



Water quality monitoring of organic pollutants

The application of passive sampling

Water quality is influenced by emissions of various substances through sources like domestic and industrial waste waters and agriculture. The presence of such substances in surface waters may adversely affect the ecology and can pollute drinking water sources and the human food chain. To achieve good ecological status and preserve sources of high quality drinking water, the water quality should be monitored in order to determine the necessity and the right location for measures.

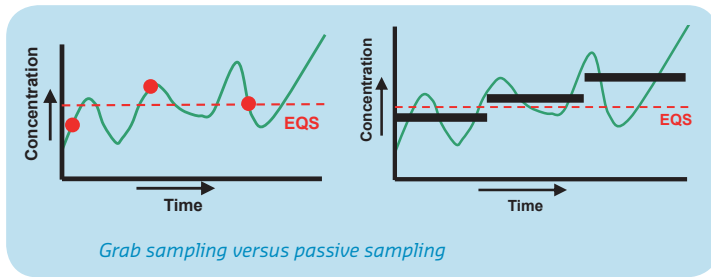
Water quality monitoring normally occurs by grab sampling several litres of water, sending them to the lab and extracting and analysing immediately. This way of sampling gives a snap shot of the water quality at the moment of sampling. Especially with substances that have an irregular emission pattern, like pesticides, peak concentrations will easily be missed. And because of the limited sampling volume, often concentrations are below the limits of detection and little information on the water quality is obtained.

Water quality monitoring of substances can also be performed with passive sampling. Deltares develops and applies this technique to improve water quality monitoring. Passive sampling is a technique at which a sampler with sorption material is exposed to water. They are applied in seas, lakes, ditches and even in groundwater wells for periods that can vary from several weeks to months. During the exposure, substances are sampled by diffusion from a large volume, generally resulting in lower detection limits when compared to classical grab sampling. The result is a time integrated average concentration that includes peaks in the concentrations. This gives more valuable information on the substances that were present in the water. A further benefit is that the passive samplers do not need to be extracted immediately after a sampling

period. Samplers from different sampling periods can be collected, stored in a simple freezer and easily sent to a laboratory for extraction and analysis. This is especially beneficial for worldwide water quality monitoring and in remote areas with limited analytical infrastructure and where transport of water samples is problematic.

Deployment of passive samplers





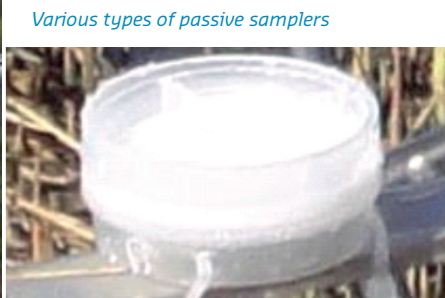
Types of passive samplers

Hydrophobic substances

Deltares has experience with the development and use of various types of passive samplers. What sampler is useful for certain monitoring depends on the substances that will be monitored. For hydrophobic substances (Log Kow >3), silicone rubber is an ideal material. It consists of a small sheet of silicone rubber, is easy to deploy and very robust. It has been widely used for marine sampling on rough seas, but it has also proved to work well in rivers and ditches. The uptake mechanism is well understood and with known partition coefficients and an adsorption model, the amount of substances found on the sampler can be converted to the average water concentration during the monitoring period.



Silicone rubber



Speedisk

Various types of passive samplers

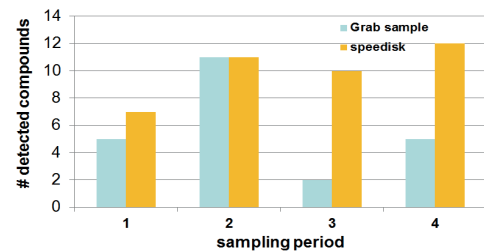
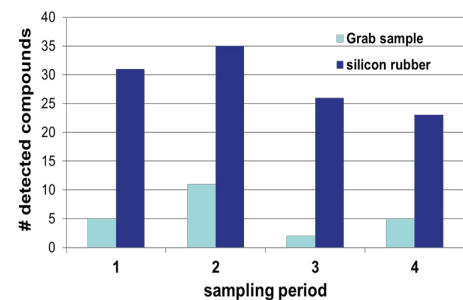
Hydrophilic substances

For hydrophilic/polar substances, Speedisk samplers can be used. This consists of a hard propylene cage with adsorption material and a glass fibre filter to keep the sorption material in the sampler. Speedisks are already regularly used in laboratories to extract water samples. By using them as a passive sampler, the extraction takes place in the field and the laboratory procedure also used for classical water samples can be followed for subsequent extraction of the sampler. That makes

it an easy tool to apply. When the Speedisk is applied in combination with silicone rubber samplers, an indicative / semi quantitative aqueous concentration can be derived.

Results

Studies showed that both silicone rubber and speedisk samplers detect many more substances compared to grab samples taken in the same period. This was mainly due to lower detection limits, but also to peak concentrations in the water that were missed by the grab samples. The resulting time averaged concentrations gave better information on the water quality and makes it possible to follow trends in water quality.



Useful projects and reports

- The use of passive sampling in WFD-monitoring (Deltares report 1202337-004)
- Research and field pilot with partition and adsorption samplers (Deltares report 1206124-000-BGS-0005, in Dutch)
- Monitoring plant protection substances with passive sampling at Hoogheemraadschap van Delfland (Deltares report 1207267, in Dutch)
- Passive sampling in the Pieterbuurstermaar, the Westernielandstermaar and the Houwerzijlstervaart. (Deltares report 1206279, in Dutch)
- Monitoring plant protection substances with passive sampling. Project in cooperation with 10 Dutch water boards and the Ministry of Infrastructure and environment (Deltares report 1206111, in Dutch)

More information

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