Enhancing Water Quality in Rural India: Use of Locally-Made Reference Materials for Effective Monitoring

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Key messages

- Rural areas in India face significant challenges related to the quality of drinking water.
- Locally-made Certified Reference Materials (CRMs) / Bharatiya Nirdeshak Dravyas (BNDs) offer a sustainable solution for monitoring and characterising chemical parameters.
- Water source mapping, and the availability, distribution, and contaminant removal are critical for ensuring safe and reliable water access in rural India.
- Policy needs to be implemented to prioritize standardization and international collaboration in microplastic monitoring.

What's the issue?

Access to safe and clean drinking water is a fundamental human right, but this right remains a distant dream for millions living in remote rural areas of India. The quality of drinking water in these regions is a grave concern, with significant challenges related to contaminants such as heavy metals, pathogens, and industrial and agricultural chemicals.

In August 2019, the Government of India committed to provide piped water supply to every household in the country by 2024, under a new national flagship programme – the Jal Jeevan (*Water for life*) Mission.[1]

Another significant threat to India's water sources is the proliferation of microplastics. These tiny plastic particles, often invisible to the naked eye, are ubiquitous; infiltrating rivers, lakes, and groundwater all over the world. In India, where millions depend on surface and groundwater for drinking, microplastic contamination is becoming a critical issue.

Non-standardized methods for sampling, extraction, purification, identification, and quantification of microplastics have created uncertainties about data quality, making it difficult to accurately assess the extent of contamination. [3] The lack of reliable data and infrastructure for water quality monitoring compounds this problem, as do inadequate quality control measures and the absence of effective distribution systems.

To address this issue effectively, it is crucial to establish reliable and consistent methods for identifying and estimating microplastics in Indian water sources.

The **Jal Jeevan** (translation: *Water for life*) is an ambitious Indian Government scheme initiated by the Ministry of Jal Shakti in 2019.

One scheme from the Mission – called **Har Ghar Jal** (translation: *Water To Every Household*) has an overall goal to provide safe and adequate drinking water to all households in rural India by 2024, through the installation of individual household tap connections.

As of 23rd November 2023, 137 million tap connections had been made.[2]

Why is this important?

Recent developments in India have increased the urgency of enhancing the quality of drinking water in rural areas. Waterborne diseases, including cholera and typhoid, continue to afflict communities, placing a significant burden on the healthcare system. Additionally, climate change, industrialization, and population growth are placing unprecedented pressure on water resources, further compromising water quality and availability.

The importance of addressing microplastic contamination in India is underscored by its growing water crisis. Recent research reveals a surge in microplastic pollution in water bodies, with the potential to impact the health of aquatic ecosystems and, ultimately, human well-being.

The need for standardized methods is evident, as non-standardized approaches have led to inconsistent data, making it difficult to assess the scope of the problem. Proactive measures are required now to mitigate potential health and environmental risks. Furthermore, as global awareness about microplastic pollution grows, addressing the issue becomes vital for international collaboration and trade relations.

The introduction of indigenous (locally-made) Certified Reference Materials (CRMs) offers a promising solution to these challenges. By using CRMs, India can significantly enhance the accuracy and effectiveness of its water quality assessment methods.

The role of metrology

Metrology, the science of measurement, plays a pivotal role in solving the pressing issue of water quality in rural India. Indigenous CRMs have a unique advantage because they are specifically tailored to local conditions, ensuring accurate measurements of chemical parameters. These CRMs serve as a cornerstone for building a robust quality infrastructure for water.

International collaborations are essential in supporting India's efforts in this arena. Collaboration with global metrology organizations can facilitate the exchange of knowledge, technology, and best practices in water quality measurement, while addressing the unique challenges it faces.

What should policy makers do?

1. **Support the development of BNDs/CRMs**
   The development of BNDs/CRMs in various matrices, including focusing on key chemical parameters, will have a significant financial benefit, as currently, huge amounts of money are being spent on importing them from overseas. CSIR-NPL, the National Metrology Institute of India, has started an initiative to support Indian Reference Material Producers for the development and production of CRMs, or the local equivalent, Bharatiya Nirdeshak Dravyas (BNDs). This will ensure the availability of reliable reference materials for water quality assessment.
2. **Enable comprehensive mapping of water sources**
   Mapping of groundwater, surface water, and community wells across India, should be conducted. This data will inform strategies for effective water distribution and quality control.
3. **Implement advanced technologies for contaminant removal**
   This could include advanced filtration systems and water treatment plants, especially in areas with high contamination risks.
4. **Establish international collaborations**
   Sign agreements with international metrology organizations to support the sharing of knowledge, technology, and support for CRMs development and implementation.
5. **Invest in capacity-building programmes**
   Invest in training schemes and capacity-building programs for scientific and technical personnel working in the field, to ensure implementation of standardized detection methods.
6. **Support a robust regulatory framework**
   Develop and enforce regulations on microplastic pollution in water bodies, including requirements for water treatment facilities to filter microplastics.
7. **Launch public awareness campaigns**
   Invest in campaigns to educate citizens on the dangers of microplastics and promote responsible plastic usage.
8. **Allocate Research Funding**: Provide resources for research on the impact of microplastics on human health and the environment.

Local example: India

In the Indian state of Rajasthan, the government, in collaboration with local NGOs and metrology experts, initiated a project to address water quality issues in rural communities. The project leveraged CRMs specifically designed for the region's unique water chemistry.

Through extensive water source mapping, they identified contamination sources and implemented filtration systems. Continuous water quality monitoring using CRMs helped maintain and improve the quality of drinking water. As a result, waterborne diseases decreased, and the *Har Ghar Jal* initiative gained significant momentum.

This local example demonstrates the power of using indigenous CRMs and efficient water quality monitoring to transform the lives of rural communities. It serves as an inspiration for other regions facing similar water quality challenges.

Key initiatives:

1. The collaboration with NGOs involved raising awareness, mobilizing resources, and implementing on-the-ground interventions.
2. The involvement of government agencies ensured that funding, regulatory frameworks, and coordination activities were all in place.
3. The inclusion of metrologists in the project team brought essential expertise in measuring and analysing water quality, and a local knowledge of the specific characteristics of Rajasthan's water chemistry.
4. The use of locally-developed CRMs/BNDs provided a benchmark for the calibration and validation of measurement techniques.
5. The local community were heavily involved, taking part in training programs, awareness campaigns, and inclusion in the decision-making processes related to water resource management.

References

1 https://www.unicef.org/india/what-we-do/clean-drinking-water

2 https://jaljeevanmission.gov.in

3 https://www.who.int/news/item/10-01-2024-infosan-quarterly-summary-2023-3

4 Saidur Rahman Chowdhury, Shaikh Abdur Razzak, Ikrema Hassan, S. M. Zakir Hossain & Mohammad Mozahar Hossain. "Microplastics in Freshwater and Drinking Water: Sources, Impacts, Detection, and Removal Strategies." *Water, Air & Soil Pollution* 234, 673 (2023). https://doi.org/10.1007/s11270-023-06677-y