Early Warning Device for Detection of Pollutants in Water

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aquawarn

SEVENTH FRAMEWORK PROGRAMME

Introduction

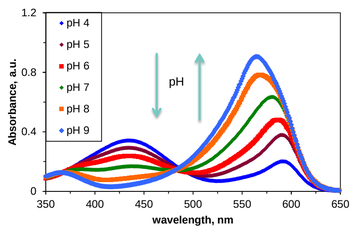
Due to a growing need to protect water resources from contamination, there is a requirement for the development of more reliable and cost effective devices for water quality monitoring. The aim of the AQUAWARN project is to develop and deploy a fully autonomous water quality monitoring device that can measure nitrite, nitrate, phosphate and pH colorimetrically in fresh water and wastewater, and communicate the information to stakeholders in real time.

Table 1. List of analytes, method of detection and range studied

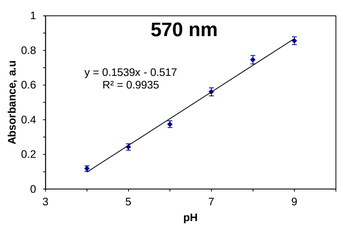
Analyte	Method	Range	Detection Limit
Phosphate	Vanadomolybdate method	0.1-300 µM	0.1 µM
pH	Mixture of dyes	4-9 pH units	n/a
Nitrite	Griess method	0.25-350 µM	0.02 µM
Nitrate	Cd reduction followed by Griess method	0.25-350 µM	0.025 µM

Spectrophotometer

pH

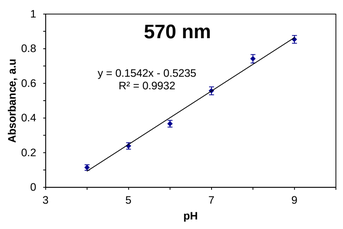


Absorbance versus wavelength of the mixture PR, CPR, BPB using UV-Vis spectrophotometer.



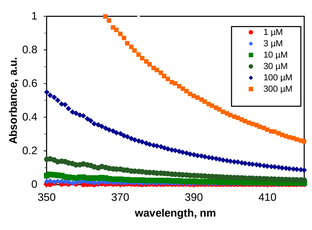
Response of pH mixture (three dyes) at 570 nm

Stability: 5 months (May – September, 2014)

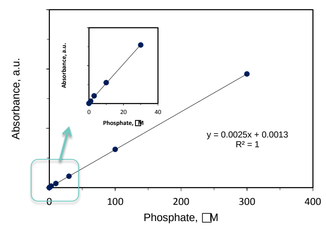


pH	Ā	s	RSD (%)
4	0.1142	0.016	12.9171
5	0.2388	0.019	7.8898
6	0.3667	0.0193	5.2734
7	0.5668	0.0230	4.1317
8	0.7418	0.0244	3.2944
9	0.8536	0.0227	2.6655

Phosphate

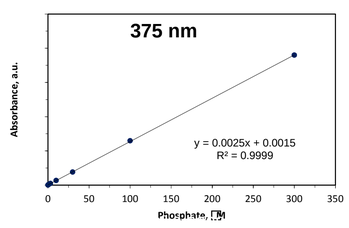


Spectra obtained from 1-300 µM using the spectrophotometer



Calibration curve obtained using the yellow method from 0 to 300 µM. Inset, lower range calibration

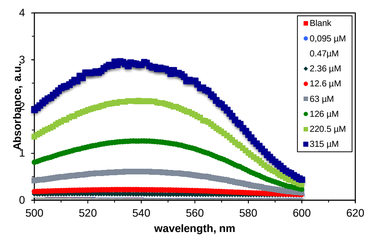
Stability: 8 months (February – September, 2014)



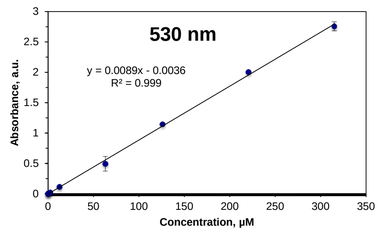
Historical calibration linear fit

R^2 0.99989 – 0.99998

Nitrite

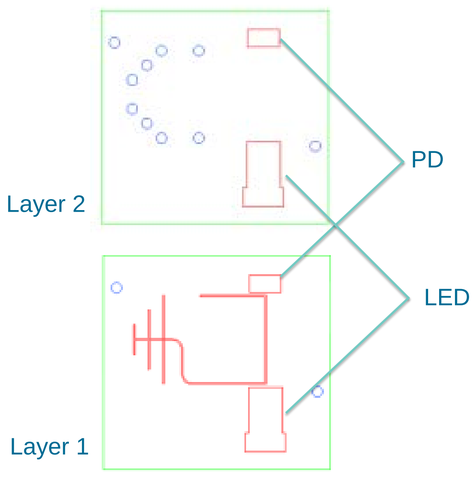


Absorbance versus wavelength for nitrite method using uv-vis spectrophotometer.

