Low Cost Autonomous Sensing Platforms for Water Quality

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Introduction:

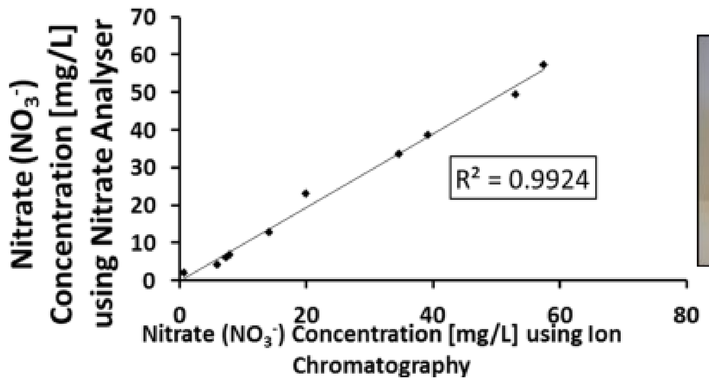
Protecting and maintaining the **quality of environmental waters** is of increasing importance as available water resources continues to decline. In this context, our ability to effectively **monitor the aquatic environment** is essential. **Microfluidic technology** has potential as a solution to the increasing demand for environmental monitoring; through minimisation of reagents and power consumption. These efforts will lead to the **development of compact autonomous instruments** for in **situ continuous monitoring.** Our approach is to combine microfluidic technology with **colorimetric chemical assays**; **low cost LED/photodiode-based** optical detection systems; and **wireless communications.** Developing low cost systems providing high-frequency data on key water quality parameters.

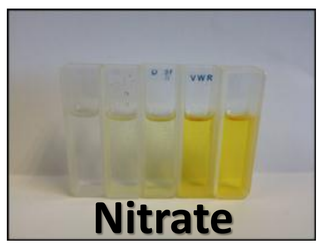
Commercially Available units	**Concept Prototype** ***GEN 1***	**Refined Prototype** ***GEN 2***	***Generation 3:*** ***Incorporating microfluidics with material chemistry***

Determination of Nitrate

Current market for nitrate sensors use direct UV spectrophotometric screening, electrodes or cadmium reduction method which in turn can be quite costly. Major market for direct, inexpensive and robust sensor. Determination of nitrate was investigated by a spectrophotometric method based on chromotropic acid.

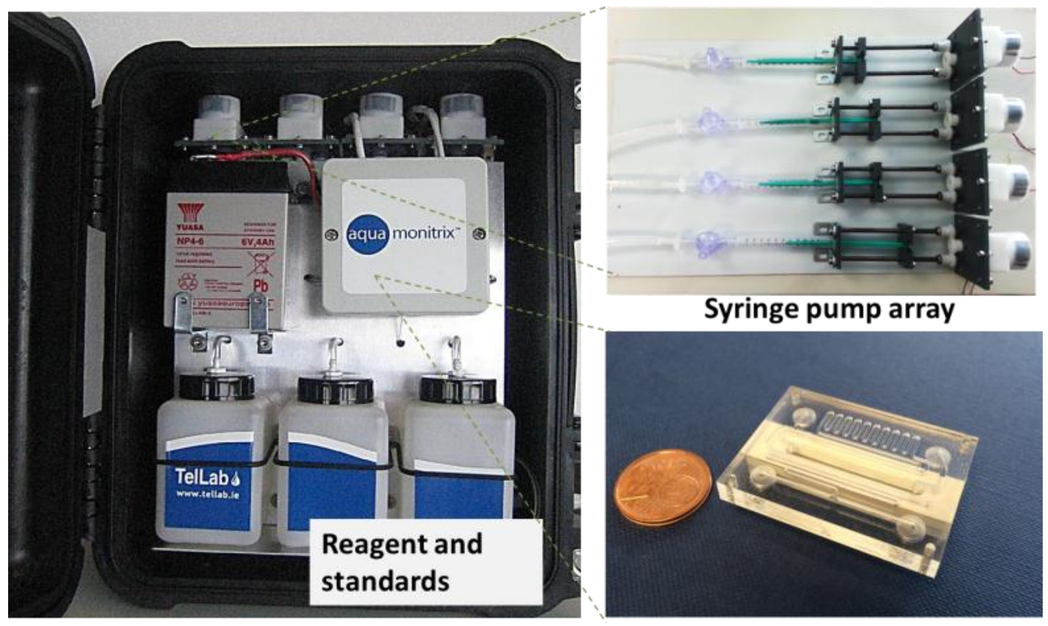
Field deployable platform (1) robust and waterproof housing; (2) reagent and standard storage bags; (3) 12 V battery and control board; (4) microfluidic chip and optical detection enclosure; (5) peristaltic pumps containing Viton Tubing; (6) Sample inlet and filter.

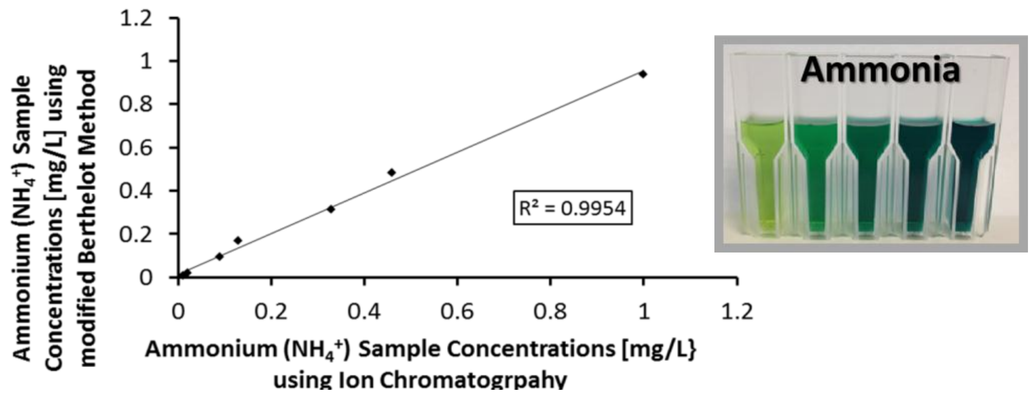




Determination of Ammonia

The reagent cocktail includes a variation on the Berthelot method which employs, salicylic acid instead of phenol which eliminates a toxic and relatively unstable reagent component. Intense colour generated is detected at a wavelength of 660nm.





Conclusion

The objective of this research is to produce autonomous chemical sensing platforms with a price performance index that creates a significant impact on the existing market focusing on a detection platform for nutrients. The goal is to integrate polymer actuators valves into the microfluidic chip, to drive down the overall cost.

The future goal is to integrate polymer actuator valves into the microfluidic chip, which will significantly drive down the overall cost of the platform, replacing conventional pumps and valves. This will achieve a fully integrated ‘matchbox’ analyser ready for field deployment.

References

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[2] Cogan, D., Cleary, J., 2014, “The development of an autonomous sensing platform for the monitoring of ammonia in water using a simplified Berthelot method,” Analytical Methods, DOI: 10.1039/c4ay01359j.

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