 min) on-site results. Four months use of the method in the center showed evolution of water quality in the pretreatment especially when chlorination was introduced in the hospital water network in January. For a first time, the decrease of microbial content between the two filters on the dialysate could be demonstrated using a microbiological analysis tool. Small differences close to 0 are probably linked to the uncertainty of measurement at this level. Based on these observations, it can be interesting, after an additional validation, to define a Decision-making table (Figure 3) for providing dialysis centers with thresholds for following the quality of RO water, and dialysis fluids after one or two ultrafiltrations.

Figure 3: Example of a Decision-making table: RO water



Conclusion

Microbiological analysis using Clear D-TECT kit is a useful tool for on-site monitoring of microbial contamination in ultrapure water production and distribution systems in dialysis. This technology showed reliable and reproducible results and confirmed the possibility to use the installation in case of urgency, while waiting culture results. The methods demonstrated the interest of the second ultrafilter on dialysate. Increased sensitivity of the method is providing interesting information on microbial content in ultrapure fluids, not studied until now.