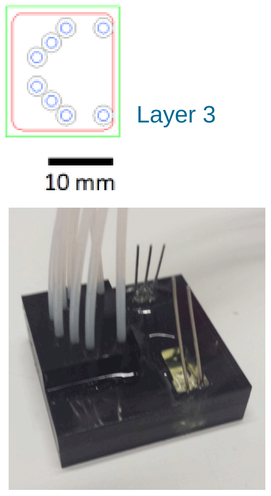


Calibration curve for nitrite.

Microfluidics

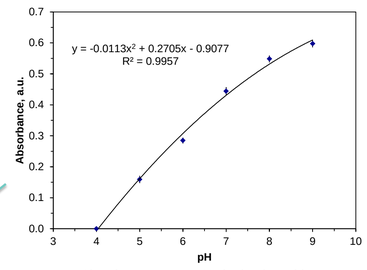


Design of the three layered chip

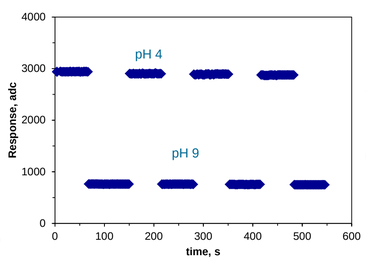


Captured image of the manufactured chip

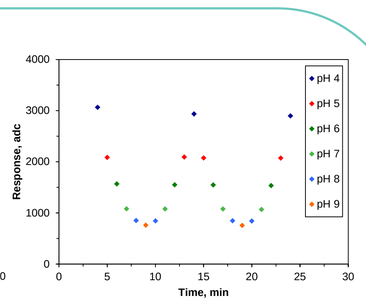
570 nm LED pH determination



Absorbance versus pH obtained on-chip

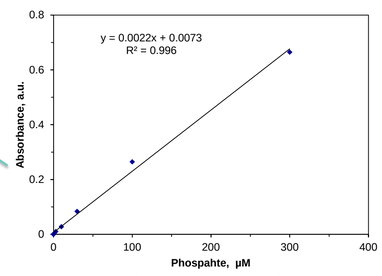


Response range examination



Response at different pH on-chip

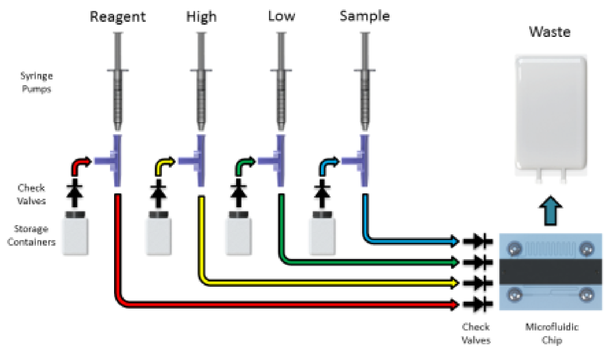
375 nm LED Phosphate determination



Absorbance versus phosphate concentration obtained on-chip

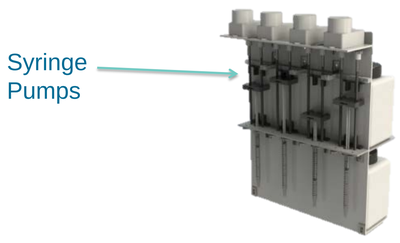
Cd Column for Nitrate

Fluid Handling

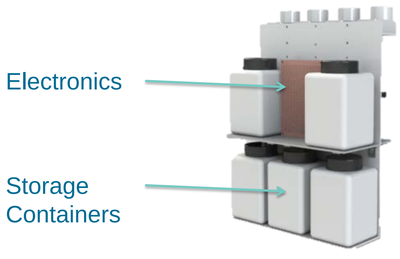


- Check Valves
- Minimisation Dead Volume
- Longer Lifetime
- Chemical Compatibility

Packaging



Rear View



Front View

Deployable Prototype

Future Work

- Nitrate studies (uv-vis and on chip)
- Nitrite on chip
- Assessment and validation of the performance of the integrated systems under field conditions

Acknowledgements

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