Ocean-Going Lab...The Real Test of a Nutrient Analyser

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The UK's National Oceanography Centre (NOC) undertakes integrated ocean research and technology development from the coast to the deep ocean. As such, the NOC has a heavy requirement for seawater analysis. However, in addition to analytical work at the NOC's facilities in Southampton and Liverpool, the organisation's researchers also need to be able to analyse samples on board a variety of research vessels. Under these conditions, high levels of precision and reliability can be a challenge for most laboratory equipment, so NOC has invested in Seal Analytical segmented flow analysers (SFAs) - the AA3 and the QuAAtro.

The SEAL AA3 Segmented Flow Analyser is operated in the onshore lab and aboard ocean-going research vessels

"The QuAAtro is the workhorse of our Southampton laboratory," said the NOC's Dr Sinhue Torres-Valdes. "It has a compact footprint and provides automatic analysis of large numbers of samples, with only small sample volumes required. The AA3 is employed for 'on-ship' analysis because as a modular SFA it is easier to maintain in the event of any problems whilst away from shore."

Wholly owned by the Natural Environment Research Council (NERC) the NOC is a leading institution for sea level science, coastal and deep ocean research and technology development, tackling the greatest environmental challenges of our age, including sea level change, the oceans' role in climate change, predicting and simulating the behaviour of the oceans through computer modelling, and long-term monitoring technologies.

The NOC's analysers are managed by Mark Stinchcombe who has been with the organisation for around 13 years following an MSc in Oceanography at the University of Southampton. He said: "Prior to the purchase of the Seal equipment, we were experiencing poor reproducibility with older equipment; rough weather was affecting the baseline and we suspected that was due to the movement of a filament inside a light source inside one our analysers during rough seas. We therefore acquired the Seal analysers because they are robust and unaffected by the rigours of a ship in the mid-Atlantic."

In addition to the ability to operate both at sea and in a land based laboratory, Mark also requires three other important features in his analytical instrumentation. First, he needs the ability to analyse large numbers of samples very quickly because, whilst at sea, he can be responsible for analysing samples from a number of scientists simultaneously, and also because his land based laboratory at the NOC provides an analytical service to a broad community encompassing research scientists, students and a number of industrial clients. Secondly, with samples coming from a wide variety of different sources, including seawater, estuarine waters, pore water, phytoplankton culture and biological samples, he needs to be able to measure a broad range of concentrations. Thirdly, he requires low detection limits so that his work is not limited when measuring at low levels. Seal SFAs are therefore ideal for Mark's work, offering high sample throughput with low sample volume, which reduces both cost and waste.

The Seal analysers provide low detection limits with excellent reproducibility. At first they were employed to measure nitrate+nitrite, nitrite, silicate, ammonium and total dissolved nitrogen. However, the NOC also needs to be able to analyse total dissolved phosphorus, and whilst this method was not available as standard for seawater, Seal's technical support staff have worked with Mark and Sinhue to adapt a freshwater total phosphorous method to meet the NOC's needs. "The development of this new method took years to refine, but we have been delighted with the result," Sinhue said.

The range of projects supported by these analysers is diverse, including for example, work to assess ocean acidification and ocean biogeochemistry; including ocean productivity, nutrient biogeochemical cycles and research to understand how currents distribute nutrients in the ocean. The analysers are also employed to check the data recorded by 'Ferryboxes' - real-time continuous monitors mounted inside flow-through chambers to measure the quality of water that is pumped from a subsurface inlet as ferries travel from port to port.

Research vessel

Seal Analytical's President Stuart Smith said: "We are delighted to be involved with the work at the NOC and it is particularly pleasing that we have been able to develop a new method specifically to meet their needs. This is an excellent example of the way in which we are continually looking for ways to refine and improve instrument software and hardware, working closely with customers to ensure that they get the most out of their Seal analysers.

The QuAAtro 39 SFA is the workhorse of the NOC laboratory for micro level nutrients

"Instrument manufacturers often claim that their equipment is robust and reliable but by successfully using the AA3 both onshore and offshore, Mark has shown that ours is no idle boast. Around the world, seawater analysis is becoming a very popular application for our segmented flow analysers, and it is very gratifying that we are contributing to the success of the important work that is being undertaken at the NOC."

Mark explains the advantages of the Seal SFA instruments in a brief video at https://www.youtube.com/watch?v=SVkfc1AJYAE