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Case Study

Water Treatment Residuals (WTR) in South Africa

Innovate UK Global Alliance Africa collaborates with Rand Water to address water security challenges and develop cutting-edge and cost-effective technologies

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Introduction

Ensuring that cities and communities have access to a safe, quality water supply is fundamental and part of the UN Sustainable Development Goal objectives on ensuring the availability and sustainable management of water and sanitation for all (SDG6)¹.

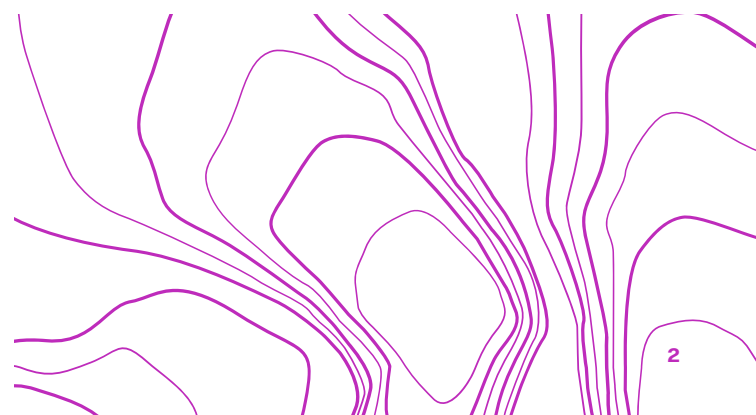
In the case of South Africa, water security is threatened due to the adverse impact of climate change, degradation of wetlands and water resources, and population growth and urbanisation which is stressing water supply facilities².

Pooling knowledge and resources to address global water challenges is at the forefront of Innovate UK's agenda for sustainable development and wider UK water sector ambitions.

As such, the UK and South Africa are collaborating through the **Rand Water Open Innovation challenge** to identify circular economy solutions to addressing water security challenges and develop cutting-edge and cost-effective technologies that enhance water security both nationally and internationally.

“The collaboration between Innovate UK and the FCDO exemplifies the power of partnerships in addressing critical global challenges through Global Alliance Africa. By fostering innovation and supporting initiatives like the Rand Water Open Innovation challenge, this partnership has driven transformative solutions that not only address South Africa's water security issues but also create opportunities for technology transfer and sustainable development across the region. Together, Innovate UK and FCDO are demonstrating how global collaboration can deliver impactful outcomes for communities and industries alike.”

Dr Nee-Joo Teh, Head of Global Alliance, Innovate UK Business Connect



1. www.ukbatteriesnetwork.org/resources/reports/71
2. devtracker.fcdo.gov.uk/programme/GB-GOV-1-300704/documents

The Challenge

In 2022, Africa's largest bulk water utility, [Rand Water](#), launched two Open Innovation (OI) challenges with support from Innovate UK Global Alliance Africa to develop innovative, environmentally sustainable solutions to the management and disposal of Water Treatment Residue (WTR) within their supply chain. The two challenges are listed below:

1. [Accelerate the Concentration of Water Treatment Residue](#) focused on developing an innovative approach to accelerate the WTR drying process that would also allow for reusable water to be extracted at the same time. The winning solution provider, Freshworks, created a centrifugal system that filters out micro-particles from fluids without any loss of flow. This works as a self-emptying and self-cleaning process, allowing reusable water and waste product to be separated efficiently.
2. [Innovative Solutions to the Beneficiation of Water Treatment Residuals](#) focused on identifying a sustainable and environmentally friendly way to utilise the dry WTR and unlock potential commercial value from the chemical compounds found within the residue. Rand Water produces 500-600 tonnes of residue daily, underscoring the significant scale of this challenge. Following a competitive process, [AC Biode](#) was selected to develop a solution that upcycles the WTR "sludge" into a high value, versatile product called CircuLite.

The partnership between [Rand Water](#) and [Fresh Works Ltd](#) to test and develop the centrifugal system has recently entered its next phase. The two companies are currently partnering on a further Innovate UK Global Alliance sponsored programme, the [Water Lead Customer Programme](#), which will see Freshworks take its solution out of the lab and set up a large-scale pilot at the Rand Water site – testing both the practical application of the solution on site and its use at scale in South Africa.



The innovations developed across both challenges also have value for the water industry more broadly. As the largest bulk water utility in South Africa – and on the African continent as a whole – technological innovation spearheaded by Rand Water has the potential for tech transfer to other water utilities nationally and regionally.

