MOBILE SEPTAGE TREATMENT UNIT

Faecal-sludge treatment technology installed on a truck that can safely treat septic tank contents on-site.

Technology Developed by

BRIDGING THE KNOWLEDGE GAP
WASH INSTITUTE

Commercialised by

Bhouma
Envirotech Pvt. Ltd.

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About Us

In a world where water scarcity, pollution, and urban pressure threaten the very foundations of life, Bhouma Envirotech Pvt Ltd is reimagining how humanity treats its most vital resource. We are more than an environmental technology company, we are a movement that believes every drop of water matters.

Bhouma was founded with a simple but powerful mission: to make wastewater management decentralized, mobile, intelligent, and sustainable. We design systems that bring treatment to the source rather than carrying waste miles away, saving time, cost, and energy while restoring the natural water cycle where it begins.

Our solutions are built on the conviction that sustainability must be practical, measurable, and inclusive. Whether in a dense city, a peri-urban settlement, or a remote village, Bhouma's technologies empower communities to take charge of their own sanitation and water futures without overdependence on complex infrastructure.

Bhouma's innovations combine engineering precision, biological intelligence, and digital control to deliver holistic results. Our product ecosystem covers the full spectrum of decentralized treatment:

Mobile Treatment Units (MTUs): Truck-mounted, plug-and-play systems capable of treating sewage, septage, greywater, well water, and hardened sludge on-site. Designed for agility, MTUs transform any location into a micro-treatment hub within hours.

Compact & Containerised STPs: Modular, space-efficient sewage treatment plants tailored for apartments, campuses, institutions, and industries, ensuring compliance and reuse with minimal footprint.

Greywater Treatment Plants: Smart, low-energy systems that recover bathroom and kitchen wastewater for reuse in irrigation and flushing, reducing fresh-water demand.

Constructed Wetland Systems: Nature-based treatment units that merge ecological design and engineered filtration, ideal for rural and semi-urban zones.

SeptaCLEAR Model: Bhouma's signature decentralized sanitation framework integrating septic-tank desludging, mobile treatment, and sludge-to-compost recovery—a replicable, revenue-generating model for local governments and self-help groups.

Together, these systems form a connected ecosystem capable of managing water and waste "from source to reuse."

Every Bhouma innovation is the product of deep scientific collaboration and decades of field experience. Our R&D partnerships span the California Institute of Technology, University of South Florida, BITS Pilani-Goa, CSIR, IITs, and the Bill & Melinda Gates Foundation, alliances that bridge global research with Indian ground realities.

We embed IoT, AI, robotics, and biotechnology into our systems for real-time monitoring, data-driven performance, and biological optimization. This fusion of technology and ecology ensures that our solutions are not only efficient but regenerative, returning treated water, nutrients, and life back to the environment.

Aligned with National Missions

Bhouma's work complements India's key national initiatives - Swachh Bharat Mission (U) 2.0, Jal Jeevan Mission, and AMRUT 2.0 - while supporting the vision of the Ministry of Housing & Urban Affairs (MoHUA), and Local Self-Government Departments (LSGDs) across states.

Our Service-as-a-Solution (SaaS) model redefines sanitation delivery as a continuous, accountable service rather than a one-time construction project. Through women-led Water & Sanitation Centers and public-private partnerships, we are building local enterprises that generate livelihoods while maintaining environmental compliance and community health.

Our Impact

With over two decades of research and innovation, Bhouma Envirotech is driving measurable impact across India's water and sanitation landscape:

- Reduced wastewater discharge and groundwater contamination
- Resource recovery through compost and treated water reuse
- Local job creation and capacity building for SHGs and youth
- Climate-resilient models that lower energy use and carbon footprint

We are proving that sustainable sanitation is not just possible—it is profitable, scalable, and transformative.

Our Vision: To create a water-secure, waste-free, and climate-resilient world where every community can treat, reuse, and regenerate its own water sustainably.

Our Promise: Bhouma stands for innovation with purpose and technology with accountability. We are redefining the future of wastewater management—one truck, one site, one solution at a time.

Driving Policy Integration and Governance Reform

Bhouma Envirotech is not just building treatment systems, it is helping shape the future of environmental governance. By working closely with local bodies, Pollution Control Boards, and mission directorates, Bhouma is translating policies like IS 2470, CPHEEO norms, and NGT directives into implementable, field-level action. Our advisory engagements and pilot projects demonstrate how decentralized sanitation can be institutionalized within municipal frameworks, ensuring regulatory compliance, citizen accountability, and financial sustainability. Each project becomes a model for how policy, people, and technology can converge to build truly circular water economies.

