

## **Mahakumbh 2025: The Challenge of Waste Management**

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### **Summary**

*The Mahakumbh 2025, with its monumental scale and logistical complexities, offered a huge challenge in waste disposal and sewage treatment. The enormous task of treating 16 million litres of faecal sludge and 240 million litres of grey water daily in addition to the solid waste from over 15 million devotees congregating daily to take a holy dip has been successfully managed by a mix of traditional and hi-tech measures.*

The sun has set on Mahakumbh – the world’s largest religious gathering of human beings in Prayagraj. The Mahakumbh – the confluence of the Ganges, Yamuna and the mythical Saraswati – reportedly witnessed over 663 million devotees take a holy dip in the period from 1 January 2025 to 6 February 2025. This year’s [Mahakumbh was particularly significant](#), due to a unique celestial alignment that occurs once every 144 years, enhancing the festival’s spiritual significance. The magnitude of the gathering throws up the mind-boggling requirement of, among other logistical requirements, the huge amount of waste generated.

The scale of waste generation at the Mahakumbh was mind-boggling: nearly 16 million litres of faecal sludge and 240 million litres of greywater daily, besides the massive solid waste from over 15 million pilgrims daily. Managing this required sophisticated solutions requiring the deployment of advanced technologies. The meticulous planning that had to be undertaken to meet with the logistical challenge of managing the waste generated each day has thrown up high-technology and advanced waste disposal technologies. The authorities enlisted the help of the Indian Space Research Organisation (ISRO) and Bhabha Atomic Research Centre (BARC), two of India’s premier scientific institutions, to tackle this Herculean task. A multitude of advanced and traditional methods were deployed to meet this challenge.

One of the advanced technologies devised was the Hybrid Granular Sequencing Batch Reactor (HGSBR), developed through an ISRO-BARC collaboration. The HGSBR is a compact biological treatment method to effectively remove contaminants from domestic and industrial wastewater. It makes use of natural microbes present in the wastewater to remove contaminants. The technology was used at three prefabricated faecal sludge treatment plants, efficiently processing human waste and ensuring that the environment remained clean and disease-free.

Another innovative technique deployed was Geotube Technology. This can be visualised as a giant tea bag which holds and treats large volumes of liquid waste. The Geotubes are used for sludge dewatering projects of different sizes because of their simplicity and low-cost factor. Geotubes comprise containers that are hydraulically filled with a slurry mix of sand

and water. The hydraulic pressure helps to transport the sand along the inside of the tube, while the water dissipates through the permeable engineered fabric, with the sand settling within the container by gravity. This technology helps with the [containment and treatment of waste](#), ensuring that only clean water is released back into the environment.

A third technique deployed was the traditional and innovative technique of Bioremediation. This approach functions through a series of large ponds, each teeming with beneficial microorganisms that break down pollutants and cleanse the water. Bacteria are the most crucial microbes in this process as they break down the waste into nutrients and organic matter. This natural and environmentally friendly method was applied to greywater collected in approximately 75 large ponds, ensuring that water was treated to ensure efficient recycling of polluted water.

The deployment of these advanced and effective technologies ensured the mitigation of several critical environmental concerns. They prevented river water contamination, reduced potential health risks from waste and sewage and minimised the ecological footprint of the massive gathering. The operational strategy for waste management included reducing manual handling to a minimum, emphasising source-level waste segregation using advanced technological interventions and implementing strategic disposal mechanisms.

The efficient deployment of these advanced technologies represented a paradigm shift in managing large-scale religious gatherings as they offered environmentally sustainable waste management, reduced health risks, created minimal ecological disruption and ensured efficient resource utilisation.

Besides leveraging on technological and scientific measures to guarantee a clean environment, Mahakumbh 2025 used 150,000 portable toilets placed strategically across 4,000 hectares of the congregation area, along roads, bathing venues, vending zones and areas vulnerable to open defecation. These toilets were colour-coded for easy identification and supported by jet spray cleaning, scientific odour neutralisers and information and communication technology-based monitoring and maintenance. Additionally, 25,000 litter bins were placed at short intervals to ensure that the congregation remained litter-free. A total of 120 Global Positioning System-enabled tipper trucks and 40 compactors, along with 94 suction machines dedicated to liquid waste management, operated round the clock and a workforce of 15,000 sanitation workers, equipped with personal protective equipment and supported by welfare provisions, ensured a clean environment.

To efficiently manage the vast waste generated daily, the authorities implemented a comprehensive waste management system capable of processing 650 metric tonnes of garbage per day at the Baswar plant. The *Mela* (Religious Fair) authority had introduced 350 advanced suction machines, along with 1.5-litre capacity toilets and urinals, ensuring zero discharge into the river. In addition to human resources, two trash skimmers were used to remove 500 to 600 metric tonnes of waste daily. Efforts were made to clear discarded items such as plants, bags, flowers, garlands, coconuts and clothing from the ghats and riverbanks to maintain the Mahakumbh's sanctity and grandeur. The administration imposed a total ban on plastic bags, utensils and bottles permitting only biodegradable alternatives such as *dona-pattal* (plates made from six or eight banyan or baubhinia leaves, stitched together with

tiny toothpick-type twigs). Food is served on these plates for traditional meals, festival or temple feasts), *kulhad* (earthen cups) and non-plastic bags.

The administration complemented these efforts by widespread publicity and educating the common devotees and locals of improved sanitation-conscious behaviour, alongside robust citizen feedback and complaint redressal mechanism. Achieving sustainable sanitation at these centres required active ownership by local institutions, management bodies, market associations and civil society. Incorporating a systematic element of volunteerism further accelerated progress toward ensuring a clean environment. It certainly goes to the credit of the administration that the 45-day period passed without any health, sanitation or ecological disaster.

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