

Er. Aakash Patwa, Senior Project Associate & AcSIR Ph. D. Scholar, CSIR-NEERI working under the guidance of Dr. Ritesh Vijay, Scientist-F and Chair, Wastewater Management, CSIR-NEERI, received the “Best Poster Award” at the 2nd International Conference on Non-Sewered Sanitation Systems (ICNSS 2026), organized by the International Water Association (IWA) and Indian Institute of Technology (IIT) Palakkad, Kerala, during 9-12 July 2026, for his poster titled ‘Innovative Solid-Liquid Separation of Faecal Sludge/Septage along with Treatment and Resource Recovery.’

The poster showcased a patented nature-based technology for the separation, treatment, and resource recovery of faecal sludge/septage. The developed system enables efficient solid-liquid separation, reduces hydraulic retention time and footprint, and facilitates resource recovery through the reuse of treated solids and liquids. This Compact Faecal Sludge/Septage Separation and Treatment (CFSST) technology advances sustainable sanitation and reinforces CSIR-NEERI's commitment to circular economy-based faecal sludge management.

2nd International Conference on Non-Sewered Sanitation Systems (ICNSS 2026)
 “Rethinking Sanitation Systems for Inclusive and Sustainable Future”
 Indian Institute of Technology Palakkad, Kerala, India | 09-12 July 2026

Solid-liquid separation of faecal sludge/septage along with treatment and resource recovery

Aakash Patwa^{1,2}, Ritesh Vijay^{1,2,*}
 1. CSIR-NEERI, Wastewater Management Division, Sector 22, Yamuna Nagar, Mohali, Punjab 150012, India
 2. Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India
 *Corresponding Author: Ritesh.vijay@neeri.res.in

Introduction

- More than 3.5 billion people globally rely on On-Site Sanitation (OSS).
- Septic tanks, pit latrines, and aqua privies are the most widely used OSS facilities.
- Faecal sludge generated from OSS requires emptying, transport, solid-liquid separation, treatment, and reuse or safe disposal.
- Solid-liquid separation reduces sludge volume, improving the efficiency of downstream treatment and resource recovery.
- Conventional electro-mechanical separation technologies are energy-intensive, whereas drying beds require large land areas (40-180 m²/t/d) and long retention times (15-30 days).
- Present study develops and evaluates an innovative media and plant-based solid-liquid separation system with reduced retention time, smaller footprint, and minimal operation and maintenance requirements.

Result and Discussion

Demonstration

- Demonstrated at Gu-Vignan Aruvandian, Kerala (2024), Design: Maharashtra.
- Designed to treat 125 L/day of faecal sludge.
- Operational since July 2023, continuously treating septage from the nearby septic tanks.
- Features a perforated tray, four-side plant support bottom on, efficient, and some pH.
- Uses graded media with different sizes and natural plant species naturally decompose organic wastes.

Separation and moisture reduction

- Moisture content of the separated solids decreased from 90% to 50% on Day 5-6, confirming efficient dewatering.
- The optimized 5-6 day retention period solids with 50% moisture content, significantly reducing drying time compared to conventional drying beds.

Treatment Performance

- Achieved removal efficiency of TSS 98%, COD 87.6%, TN 44.8%, and TP 66.6%.
- Separated solids contained TN 7345 mg/g (0.5%), TP 4104.02 mg/g (0.4%), TC 1.8011 mg/g (0.1%), and TC 2332.0 mg/g (0.2%), indicating high nutrient recovery potential.
- Faecal coliform concentration of 5.5×10^4 MPN/g indicates the need for disinfection before agricultural reuse.
- Cost of the plant for 1 t/d system is INR 5 Lakhs and land requirement is 15 m².
- Less operation and maintenance with no chemicals and less energy use.

Design specifications

- Completely nature-based separation system.
- Integrated perforated tray and plant bed.
- Grated multi-layer filtration media.
- Multi-directional separation mechanism.
- Separation through exsurgency.
- Support bottom liquid collection.
- Waterlight solids outlet gate.
- Medium bed with less footprint.
- Less electro-mechanical equipment and energy (2 pumps for feeding faecal sludge).
- Cost-effective with less O&M.

Resource Recovery

- Soil Fertilizer
- Compost/Fertilizer
- Landfill
- Flowerbeds
- Waterbody

Conclusion

The developed media and plant-based solid-liquid separation system provides efficient separation (pathogen removal) through a compact, nature-based design. The system reduces hydraulic retention time, requires less energy, and facilitates resource recovery through the reuse of treated solids and liquids. The system requires post-treatment before reuse or safe disposal. Treated effluent and nutrient-rich solids resource recovery, promoting sustainable faecal sludge management and circular economy.

References

- CPHEO, 2013. “National on Sewerage and Sewage Treatment Systems”. Ministry of Urban Development, Govt. of India.
- Shukla, A., Patel, A., Patel, S., & Vijay, R. 2023. Review on generation, characterization, management, transport and treatment of faecal sludge and septage with resource recovery-oriented sanitation. *Environ. Res.*, 216, 114398.
- Patwa, A., Kumar, A., & Vijay, R. 2023. Critical review on on-site sanitation technologies: Typologies, treatment and transition towards circular economy. *Resource Technol.*, 110564.

Acknowledgement

The authors would like to acknowledge the Director, CSIR-NEERI, Nagpur, for providing the infrastructure and necessary support to carry out this Research & Development.

ICNSS 2026
 IIT Palakkad, Kerala, India

2nd International Conference on Non-Sewered Sanitation Systems

Best Poster Award

ICNSS

RECOGNIZED FOR INNOVATION. DRIVEN BY SUSTAINABILITY.
 Advancing faecal sludge management for a cleaner, inclusive and circular future.

INNOVATION SUSTAINABILITY RESOURCE RECOVERY