Pioneering the Future of Regenerative Infrastructure

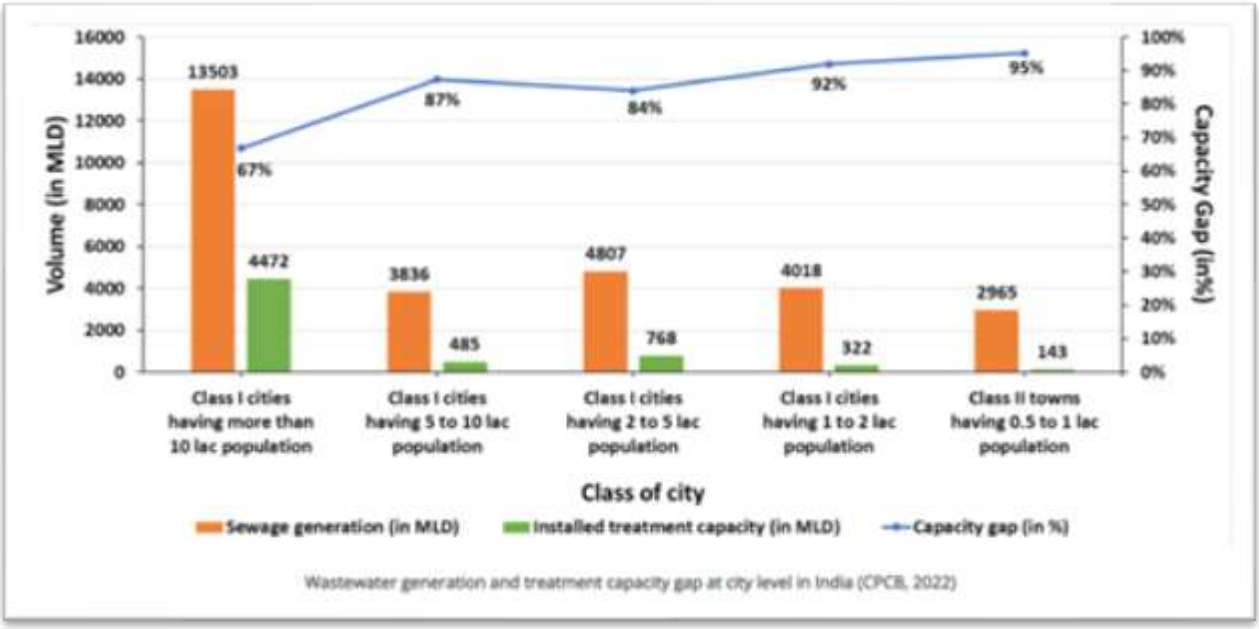
As climate risks intensify, Bhouma is advancing toward a new paradigm of *regenerative infrastructure* - systems that heal rather than harm. Through data-driven lifecycle management, carbon-neutral operations, and digital twins for performance visualization, we are setting benchmarks for future-ready sanitation and water systems. Our goal is not merely to treat wastewater but to convert it into value—water for reuse, compost for soil, data for governance, and dignity for workers. In doing so, Bhouma stands as a beacon of India's innovation leadership in the global mission for a sustainable and water-secure planet.

Water and Sanitation – India

A clean, healthy, and sustainable environment is now globally recognized as a fundamental human right and a cornerstone of human well-being. In India, it is an inseparable part of the constitutional right to life under Article 21, affirming that every citizen is entitled to live in an environment free from pollution and degradation. Over the past decade, the country has made remarkable progress in achieving the primary goals of sanitation through nationwide programmes such as the Swachh Bharat Mission (SBM), AMRUT, and Jal Jeevan Mission. However, beyond toilet construction and improved access, India continues to face serious secondary challenges that threaten its environmental hygiene and public health. Increasing discharges of untreated solid and liquid waste, cross-contamination of septage with groundwater, unregulated industrial effluents, and poor waste management practices have collectively imposed severe stress on the nation's water resources and ecological balance.

According to Census 2011, India's urban population stood at about 377 million—nearly 31% of the total population—and is projected to rise to 600 million by 2031. Rapid urbanization, coupled with inadequate sewage and sanitation infrastructure, has placed enormous pressure on the country's water systems. Weak sanitation has enormous health and economic costs, with untreated fecal sludge and septage from urban settlements being one of the biggest sources of water pollution in India. Human waste alone has been identified as the leading cause of contamination in rivers, lakes, and groundwater, resulting in widespread outbreaks of waterborne diseases such as diarrhea, cholera, typhoid, and hepatitis. The contamination of irrigation water also affects agricultural produce, leading to indirect health risks and food insecurity, while polluted water bodies degrade aquatic life and natural ecosystems.

