Fact sheet no 2: The AquaVir Sensor System

Introduction

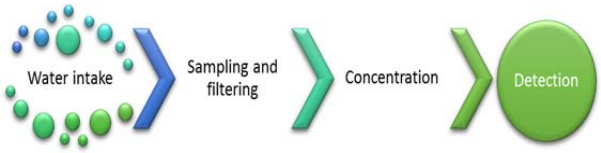
The broad nature and the diversity of virus detection and monitoring in water supplies presents a formidable analytical challenge that has been difficult to solve using single analytical methods, protocols and analytical systems. The Aquavir project attempts to address this challenge by providing a flexible platform that can be assembled for specific virus monitoring tasks by employing modular subsystems tailored to the specific virus application. Thus, the AquaVir system is meant to fulfill the needs of an analytical systems tailored to specific virus applications, i.e., virus to be analyzed from specific sample matrices.

Objective

The concentration range relevant for monitoring depends on the type of water and its intended use i.e. the human exposure. The available values are based on the current knowledge on exposure volumes during human activities, and on current dose-response relationships available in the scientific literature. The required sensitivity of the monitoring system must be related to the unit of virus concentration applied in the dose-response function.

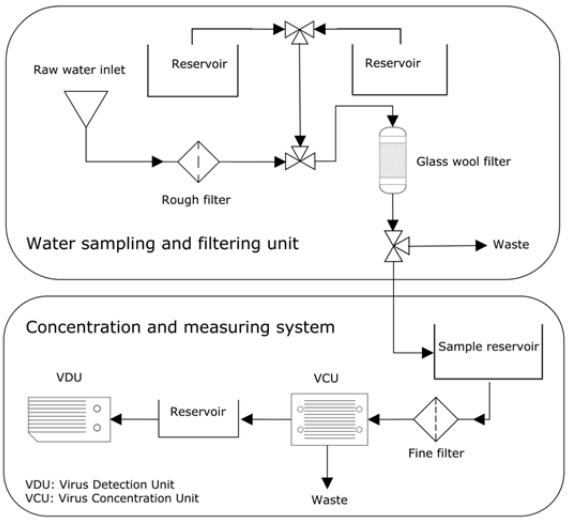
The objective of this part of the project was to develop a sensor system, which is capable to detect low concentrations of pathogenic viruses in raw water.

General overview of the AquaVir Sensor System



General overview of the AquaVir System

We have developed a system (based on state-of-the-art micro and nanotechnologies), which consists of a water sampling and filtering unit (WSFU) and a virus concentration and detection unit (VDU). The data from the measurements can be sent to a monitoring station, which is used for early warning for infections.



The schematics of the AquaVir sensor system

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Water sampling and filtering unit

The Water sampling and filtering has the function to collect the raw water from the original source. In the next step the water is filtered through a rough filter to remove the large objects and particles. After this, a pre-concentration step is included, in which the water is slowly filtered through a glass wool filter. An elution buffer is used for recovering the viruses from the glass wool. The collected sample is stored in a sample reservoir for further processing.

The concentration unit

The concentration unit is utilized in an effort to further increase virus concentration in the liquid sample to improve the limit of detection (LOD) of the system. The principle is to push the virus particles towards the centre of a microchannel, where a fraction of the liquid containing all the virus particles is collected. The remaining liquid is discarded thereby increasing the virus concentration in the sample liquid and decreasing the total sample volume, while retaining the virus particles.

The detection unit

The detection unit is a single-use inexpensive plastic chip, which has the function of selectively and accurately detecting the targeted viruses. There is a possibility to detect different viruses in the same time in a single chip. After detection of any pathogen or after a pre-defined running time, the detection chip should be replaced with a new one.

Recommendations

The clean water management is internationally recognized as a challenging task.

The conventional biological water quality indicators do not provide adequate information about the presence of pathogenic viruses. The currently available reliable virus test - based on molecular detection - is expensive, time consuming and labour intensive, thus limited to few laboratories with sophisticated facilities and well-trained personnel, even though the protection of water networks against pathogenic viruses is crucial.

We recommend therefore using a virus monitoring system to prevent the water-borne viral diseases and outbreaks, which pose high risks for public health worldwide.

References

http://www.aquavir.eu/

Other fact sheets 1: Aquavir – Development of a Portable Automated Water Analyser for Viruses. 3: Application of sensor results for modelling and managing of health risks in water. 4: Development of a “European” map of viruses in water. 5: Standardization in the Aquavir project

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