

# Monitoring of Organic Micro Contaminants in Drinking Water using a Submersible UV/Vis Spectrophotometer

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## Introduction

An uninterrupted supply of drinking water of impeccable quality is the primary objective of the Dutch drinking water companies. Up-to-date knowledge on the composition of both raw- and drinking water is essential for achieving this goal, and requires the employment of on-line analytical devices. One such a device is the portable, submersible, UV/Vis spectrophotometer. In the study described here, this spectrophotometer was evaluated for monitoring the presence of organic micro contaminants in drinking water.

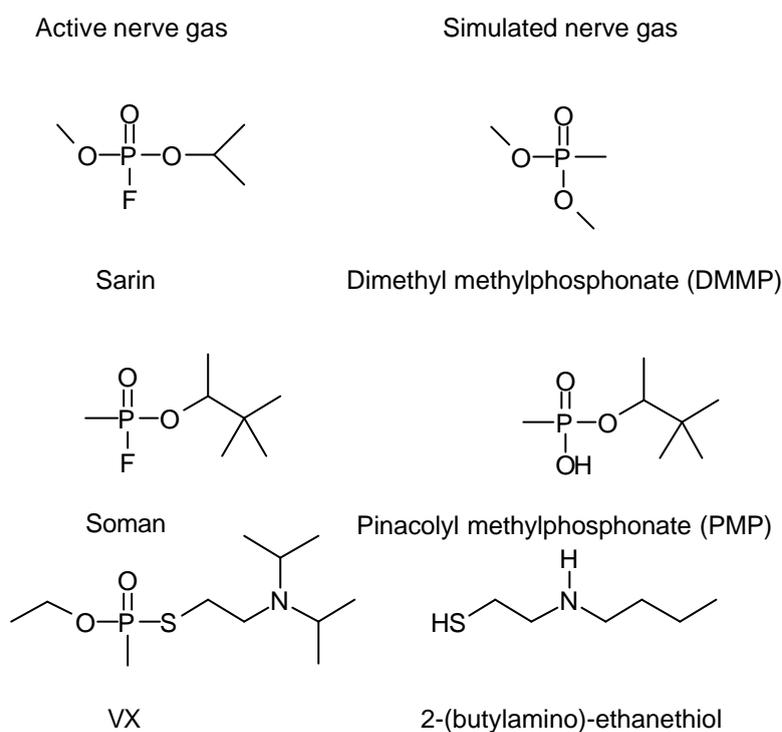
## Materials and methods

A S::can Spectro::lyser UV-probe (figure 1) was evaluated both under laboratory as well as field conditions. The instrument was tested in off-line and on-line modes in the laboratory at Kiwa Water Research in Nieuwegein, and at the water treatment plant WRK in Nieuwegein.



**Figure 1:** S::can Spectro::lyser, 100mm pathlength, and inserts.

This study focused on the ability of the spectrophotometer to detect toxic compounds, such as pesticides and (simulants for) chemical warfare agents (figure 2). Drinking water samples spiked with a selection of compounds, which are considered as most likely for use in the event of an intentional contamination of a drinking water supply, were analysed (table 1).



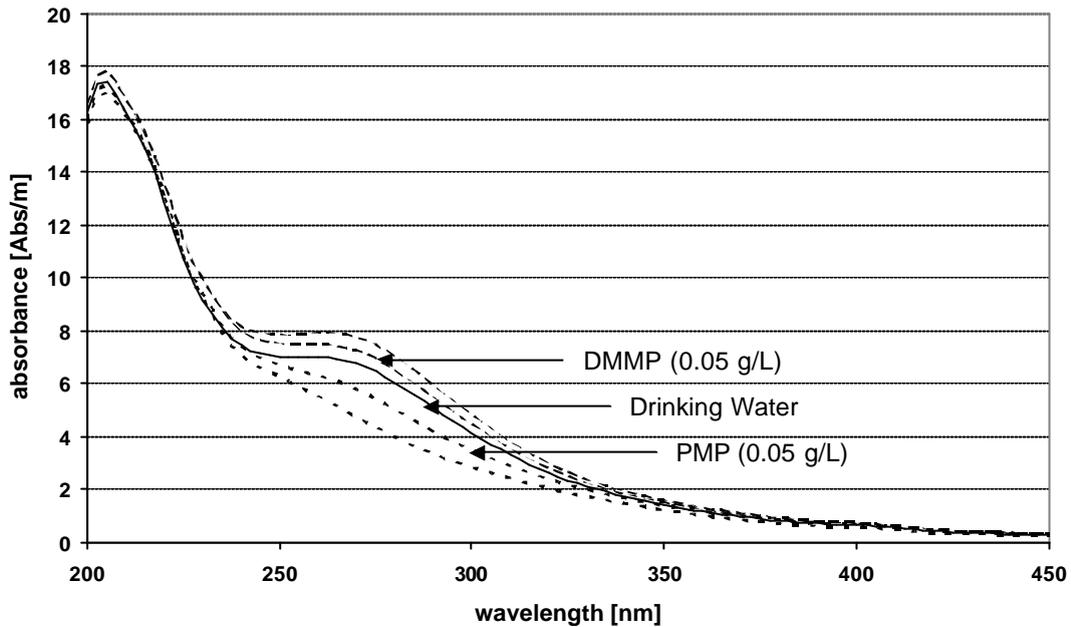
**Figure 2:** Nerve gas simulants measured using the Spectro::lyser.