As per the Central Pollution Control Board's (CPCB) report *"Inventorization of Sewage Treatment Plants, 2015,"* India has 816 municipal sewage treatment plants (STPs), out of which only 522 are operational—around 64%. About 79 are non-operational, 145 are still under construction, and 70 are at the proposal stage. The country generates approximately 72,000 million litres per day (MLD) of sewage, but the total treatment capacity available is only around 23,277 MLD—just 37% of the total. This means that nearly two-thirds of urban sewage flows untreated into the environment, contaminating freshwater resources and contributing significantly to environmental and health hazards. The absence of safe and sustainable sanitation has led many Indian cities to suffer from serious pollution of water and soil resources, causing ecological damage and heavy financial losses through increased healthcare burdens and reduced productivity.



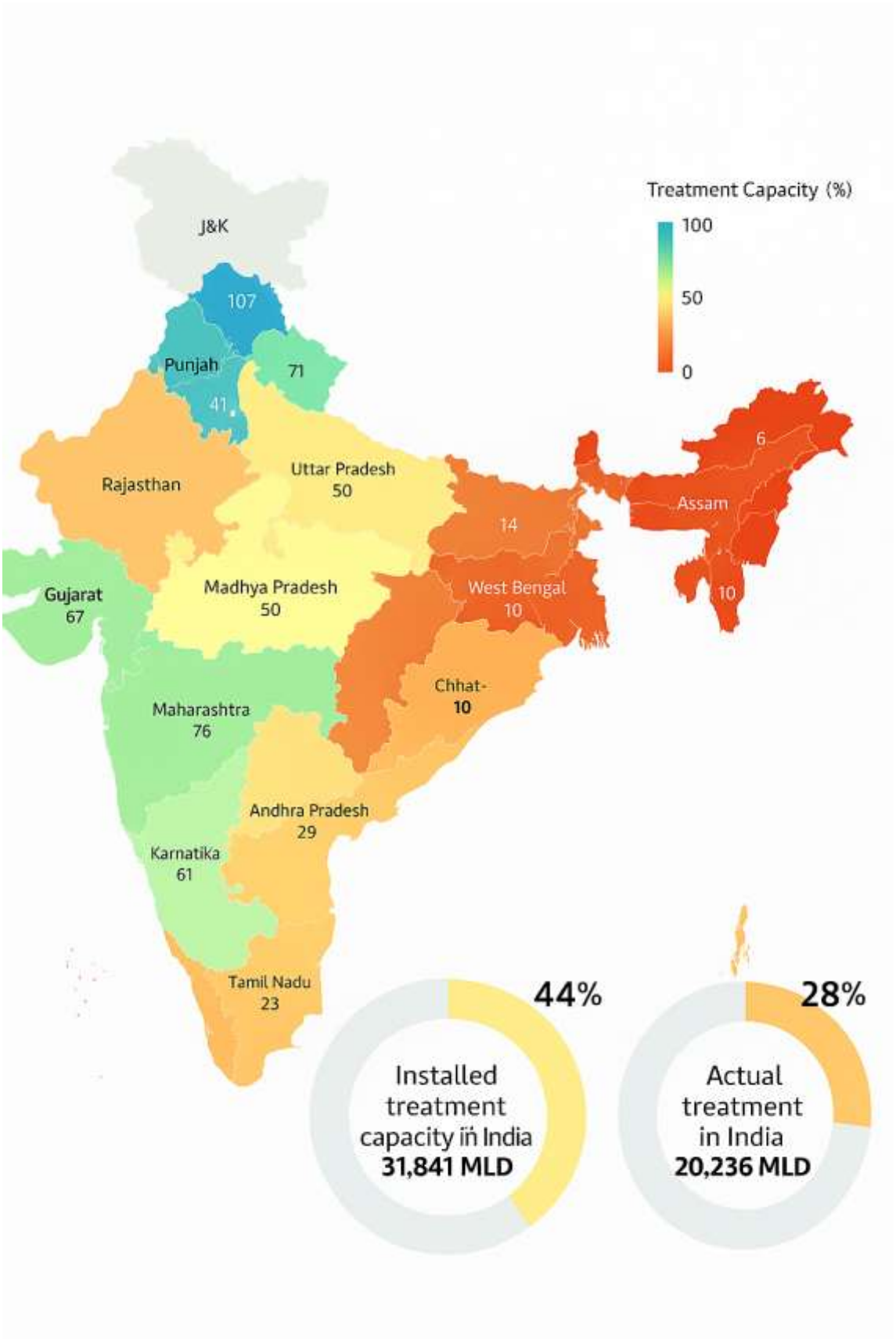
Wastewater generation and treatment capacity gap at city level in India (CPCB, 2022)

In rural and peri-urban India, where over 70% of households rely on on-site sanitation systems such as septic tanks, twin pits, or soak pits, the challenge is even more acute. Without regular desludging, proper transportation, and treatment facilities, these systems often turn into sources of contamination rather than protection. The lack of fecal sludge treatment plants (FSTPs), unregulated private desludging operations, and non-compliance with standards like IS 2470 and CPHEEO guidelines have exacerbated the problem. There is an urgent need to integrate fecal sludge and septage management (FSSM) into the sanitation value chain through decentralized, sustainable, and community-led models. Mobile treatment units, compact STPs, and cluster-level treatment facilities can play a critical role in bridging the infrastructure gap, especially in smaller towns and Gram Panchayats.