"The whole process showed us that it's important to be in touch with the network of Solution Providers and to have your finger on the pulse of what is happening. Our goal is to become pioneers in the field. Already, our innovations have led to other water utilities seeking guidance from us."

Judith Seopa, Scientific Innovation Consultant, Rand Water

Spotlight 1: Freshworks



Removing sediment from drinking water is an essential component of water management and processing. Rand Water has traditionally used flocculants (chemicals added to a suspension for solids removal and water clarification), sedimentation and large drying beds at a secondary site to remove the sediment. However, tighter environmentally regulations and lack of land capacity to “dry” large volumes of sediment have led to Rand Water exploring innovative solutions to the WTR process.

The solution developed by Freshworks adapted their existing, patented, centrifugal system that removes laundry water waste to meet the requirements set out in the Rand Water challenge to remove sediment from drinking water. The lab prototype developed using WTR samples provided by Rand Water proved a flexible and cost-effective way of testing and refining the process with potential to scale up for commercial use. The final prototype surpassed the original technical specifications, achieving a filtration efficiency of 99.1%.

The prototype represents the successful culmination of the bilateral collaboration between Rand Water and Freshworks, with both partners committed to scaling up the lab prototype for commercial use by developing a larger, industrial prototype that can be piloted on site at Rand Water.

To support this next venture, the partners have successfully secured follow-on funding through Innovate UK Global Alliance Africa’s [Water Lead Customer Programme](#).



“Freshworks were on top of their game. You can see that they’re excited about their technology and they want to see it work. It’s great that we are now having a second leg of this project with a full scale on-site pilot.”

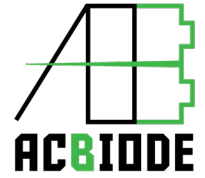
Judith Seopa, Scientific Innovation Consultant, Rand Water

“[The Open Innovation challenge] exposed us to a dewatering system that we wouldn’t have had access to otherwise because the technology was literally designed and customised for our challenge... It also gave us a different perspective and inspired other projects internally that we wouldn’t have thought about before.”

Judith Seopa, Scientific Innovation Consultant, Rand Water

When fully operational, the innovative solution will allow Rand Water to treat the WTR at its main treatment site rather than transporting the residue to a secondary site to dry the residue in large beds. This represents a significant efficiency saving for Rand Water and will free up over 100 hectares of land for other uses.





Spotlight 2: AC Biode

Rand Water currently produces 500-600 tonnes of water treatment residue (WTR) per day, creating a need to dispose of the WTR through a commercially viable, environmentally sustainable process. The process of recovering value in WTR is generally referred to as valorisation and locally, 'beneficiation'.

"We realised there are other benefits that we can derive from the WTR as a commodity instead of as waste. Basically, approaching it from a perspective of circular economy thinking, we wanted to see what else we would do with this material to derive value from it."

Judith Seopa, Scientific Innovation Consultant, Rand Water

Extending on their existing CircuLite technology, AC Biode created a novel filtration process to separate harmful and valuable substances from the WTR, before reforming the valuable substances into a chemically activated substance that can be used as an adsorbent for processes including carbon capture, self-cooling concrete, soil improvement, water purification and air purification.



The Open Innovation project involved comprehensive testing and analysis of multiple WTR batches on their compositions, minerals, solubility and other characteristics to optimise consistent CircuLite outputs suitable for commercialisation. According to AC Biode, benefits of the CircuLite technology include offering a cheaper production cost and sustainable alternative compared to other conventional adsorbents, such as Zeolite and Activated Carbon, as well as its capacity to absorb a broader range of substances.



"Upcycling of sludge into a high value product... allows sewage sludge plants to lower their carbon footprint, costs and create a circular economy... This makes sustainable adsorbent locally available and gives new opportunities to the cleantech ecosystem in South Africa."

Robert Kunzmann, COO, AC Biode

Rand Water and AC Biode are also currently exploring opportunities to further develop the potential uses of the valorised WTR, including soil beneficiation within local agricultural sectors and brick making.

"We are trying to find an integrated solution for the business. [For example] another project that we are handling is to see if we can use the WTR to produce bricks."

Judith Seopa, Scientific Innovation Consultant, Rand Water



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If you would like more information
please contact Babar Javed

Babar Javed

Open Innovation Lead - Global Alliance Africa

✉ babar.javed@iukbc.org.uk

@IUK_Connect

iuk-business-connect.org.uk