**Table 1:** Lower detection limit of the Spectro::lyser towards a selection of pesticides and simulant agents.\*

Compound	Detection limit
PMP	50 mg/L
DMMP	50 mg/L
Aldicarb	0.1 mg/L
Mevinphos	0.1 mg/L
Oxamyl	0.1 mg/L
Azinphos-methyl	10 mg/L
Methamidophos	1 mg/L
Isoproturon	0.05 mg/L
Linuron	0.001 mg/L

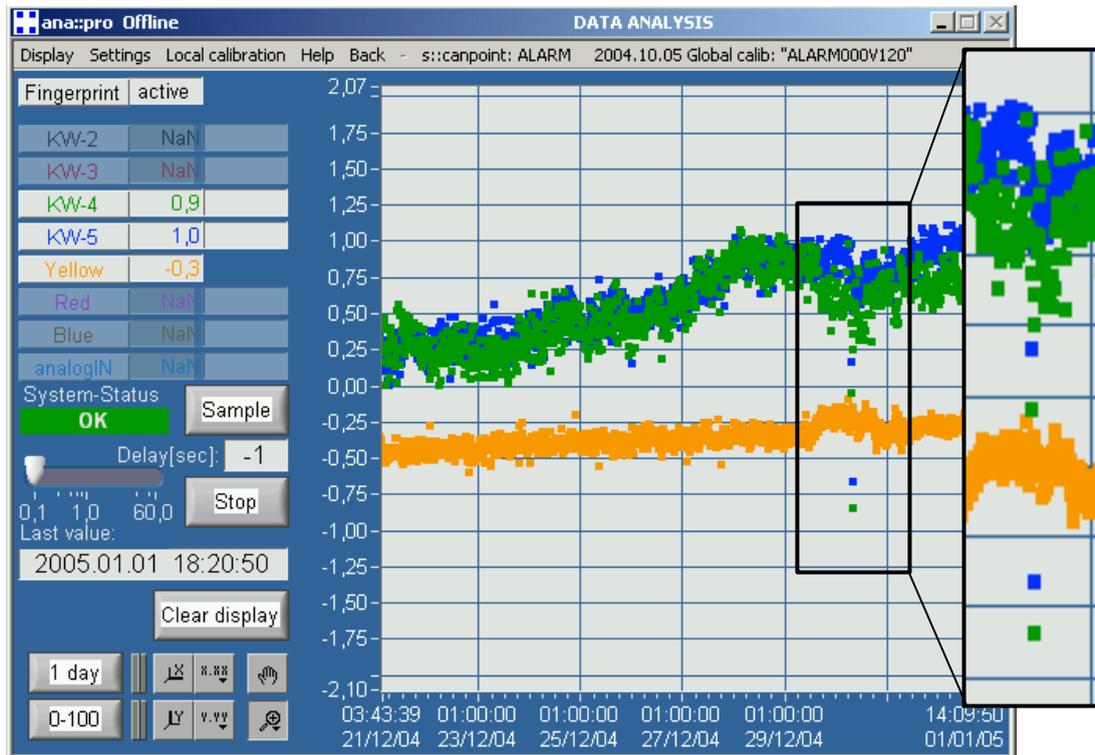
\*: 2-(Butylamino)-ethanethiol was also measured but no detection limit was established as the compound contained an impurity with very high UV-extinction coefficient.

It was demonstrated that substances with a high UV-extinction coefficient can be detected down to the  $\mu\text{g/L}$  level in drinking water. However, due to the superposition of the spectra of all compounds present in the water, it was not possible to identify single compounds at these concentration levels by their fingerprint (figure 3). Compounds with a lower UV-extinction coefficient could be detected at higher concentrations only, e.g.  $\text{mg/L}$  levels.



**Figure 3:** Fingerprints of drinking water contaminated with simulants DMMP and PMP. Spectra are shown for 0.05 and 0.1 g/L concentrations.

The use of the alarm module in the software allows automated detection of anomalies in water composition (figure 4).



**Figure 4:** Response of alarm parameters to changing water quality.

## Conclusions

- presence of most compounds could be detected down to mg/L or even  $\mu\text{g/L}$  levels without any pretreatment of the sample
- it is very difficult to identify contaminants in whole water samples using UV-spectroscopy only
- anomalies in water composition can be detected. This implies that UV/Vis spectroscopy is a valuable tool for detection of (intentional) contamination of a drinking water supply system.

## Acknowledgements

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