Volunteer led sampling to monitor phosphate levels using paper analytical devices (PADs) and a smart phone

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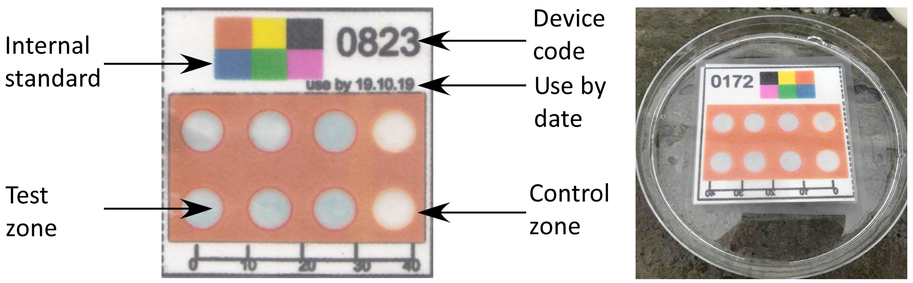
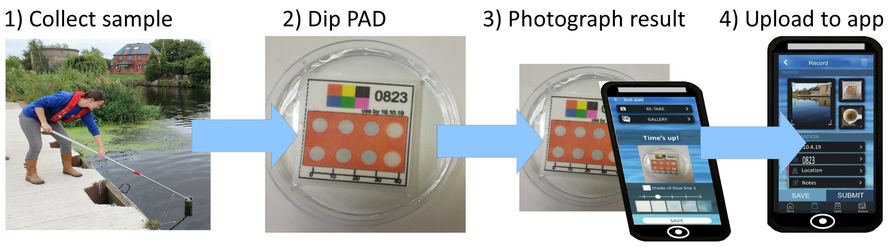
Regular monitoring of fresh water contaminants is limited, often to a frequency of once per month with only a small number of sites across a waterbody. In order to truly understand pressures and patterns, monitoring needs to occur with a higher frequency and spatial resolution.[1-2] One approach is to combine a volunteer-led sampling campaign with a simple to operate paper microfluidic analytical device (PAD) with a mobile phone as detection system.[3-4] We have previously shown development of a simple PAD for detection of phosphates in river water.[5] Here we demonstrate the use of this PAD together with a custom-built app, RiverDIP, for in-the-field analysis with volunteers to carry out monitoring of phosphate levels across the Humber catchment in the UK.

Paper-microfluidic analysis device (PAD)



Two control zones account for water colour, internal standard (blue square) accounts for differences in camera, use-by-date ensures users understand device stability.

Volunteer workflow

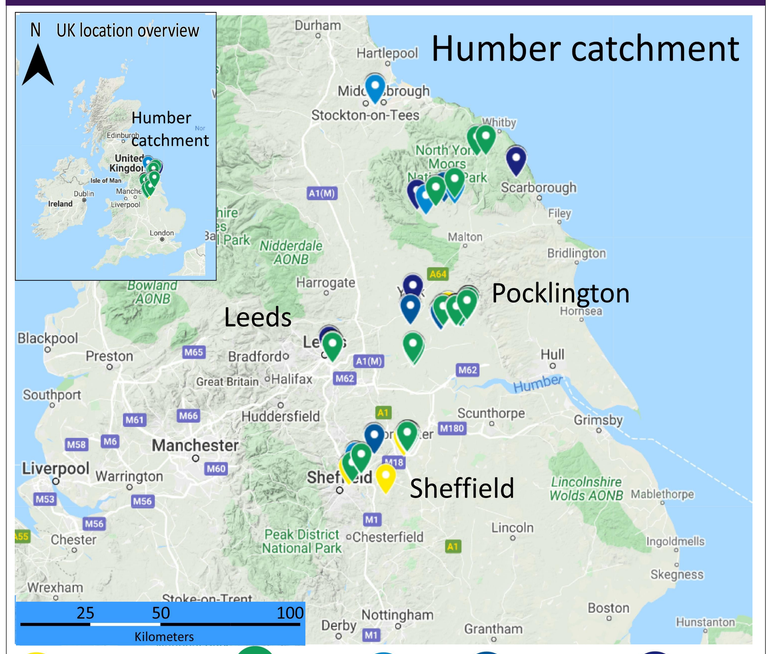


(1) Volunteers collect water sample, (2) dip PAD in for 3 min, (3) photograph the result (4) record date, GPS location and sampling notes to RiverDIP app.

RiverDIP APP

Custom made RiverDIP app (in collaboration with Natural-Apptitude[5]) to record, upload and interpret field data. Images were analysed off-site to determine phosphate levels.

Volunteer led monitoring



Volunteers carried out independent sampling across the Humber catchment (UK) during 2019. After analysis, results were uploaded onto an interactive map so that volunteers could see their own results.
(https://drive.google.com/open?id=1Lb-f0thmOxFGvkaBXCOm7VgdPsH89bGe&usp=sharing)

Conclusions

- We have developed a device and workflow suitable for volunteers to carry out chemical measurements on site to produce data that, after image analysis, can report phosphate levels in river water.
- We have demonstrated the potential for a combined approach for monitoring water quality by using paper microfluidic devices and a volunteer led sampling campaign.
- Future work will include wider roll out and further validation of the paper devices.

References

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6. www.natural-apptitude.co.uk/

Acknowledgements

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