India's sanitation framework is supported by multiple national policies, including the National Urban Sanitation Policy (2008), Swachh Bharat Mission, AMRUT, Smart Cities Mission, National Water Policy (2012), and the Draft Liquid Waste Management Rules (2024). Together, these aim to promote a circular economy approach, emphasizing wastewater reuse, sludge resource recovery, and sustainable operation and maintenance. However, challenges such as institutional fragmentation, limited technical capacity, and inadequate financing continue to hinder effective implementation. To achieve the targets of Sustainable Development Goals 6 (Clean Water and Sanitation) and 11 (Sustainable Cities and Communities), India must move towards integrated water resource management that links sanitation, waste management, and environmental protection. Strengthening decentralized treatment systems, enforcing compliance with CPCB norms and IS 2470 standards, empowering local governments, and encouraging community participation are essential to sustain the progress achieved so far.

Ultimately, India's journey toward a clean and resilient future depends on shifting the focus from mere infrastructure creation to long-term management, monitoring, and reuse. Ensuring safe water and sanitation for all is not only a public health imperative but also an environmental and economic necessity. A truly clean India will emerge only when every litre of wastewater is safely treated, every drop of freshwater is protected, and every citizen becomes a stakeholder in maintaining ecological harmony and public hygiene.

Sewage Treatment Capacity



Need for Innovative Solutions

India's rapid urbanization and economic growth have come at the cost of severe environmental degradation. Fragile ecosystems, over-exploited groundwater, and rising pollution levels now threaten the sustainability of future growth. Ensuring environmental security requires innovative, decentralized, and community-driven solutions that protect natural resources while generating local value.

1. Environmental Challenge

India produces over 72,000 MLD of wastewater, of which less than 30% is treated. Untreated effluents contaminate rivers, groundwater, and agricultural lands, leading to water scarcity, ecosystem decline, and widespread health issues. In many towns and villages, centralized sewage systems are financially and technically unviable, resulting in untreated wastewater discharge and unsafe desludging practices.

2. Decentralized Waste Management: The Way Forward

Decentralized wastewater management systems (DWMS) offer a flexible, low-cost, and sustainable alternative. They treat wastewater near its source, enabling:

- Local reuse of treated water for irrigation, landscaping, or flushing.
- Reduced transport and operational costs.
- Simplified maintenance and local job creation.
- Lower carbon footprint and improved accountability.

These approaches align with Swachh Bharat Mission (Urban/Rural), AMRUT 2.0, and Jal Jeevan Mission, all emphasizing community-led sanitation and circular water management.

3. Wastewater as a Resource

Modern wastewater treatment focuses not just on pollution control but on resource recovery reclaiming water, nutrients, and energy. This supports:

- Water security through reuse in agriculture and industry.
- Nutrient recovery from biosolids as organic fertilizers.
- Climate action by reducing emissions and energy demand.

Thus, wastewater management becomes a driver of resilience, food security, and green growth.

4. Public Health and Livelihood Benefits

Untreated wastewater contributes to diseases like cholera and dysentery, especially in low-income settlements. Decentralized treatment safeguards public health while generating local employment, empowering women and youth, and promoting sustainable livelihoods through O&M and reuse-based enterprises.

5. Alignment with National and Global Goals

The proposed initiative directly supports:

- Swachh Bharat Mission (ODF+ / ODF++)
- AMRUT 2.0 & Jal Jeevan Mission
- National Climate Action Plan
- UN Sustainable Development Goals (SDG 6, 11, and 13)

By integrating technology, local governance, and community participation, the project aims to demonstrate a replicable model for inclusive and resilient wastewater management across India.

Mobile Septage Treatment Unit (MTU)

The Mobile Treatment Unit (MTU) is an on-site faecal-sludge treatment technology. It is a compact treatment system mounted on the bed of a truck, capable of treating the contents of septic tanks directly at the point of collection.

The MTU-treated septage effluent meets India's disposal standards, ensuring that the treated output is safe for disposal or reuse. The on-site mobile treatment unit functions through a series of processes that include solid–liquid separation, sludge thickening, and effluent treatment.

In operation, the liquid portion is separated from the solid fraction, and the effluent passes through the treatment process before being safely disposed of. The sludge thickening process further reduces the moisture content in the solid portion, making it easier to handle and transport.

The capacity of the mobile treatment unit ranges from 3,000 to 6,000 litres per hour (L/h).

