AUTOMATIC BACTERIAL CONTAMINATION MONITORING

– Impacts and possibilities

New technologies for monitoring of bacterial contamination are opening up new possibilities that previously required a great deal of human and financial effort. The advantages of these new methods are fully automated measurement, short measurement time, low cost per measurement, and the resulting high measurement frequency.

By **Wolfgang Vogl**

The demand for water of adequate quality is constantly increasing; especially in large processes, there is a need to make them more efficient and thus more sustainable. Reuse of water and the development of a well-functioning circular economy are the most important building blocks of a sustainable society of the future. Many large, but equally small innovative companies and start-ups are working with their new technologies to achieve these goals.

Water and wastewater processes as well as distribution networks are increasingly automated and automatically monitored. Digitalisation is also gaining ground in the water industry. Large units are simulated using digital twins to ensure efficiency and safety even in exceptional situations. Both processes and simulations require reliable input, relevant measurement data, to work efficiently or to map all relevant parameters reliably and correctly.

AT THE RIGHT TIME

The new technologies for automatic measurement of bacterial contamination have come at just the right time. Currently, there are various suppliers that use different approaches to provide the microbiological dimension of water quality in near real time. Each technology has its advantages and disadvantages, and should be used accordingly. This, of course, also applies to the traditional methods of microbiology, which have their fixed place in compliance monitoring, but are not suitable for real-time applications – operational monitoring, process control, and early warning.

VWMS – COLIMINDER

Vienna Water Monitoring Solutions (VWMS) started to develop devices for automatic online measurement of bacterial contamination of water in 2010, and in 2014, the first prototypes of the ColiMinder devices were installed in the field.

The measurement technology of the ColiMinder is based on the direct measurement of the current metabolic activity of the target organims, the so-called enzymatic measurement approach. This measurement approach therefore provides a result that directly addresses the issue on bacterial contamination, because the goal is to obtain a measurement signal from living organisms. Moreover, the enzymatic method is the only such measurement approach that is able to specifically measure the contamination of water with certain microorganisms.

Equipped with the appropriate reagents – for example, to measure E. coli specific enzymatic activity – the instrument is capable of measuring the level of faecal contamination. This measurement approach is therefore compatible with the concept of indicator organisms, which traditionally forms the basis of microbiological quality assurance.

For many applications, the ability to measure specific target organisms is a basic requirement. Measuring the degree of faecal contamination

ColiMinder Arthur monitoring drinking water production in a municipal drinking water plant

of a sample is a pre-requisite for making statements about the quality of surface waters or for determining the necessary disinfection intensity in wastewater treatment plants.

PARAMETERS AND ACCURACY

The device is robust and has the ability to manage particles or suspended solids; the influence of turbidity on the measurement result is automatically eliminated. The oldest instruments have been running 24/7 since 2014, and maintenance requirements are low. Reagents for measuring E. coli, enterococci, coliform bacteria and for total microbiological activity are currently available as target parameters.

In terms of accuracy, the enzymatic method is not inferior to the other technologies; on the contrary, according to a comparative study on the measurement of microbiological contamination of drinking water under real conditions, the ColiMinder was the only device capable of detecting 100% of all contaminants.

APPLICATIONS

Currently, approximately 50 ColiMinder units are running at customers from New Zealand to South Africa to the US and Canada. The application where ColiMinder units are already installed range from wastewater treatment plant effluents to mineral water production, and even the pharmaceutical industry.

The customers include several research institutes in New Zealand, Japan, Germany, and Canada, but also governmental utilities in the field of wastewater treatment and drinking water supply or those responsible for bathing water, as well as industry.

In Hong Kong, for example, a device is monitoring the effluent from Stonecutters Island Sewage Treatment Works operated by the Drainage Service Department since 2017. The Water Supply Department in Hong Kong uses the ColiMinder to monitor the quality of the produced drinking water.

Both the City of Paris and Eau de Paris are using several ColiMinder units for monitoring bathing water quality in the Seine River and other urban waters, especially in view of the 2024 Summer Olympics; a ColiMinder will also monitor parts of the drinking water production in the future.

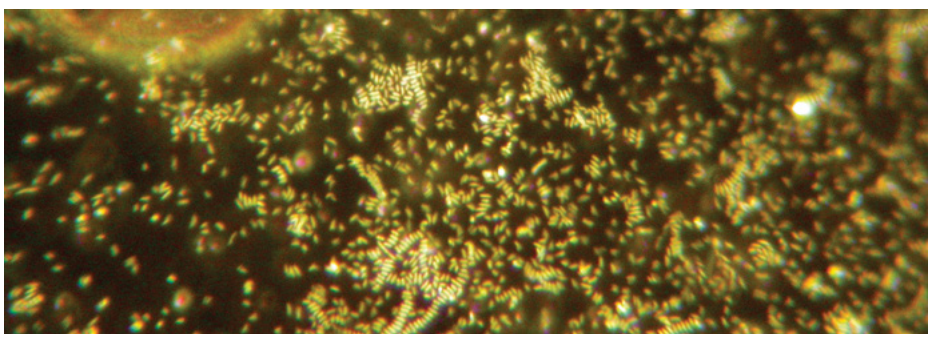
Drinking water utilities such as Unitywater and Bathurst Council in Australia, as well as several Canadian cities in the province of Québec, have installed ColiMinder equipment to monitor raw water extracted from surface water for the drinking water production and, at the same time, to monitor bathing water quality in these water bodies.

ColiMinder is of particular importance in the beverage industry, where it is already used by manufacturers such as Nestlé Waters or Romaqua. In the production of bottled water, the technology is used in several ways. On the one hand, the short measurement time eliminates the need to wait for days for laboratory results before products can be dispatched, and on the other hand, the devices provide explicit measurement results on the basis of which it can be decided whether the bottling line is still clean and production can continue or whether it must be stopped to carry out a cleaning-in-place (CIP) process. This can extend production time and reduce CIP costs, making the production process more efficient and sustainable.

There are a multitude of other applications, in all closed systems such as cooling circuits, process water, or for sustainable fish production in Recirculating Aqua Cultures, where it is crucial to efficiently control the microbiological quality of the water.

The applications for rapid automatic measurement of microbiological quality are therefore almost limitless. The first steps have been taken and the direction is right. Next steps into a sustainable future will follow, the ColiMinder and its team try to make their contribution.

Wolfgang Vogl is founder and CEO of Vienna Water Monitoring Solutions (VWMS).



E. coli bacteria under the microscope