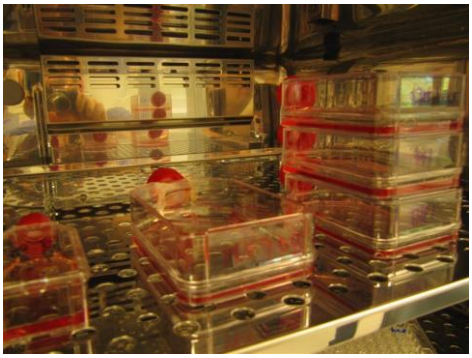
Assessing drinking and recycled water quality



Project team

Frederic Leusch

Timeframe

2007–present

Project description

Ensuring sustainable drinking water supplies for urban populations has become more challenging as urban growth, the opportunity cost of nearby land and climate change are putting significant pressures on available fresh water supplies. Water security is a vital feature of economic, social and cultural prosperity. Augmenting the existing, climate-dependent sources of water (e.g. rivers, reservoirs, ground water) with unconventional sources (e.g. saline water, recycled water and storm water) is increasingly occurring or being considered worldwide.

Unconventional water sources however raise unconventional issues. The technical challenge with potable reuse is to remove biological and chemical hazards in the source water to levels that are deemed safe by health regulators, so that the purified water can be re-introduced to the drinking water system. The social challenge with potable reuse is to ensure that communities have appropriate information available to help them reach their own conclusions as to the safety of the purified water and whether the risks have been appropriately managed. Conventional chemical analysis has some significant limitations in assessing chemicals in complex environmental mixtures, including the inability to detect non-target compounds and to provide a measure of mixture interactions.

In vitro bioassays, which measure the biological activity of a chemical mixture or environmental sample using biological molecules or living cells, have been applied to purified water quality assessment in an attempt to address these issues. Such methods have played a significant role in the pharmaceutical industry in ensuring the safety and efficacy of new drugs, and are a cornerstone of the modern toxicology paradigm.

Outcomes

This research has shown that novel in vitro bioassays are compatible with water quality assessment, and illustrated some of the current water-related applications for these types of bioassays.

The application of *in vitro* bioassays in parallel to conventional techniques has greatly improved our ability to determine water quality and benchmark purified recycled water against other water sources, demonstrating the high quality achievable with advanced water treatment. This again illustrates that water should be judged by its quality, not its history.

The novel bioanalytical tools developed in this research programme are now routinely applied to a variety of environmental water samples by the In Vitro Toxicology Research Group at ARI, led by A/Prof Leusch, to provide a measure of total toxicity from mixtures of chemicals in environmental samples. This can help prioritise environmental monitoring and screening for toxic chemicals in ecological (e.g., surface water, wastewater discharges, irrigation water) and human health applications (e.g., alternate water sources, stormwater harvesting, drinking water).

Bioanalytical tools are gaining recognition by environmental and health regulators in Australia, Europe and the US as a promising method to provide a more comprehensive measure of water quality.

The ultimate aim of this work is to provide a testing platform to measure not just water quality, but water safety. There are still steps required to achieve this ultimate goal, and we collaborate with scientists worldwide under the BRAVE endeavour (www.bravebioassays.info.

Funding

- National Water Commission (NWC)
- Global Water Research Coalition (GWRC)
- Water Research Australia (Water RA)
- Urban Water Security Research Alliance
- Water Reuse Research Foundation (WRRF)
- Australian Water Recycling Centre of Excellence (AWRCoE)

Partners

- Stuart Khan, UNSW
- Beate Escher, Helmholz Centre for Environmental Research, UFZ
- Andrew Humpage, SA Water
- Shane Snyder, University of Arizona
- Helen Nice, WA Department of Water
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Publications

Mehinto AC, Jia A, Snyder SA, Jayasinghe BS, Denslow ND, Crago J, Schlenk D, Menzie C, Westerheide SD, Leusch FDL and Maruya KA (2015). Interlaboratory comparison of in vitro bioassays for screening of endocrine active chemicals in recycled water. Water Research 83: 303-309.

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