The technology is developed by WASH Institute and commercialized by Bhouma

- Complete septage treatment system mounted on a truck.
- Designed to treat the contents of a properly constructed septic tank as per the IS 2470 standards at the site itself.
- Solid and Liquid Separation & Sludge (Solid) - Thickening through Centrifuge. Liquid treatment –Membrane Filtration.
- The treated effluent is safe for disposal on-site itself.
- Meets all national and international standards
- Operational capacity is 6000 liters/hour
- GPS and IoT enabled – Location of the vehicle, treated effluent quality etc. can be remotely monitored.

How MTU Treats Wastewater from a Properly Constructed Septic Tank

The Mobile Treatment Unit (MTU) operates on a robust solid–liquid separation and on-site treatment principle designed to handle septage directly at the point of generation. When desludging a properly constructed septic tank, the MTU performs a series of treatment steps that ensure both environmental safety and operational efficiency.

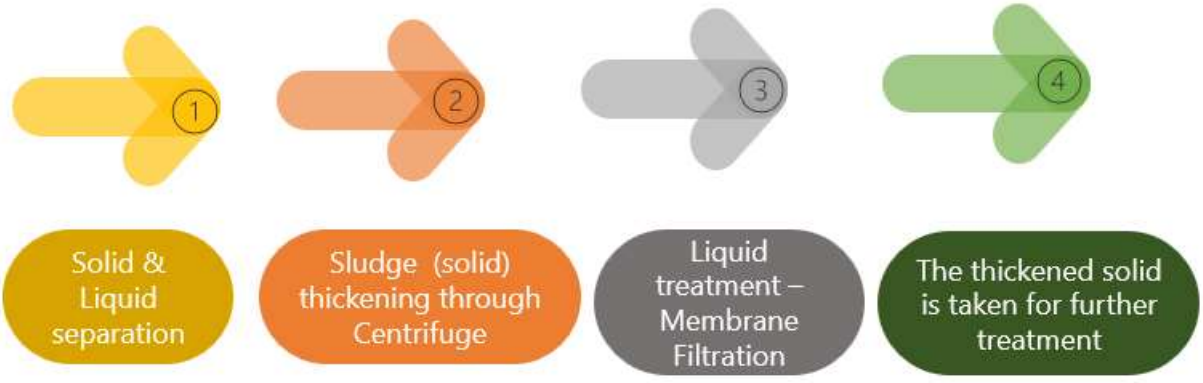
Solid–Liquid Separation: The incoming septage is first subjected to mechanical separation, where heavier solids and grit are isolated from the liquid fraction. This prevents blockages and facilitates efficient downstream processing.

Sludge Thickening: The separated sludge undergoes a thickening process to significantly reduce its moisture content. This process minimizes the sludge volume, making it easier and safer to handle, transport, or co-treat at a designated facility.

Effluent Treatment: The clarified liquid portion passes through an integrated treatment system—typically involving physical, biological, and/or chemical stages—to remove suspended solids, organic matter, and pathogens. The treated effluent thus meets safe discharge norms.

Safe Disposal or Reuse: The treated effluent can be safely disposed of on-site, as per regulatory guidelines, or reused for non-potable applications such as gardening, landscaping, or dust suppression.

Operational Capacity: Each MTU has a treatment capacity ranging from 3,000 to 6,000 litres per hour, enabling rapid, decentralized treatment of septage without the need for large-scale stationary infrastructure.



Approvals & Accreditations

MTU has been tested and validated by National & International Institutions such as Duke University, US in 2017; RTI international, US in 2019; BITS Pilani, Goa in 2020. MTU has also received many awards and accreditations.

Ministry of Jal Shakti – Department of Drinking Water and Sanitation

- MTU identified under *Swachh Bharat Mission (SBM) Kosh* as one of the approved technologies for septic tank cleaning equipment.
- File No: S-18011/12/2022-SBM-III-DDWS Date: 20.05.2022

Ministry of Housing and Urban Affairs (MoHUA)

- The Secretary, MoHUA issued a letter to all State Chief Secretaries directing urgent steps to stop manual desludging of septic tanks.
- MTU was specifically mentioned as an eligible product and process examined under the Emergency Response Sanitation Unit (ERSU) technology challenge.
- Letter No: DO. NO. Z-16025/3/2018-CPHEEO Date: 12.07.2019

MoHUA Advisory- "Sewer, Faecal Septage & Drain Cleaning Equipment Manufactured in India" (2019)

- Recognized MTU as one of the viable options for emptying and treating faecal sludge and septage through mechanized means.

