FIELDNOTE

Emerging contaminants pose a challenge to water laboratories

WIN-SA
WATER INFORMATION NETWORK
- SOUTH AFRICA -

WATER RESEARCH COMMISSION

August 2018

There are a number of current issues facing South Africa's water laboratories, but the issue of emerging contaminants (ECs) has been garnering a lot attention and is an issue with which our laboratories are also grappling. An example of the challenge posed by ECs was the focus in the media during July 2018 when a study confirmed micro plastic pollution in Gauteng drinking water. While the people of Johannesburg and Tshwane have been drinking micro plastics in their tap water, the jury is still out in terms of health effects and more research is needed.

Dr Eunice Ubomba-Jaswa, Water Research Commission Research Manager
Water Resource Management and Quality

At the Water Research Commission (WRC) , emerging contaminants is one of the programmes within the Water Resource Quality portfolio, however it is a topic that touches on the entire water cycle (from source to tap).

The problem of ECs is of course by no means unique to South Africa. For example, pharmaceutical compounds are known emerging contaminants and have been detected in various water bodies worldwide. They are regarded as chemicals of environmental concern because of the risk to aquatic life associated with their exposure in water and the risks to humans when they reach drinking water.

While several papers and reviews have been published about their occurrence on other continents, data about their presence in water bodies in Africa is limited, yet water needs to be regularly monitored for these compounds especially because the specific types of pharmaceuticals and/or their metabolites found in water sources can differ between countries or regions depending on social, cultural, technological and agricultural factors.

Dr Eunice Ubomba-Jaswa is responsible for the WRC's portfolio that seeks to address emerging contaminants. However, she says, "It is essential to know what concentrations of contaminants are in the resource and whether they can be removed from by our waste water treatment works. If we don't have this information, then they are highly likely to end up in our drinking water."

In a number of workshops, including a 2011 workshop on emerging contaminants – which was linked to a WRC project on *Persistent Organic Pollutants (POPs) in the water environment* – matters common to all stakeholders included the need for effective analytical infrastructure; well-trained technical staff; as well as the required sophisticated and efficient equipment to detect contaminants.

The POPs study assessed the scale and significance of pollution in South African waters of certain organic pollutants (OPs) and persistent organic pollutants. Of the 96 chosen sites, 23 had quantifiable levels of dioxin-like compounds. These sites were mainly of industrial, semi-industrial or low-income residential origin. The concentrations were generally intermediate when compared to concentrations measured in some European, Asian and Scandinavian countries. A screening human health risk assessment identified a few chemicals at some locations to be of potential concern with carcinogenic effects being anticipated. Further investigation is being done into the sources and levels of certain OPs and POPs at various sites. Regular monitoring is also recommended to detect other possible areas of concern around the country.

"A robust analytical infrastructure ensures that the South African Science community can be provided with reliable results of determinants in order to make the decisions needed to protect our environment and communities." – Dr Eunice Ubomba-Jaswa, Water Resource Quality, WRC

The Stockholm Convention on Persistent Organic Pollutants (SC POPs), of which South Africa is a party, carries a number of obligations and expectations. Based on the obligation to develop a National Implementation Plan (NIP), the State is obliged to reduce or terminate all sources of POPs within the SC provisions. This therefore implies that a state should know the environmental levels of these POPs whereby priority sources and hotspots can be targeted for interventions.

South Africa does have the scientific capability to conduct analyses, however, there is still a lot of improvement needed in order to comply with certain conventions like the National Implementation Plans (NIP) requirements under the Stockholm Convention, or meet the specific criteria laboratories need in order to be considered capable of conducting EC analysis. "Specifically," adds Dr Ubomba-Jaswa, "Laboratories must conduct more effective field sampling; cheaper and faster test methods need to be used/developed (this will ensure that municipalities for instance can afford to pay for more rigorous testing); improved training and retention of skills is required; as well as ensure accreditation of laboratories for methods."

The status quo

South Africa has a number of specialist research organisations such as the Council for Scientific and Industrial Research (CSIR), Agricultural Research Council (ARC) and East Rand Water Care Company (ERWAT) and some universities that can provide the analytical research needed to continuously improve emerging contaminants detection. However, funding is needed to strengthen these laboratories and develop and maintain the skills necessary.

