

## Portable MS-UV Sensing Platform for Water Quality in Aquaculture

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Seafood production through intensive aquaculture in water reuse and recirculating systems (WRAS and RAS) is increasing worldwide. Whilst RAS technology is designed to increase output and improve environmental control, it is becoming increasingly clear that unexpected water quality problems can develop. AquaMMS is a new robust and real-time multi-sensor water quality monitoring device for the aquaculture industry. The device uses both mass spectrometry and optical technologies, to measure a range of parameters that can affect the water quality in the harsh environment of fish farms. The technology provides the fish farmer advanced warning of a broad range of potential pollutants that can otherwise inflict chronic stress on the fish resulting in disease outbreaks and/or poor product quality.

A membrane inlet mass spectrometer (MIMS) is used which allows real time *in situ* monitoring of dissolved gases and organic compounds in the water matrix. Not all of the desired target compounds however are detectable by the MIMS methodology. An optical fluorescence sensor complements the MIMS instrument providing additional sensing capabilities. The integrated fluorescence sensor targets harmful substances such as heavy metal ions, bromides, nitrides, nitrates and ammonium. An optical pH sensor further complements the other two components of the AquaMMS instrument.

The MIMS instrument has been optimized for monitoring of dissolved gases (CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>) and volatile organic compounds of interest in the aquaculture environment. Heavy metal ions (Cu, Ba, Fe, Zn etc) not amenable to detection by MIMS are monitored using the UV technique. Each individual sensing component has a range of target analytes for which it has been optimized independently. On site tests at Anglesey Aquaculture show real time monitoring of the water quality in response to farming practices. Monitoring of water was carried out at various stages during the water treatment process. Dissolved gases and VOCs were monitored to sub ppm levels. The instrumentation is shown to provide advanced warning of potentially harmful substances which allow the aquaculture farmer time to take management decisions such as increasing oxygen flow or employing water treatment to rectify the problem.