Ministry of Jal Shakti – Empanelment under Jal Jeevan Mission / Swachh Bharat Mission

- MTU empanelled as an innovative technology for decentralized faecal sludge management.
- Letter No: W-11015/11/2022-JJM-VI-DDWS Date: 04.08.2023

Office of the Principal Scientific Adviser (PSA), Government of India

- MTU vetted and approved by a Technical Committee chaired by the PSA.
- Listed on the Jal Jeevan Mission website under PSA-approved projects.
- Reference No: S-000059 Date: 13.07.2022

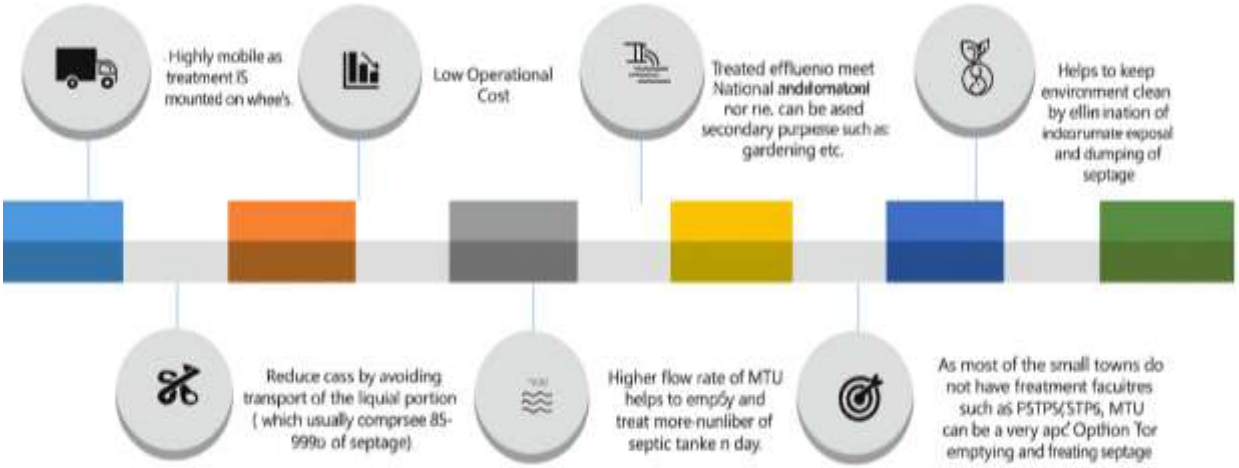
Suchitwa Mission, Government of Kerala

- Official communication regarding procurement and deployment of Mobile Septage Treatment Units across Local Self-Governments in Kerala.
- Letter No: 4744/G/2023/SM Date: 29.01.2024

Birla Institute of Technology & Science (BITS) – Pilani, Goa Campus

- Conducted field testing and validation of MTU's solid-liquid separation performance for treatment of faecal sludge from septic tanks.

Advantages of MTU



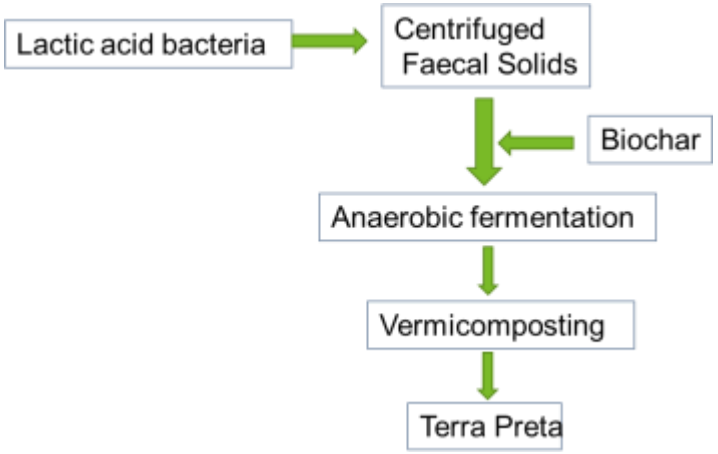
Sustainable Development Goal (SDG) Impact

SDG 3 - Good Health and well being	*Access to improved sanitation promotes health and wellbeing by reducing communicable diseases.*
SDG 6 - Clean water and sanitation	*Wastewater will be treated and can discharged to environment safely.*
SDG 8 - Decent work and economic growth	*The model aids increased economic growth and will ensure decent work environment.*
SDG 11 - Sustainable cities and communities	*Will bring improved sanitation accessible and affordable to all thereby improving their access to clean water.*
SDG 13 - Climate Action	*Project is capable to combat climate change and its impacts.*
SDG 14 - Life Below Water	*Project will help to prevent and significantly reduce marine pollution though wastewater discharges to sea.*
SDG 15 - Life on Land	*Project will have significant actions to reduce the degradation of natural habitats, halt the loss of biodiversity etc.*

Faecal Sludge to Terra Preta

The separated sludge from treated septic tank sludge will be processed at a centralized location using a patented technology developed by Bactreat Environmental Solutions, Birla Institute of Technology, Goa. The sludge is added with lactic acid bacteria and biochar, which then undergoes anaerobic fermentation and vermicomposting. Through this, the solids will convert to high fertile terra Preta compost. The quality of Terra Preta in the experimental design meets the FCO standards.

