

AN INTRODUCTION TO *IN VITRO* BIOASSAYS AS A MEANS OF WATER QUALITY ASSESSMENT

Prepared by: Shane Snyder, Caixia Li & Joon Chuah



SAY, WHAT'S IN THIS DRINK?

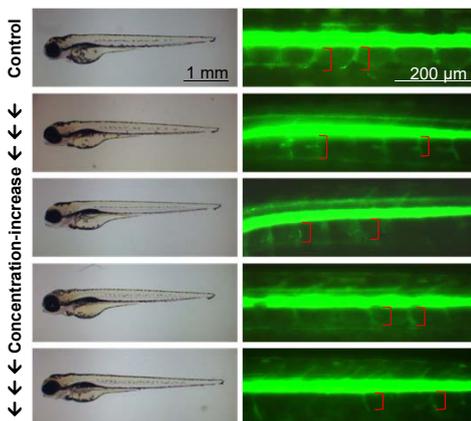
Man-made products containing >100,000 chemicals are [registered](#) in the EU while in the US has tens of thousands are [listed](#); and the USEPA is struggling to get a handle on which are being produced and used. In developing nations, the situation is likely to be even more dire.

This then presents a difficult challenge for environment and water agencies when it comes to monitoring the quality of drinking-water supplies, wastewater effluent and water bodies.

THE RIGHT TOOLS FOR THE RIGHT JOB

While targeted chemical analysis is often used, it is not feasible to comprehensively capture such a diverse range of chemicals potentially present.

Instead, *in vitro* bioassays can be applied to complement chemical analysis as they can incorporate the mixture effects of all active chemicals in a sample.



▲ Zebrafish have been widely used as they develop as "see through" embryos i.e. all internal development can be clearly observed from the outside. In a recent study, Li et al. observed the development of shorter nerve fibres of motor neurons in zebrafish embryos dosed with different concentrations of wastewater treatment plant effluent.

AN EFFECT-BASED TOOL

In vitro biological assay (bioassay) is the process by which the potency of a substance or the combination of substances is measured on components of an organism (e.g. cells, tissues) rather than the organism itself (*in vivo*).

Although technically *in vivo*, early life-stage whole organism assays, such as the fish embryo toxicity (FET) assay, are considered legally as *in vitro* and have been applied to evaluate the quality of water.

THE FUTURE OF H₂O QUALITY MONITORING?

While there are limitations (e.g. common sample preparation methods not ideal to enrich volatile chemicals), a lot of progress has been made to advance this science in recent years. When applied together with analytical chemistry methods, *in vitro* bioassays can provide valuable holistic and integrative assessment of water quality.

References and further reading:

- Jia et al (2015). *In vitro* bioassays to evaluate complex chemical mixtures in recycled water. *Water Research*. 80, 1-11
 Li et al (2018). An integrated approach with the zebrafish model for biomonitoring of municipal wastewater effluent and receiving waters. *Water Research*. 131, 33-44
 Neale & Escher (2019). *In vitro* bioassays to assess drinking water quality. *Current Opinion in Environmental Science & Health*. 7, 1-7