

Reliable on-line determination of nutrients (PO_4^{3-} , NH_4^+ , ...)

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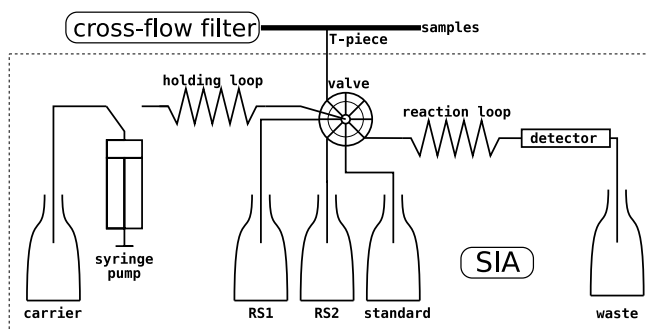
Introduction

The **reliable** on-line determination of dissolved nutrients is still a big problem in the marine monitoring community. There are nutrient analyzers commercially available, however those are based on designs for the laboratory use with only slight modifications for the use in on-line monitoring systems. Our experience is that all devices we tested up to now have a very limited reliability and stability and are not versatile enough for autonomous applications.

HZG has developed nutrient analyzers for Phosphorous (PO_4^{3-}) and Ammonia (NH_4^+) for seawater and brackish waters which solve these problems.

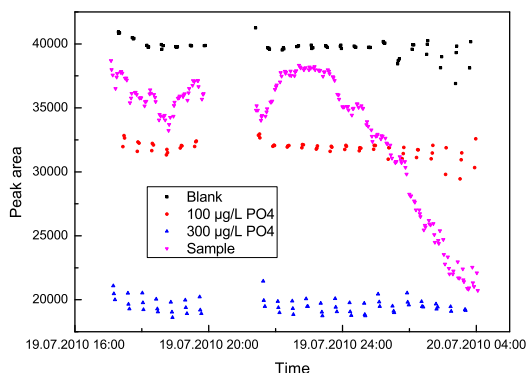
Method

The method is based on the Sequential Injection Analysis (SIA). This flow method uses a syringe pump and a selection valve to aspirate the sample and the reagents into the holding loop. This mixture is then pumped through the reaction loop into the detector.



“Retraceability”

The big advantage over nearly all other analyzers is that one or more standards can be measured alternatively. On the figure on the right side is a plot of a series of measurements taken on a trip where we came from the north sea going into a river. Sample rate is 1 per minute. Reagents, standard and sample consumption is in the range of 10 – 200 μL .

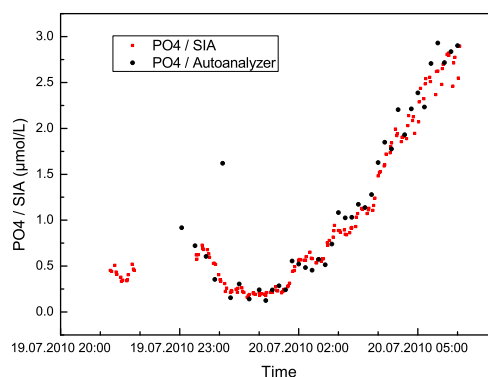
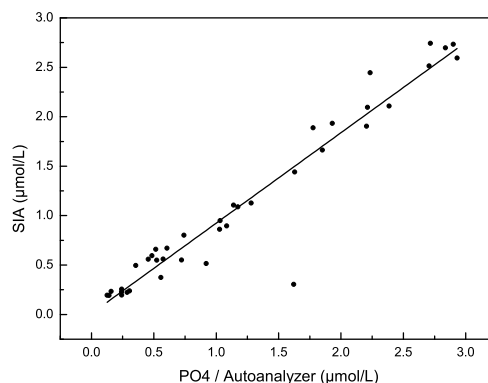


Fact sheet

- optimized for nutrient determination in seawater, brackish waters and freshwater
- detection limit 0.1 $\mu\text{mol/L}$**
- upper limit → 10 $\mu\text{mol/L}$,
- fast (< 1 per minute),
- very low reagent consumption (< 200 μL /measurement),
- very **reliable** (>10 000 measurements without service),
- results can be directly compared to standards which are determined e.g. every three measurements (→ **retraceable results**).

Results

This system was tested several times on the North Sea. The last test was in fall 2010 where we also took a lot of samples manually to compare the results of the SIA method to the results of the Autoanalyzer (Grasshoff-Methods). As can be seen in the left figure the results are highly similar. The correlation is depicted in the right graph.



Outlook

Good results were already achieved with a similar system for the determination of Ammonia (using the OPA method). NO_x and Silicate methods and analyzers are planned.

The demonstrator shows the setup used to generate this data.