Process

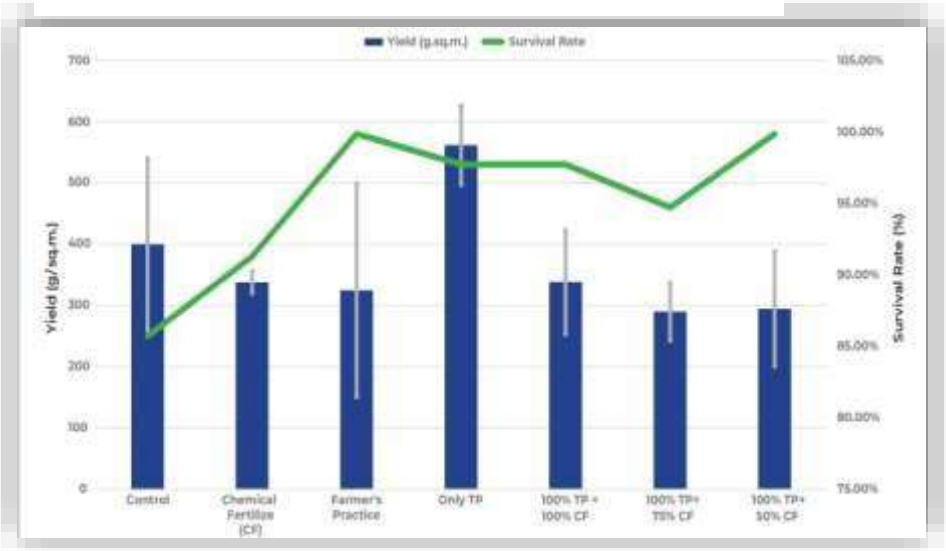


Highest to Lowest

Terrapreta Chili Data

Chili Bed Input	Yield (g/2,25 sq.m.)	Yield (g/sq.m.)	Survival Rate	Std. Error
Only TP	1263,63	561,61	97%	64,51
Control	899,53	399,79	86%	140,11
100% TP X 100% CF	761,17	338,30	97%	85,26
Chemical Fertilizer	760,17	337,85	92%	17,94
Farmer's Practice	730,83	324,81	100%	174,21
100% TP X 50% CF	662,63	294,50	100%	93,75

TerraPreta Chilli Yield vs. Survival Rate



Field experiments were conducted in the year 2020, at the agricultural field in St.Cruz, Goa, India (15.477727,73.84109). Same kind of test were done in Paddy, Brinjal etc. and found that terra Preta recovered from the sludge is more efficient than chemical fertilizers

Lab Testing of Terra Preta

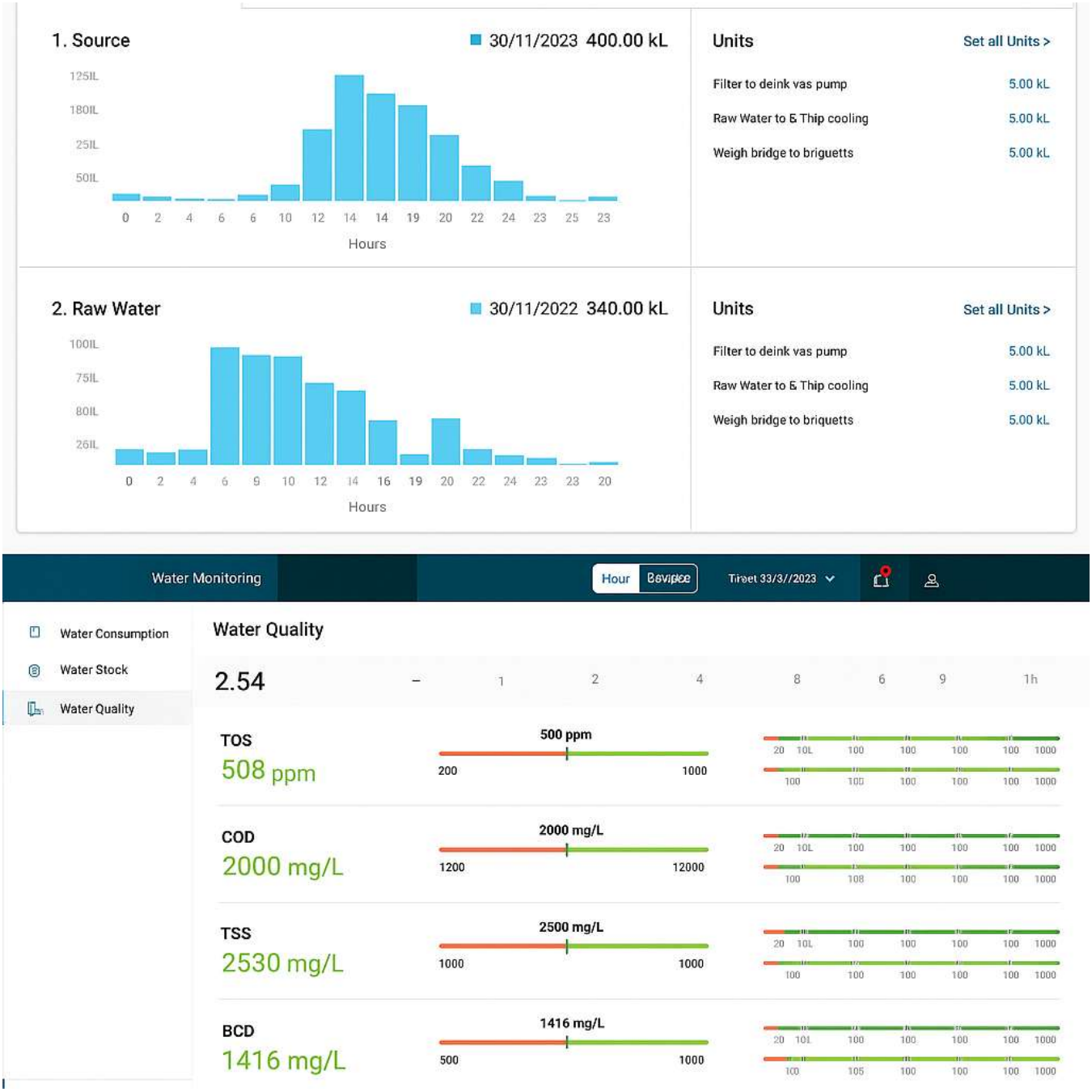
Quality of Terra Preta meets the Fertilizer Control Order Standards and the following is the test result of Indian Council of Agriculture Research (ICAR) Goa.