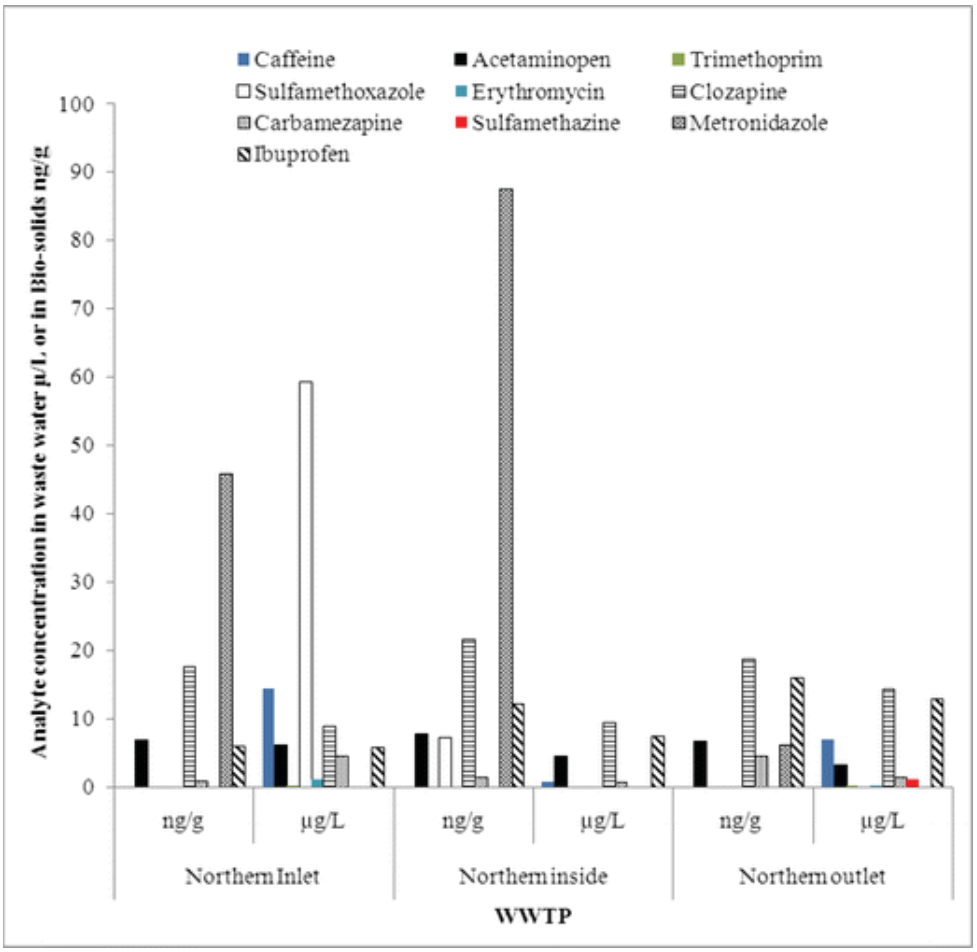
There have been some innovative projects around the country where the issue of detecting and quantifying ECs has been addressed.

Case study: Detecting and validating ECs in the waterways of KwaZulu-Natal

A project to detect ECs in the waterways of KwaZulu-Natal focussed on the determination of selected pharmaceutical compounds in the Durban area. The Umgeni River and one wastewater treatment plant (WWTP) in this catchment area were selected i.e. the northern water works were selected because it is the primary source of water to the city of Durban in KwaZulu-Natal. The Umgeni River has a catchment about 441 km2 and length of 225 km from source to mouth. It has four large dams in its catchment basin: the Albert Falls, Inanda, Midmar and Nagle Dams. This river passes through the most densely populated parts of the province and therefore presents an opportunity to study and monitor the level of pharmaceuticals as it passes through rural to urban areas.

The project sought to understand the state of selected emerging organic pollutants in Pietermaritzburg/ Durban and KwaZulu-Natal's water systems; determine levels of emerging organic pollutants in selected water bodies; and develop and validate protocols for the quantification of emerging organic pollutants in natural and wastewater samples

Water and sediment samples were collected from several points along the Msunduzi and Umgeni Rivers. Samples were analysed for the presence of manufactured organic chemicals, organochlorine pesticides, pharmaceuticals and personal care products.



NOTE: Image above taken from research paper: Occurrence of selected pharmaceuticals in water and sediment of Umgeni River, KwaZulu-Natal, South Africa as published in *Environmental Science and Pollution Research* (Springer).

Selected pharmaceuticals were detected in wastewater, surface water, bio-solids and sediments along the Umgeni River in KwaZulu-Natal. The results indicate that while WWTPs contribute pharmaceutical loading to surface water, anthropogenic activities along the river also contribute greatly.

In some instances, the levels found for the selected manufactured organic chemicals and organochlorine pesticides in the Msunduzi River is much higher than areas in India, China, Norway and the United States. Furthermore, the current wastewater treatment at the sites investigated during the study period was insufficient for removal of pharmaceutical contaminants. In future, the researchers will investigate seasonal variation and fate of the pharmaceuticals detected in this study.

On this project, new methods of analysis were developed that can be used to determine selected compounds in environmental samples. The findings can be used to inform water quality monitoring in the studied catchments. Methods developed can be used by other researchers.

The way forward

Despite considerable progress, there is ongoing concern over the presence of ECs in the environment, as well as their potential human health risks. The WRC has realised that more needs to be done in order to understand, assess and manage the risks associated with ECs in the environment, to advance the science, as well as to communicate with the authorities and the public.

While scientists grapple with determining whether microplastics and engineered nanoparticles in the water environment are hype or a real health risk, the WRC continues to share insights on the emerging threat of contaminants, explore mechanisms on lessening negative impact on the environment and addressing water pollution challenges arising from the use of both plastics and other emerging contaminants.

For more information, contact Eunice Ubomba-Jaswa at euniceuj@wrc.org.za or visit www.wrc.org.za

WIN-SA
WATER INFORMATION NETWORK
- SOUTH AFRICA -

WATER
RESEARCH
COMMISSION

Water Information Network-South Africa (WIN-SA) aims to capture the innovative work of people tackling real service delivery challenges. It also aims to stimulate learning and sharing around these challenges to support creative solutions. Most importantly, WIN-SA strengthens peer-to-peer learning within the water sector.

To read further, download reports from the WRC Knowledge Hub visit www.wrc.org.za

Contact: Hlengiwe Cele, Stakeholder Liaison, Water Research Commission
Email: hlengiwec@wrc.org.za or call +27-12-761-9300