Sl.No	Parameter	Result	Specification (FCO 1985)
1	Moisture	27.47 %	25.0 % max
2	Particle size	93.75 %	Min 90 % material should pass throu g 4.0 mm iS sieve
3	Bulk density	0.842 g/cm^3	<1.0 g/cm^3
4	Total organic carbon	21.22 %	14.0% min
5	Total Nitrogen as N	1.88 %	0.5% min
6	Total Phosphate as PO_5	0.50 %	0.5% min
7	Total Potash as K_2O	0.35%	0.5% min
9	*C.N Ratio P*	2.73 %	<20.0
10	pH	11.29:1	6.5–7.5
11	Conductivity (as dsm1)	1.567	<4.0
12	*Arsenic as As_2O_3	Nil	10.0 mg/kg max
13	Cadmium as Cd	4.92 mg/kg	5.0 mg/kg max
14	Chromium as Cr	45.62 mg/kg	50.0 mg/kg max
15	Copper as Cu	109.75 mg/kg	300.0 mg/kg max
16	Mercury as Hg	38.13 mg/kg	50.0 mg/kg max

IoT System integrated in MTU

The Internet of Things (IoT) describes the network of physical objects -“things” - that are embedded with camera, sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. MTU is IoT enabled and generates online test reports like TSS, TDS, PH, Flow Rates etc.

Cloud Based Treatment Monitoring in MTU



Conclusion

India stands at a defining moment in its sanitation journey, where the success of infrastructure must now evolve into the success of sustainable operation. The Mobile Septage Treatment Unit (MTU) represents not just a product, but a paradigm shift in how urban and rural India can manage wastewater responsibly, efficiently, and inclusively. By bringing treatment to the source, it eliminates the need for costly, centralized systems, minimizes environmental risks, and empowers local governance to meet national and global sanitation goals with measurable outcomes.

Bhouma Envirotech Pvt. Ltd. envisions a future where every litre of wastewater is treated as a resource, every community becomes a stakeholder in its reuse, and every local body operates within a circular, accountable, and climate-resilient sanitation framework. Through its field-proven MTU technology, supported by national and international validations, Bhouma offers India a scalable, service-oriented model that transforms sanitation from a logistical challenge into an opportunity for environmental regeneration, livelihood creation, and social dignity.

By integrating engineering innovation, biological intelligence, and digital governance, the MTU initiative bridges the last-mile gap between policy intent and ground reality. It is a solution designed for impact reducing pollution, creating green jobs, and advancing India's commitments under the Swachh Bharat Mission, AMRUT 2.0, and the Sustainable Development Goals.

Together with state and local governments, development agencies, and community enterprises, Bhouma is ready to lead the next phase of India's sanitation revolution - one where every septic tank becomes a node of circular economy, and every treated drop contributes to a cleaner, healthier, and more resilient nation.

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Bhouma Envirotech Pvt. Ltd.
TC 4/1315, Kowdiar PO, Thiruvananthapuram, Kerala - 695003
sales@bhouma.com | www.bhouma.com