

The concept of Zero Discharge Green Toilet (Zero D Green Toilet) was selected among 21 finalists out of 133 applicants in national level competition 'San-Sadhan' organized jointly by NITI Ayog, Atal Innovation Mission, Ministry of Jal Shakti, Department of Empowerment of Persons with Disabilities (DEPWD) and Bill & Melinda Gates foundation. The work was showcased at Ambedkar bhavan, Delhi to ministry officials, government dignitaries and subject matter experts from all over the country.

The objective was to provide sustainable, scalable and affordable solutions to make toilets more accessible for physically challenged people in rural area. We have dedicatedly focused on all the mentioned objectives along with sanitation as primary aspect while designing Zero D green toilet.

Key deliverables of the projects are following, along with secondary benefits which vary with the geographic location and user segment.

1. Zero solid waste discharge
2. No manual handling of fecal sludge involved
3. Almost Zero greenhouse gas emission
4. Natural air detoxification mechanism
5. No synthetic chemicals to be used
6. Urea, NPK extraction from urine
7. Water conservation

Rural community centric features

1. Recreational Space
2. Digital kiosk for information on sanitation and personal hygiene

One working rig of Zero-D Green Toilet with 1 WC and 1 urinal had been setup in IIT Bombay and was run for 2 years. It was exclusively dedicated to women and children to get the user feedback. It was independently operating and there was no connection with sewer line, apart from this there was no byproduct handling needed for the whole 2 years.

Zero-D Green Toilet

Sustainable Zero Discharge Toilet based on Soil Bio Technology
for rural community use

INTRODUCTION

This work has three prime objectives -

1. In situ waste processing
2. Sanitation via green chemistry
3. Ergonomics, accessibility and architectural aspect

The integrated wastewater processing system attached with the toilet complex addresses fecal sludge handling Issues. This work brings in 20 years of waste processing experience of IIT Bombay technology (Advance Soil Bio Technology).

The design aspect of toilet interior covers ergonomics for target user, ease of access and personal safety. Architecture is oriented towards scalability, while innovative material of construction choice is aimed for sustainability. Natural lighting, ventilation & indoor green space is integral to design of Zero-D restroom.

ZERO-D CHEMISTRY

Zero-D chemistry is unique in this design wherein waste streams from urinal & WC are processed separately to minimize odour & loss of nutrients inherent to conventional septic tank route of disposal.

- From urine, urea is captured on solid matrix which can be transported to farms as bio mineral fertilizer
- Fecal matter is processed in situ in ASBT reactor attached to toilet, hence no sludge generation/accumulation which implies no further fecal solid handling.
- Water is recycled for flushing & excess water for arboriculture
- Aerobic processing within ASBT implies no GHG emission

NATURAL SANITATION CHEMISTRY

Indoor air freshening via natural sanitizer & natural ventilation

Detoxification of indoor air through green wall technique

Judicious use of water in cleaning implies very low moisture retention on floor and wall surface which minimizes growth of infectious micro organisms

ERGONOMICS & ARCHITECTURE

The components of toilet are so arranged as to have ease of access for a wheelchair user as well as visually impaired. L shaped Handrails, tactile paving, emergency/help alarm system have been incorporated along with emergency door access from outside. Geometric grid framework is designed to make the toilet complex flexible for type and number of washroom units. Modular approach has been adopted and the design supports on-site assembly of components to ramp-up execution and scalability. Chosen structural dimensions and specifications comply with CPWD Standards

ACHIEVEMENTS

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Introduction and Achievements of Team

Dr Biplab R. Pattanaik is the Founder Managing Director - Life Link Eco Technologies Pvt. Ltd - a social business initiative for promotion of green technologies established in 2001.

He has co-authored 4 Patents(US Patent No: 6890438, 7604742B2; India Patent Application MUM/384/26, MUM/383/26) on Soil Bio Technology.

Prof. K. V. Venkatesh is Professor in Department of Chemical Engineering at IIT Bombay. He has total 160 peer reviewed publications and has guided 30 Phd theses till now.

Sharad Yadav is chemical engineering graduate from IIT Bombay with 2 years of industrial experience as process engineer.

SUMMARY

We have developed an approach which incorporates multiple innovative technologies related to sanitation chemistry and sustainability to tackle several environmental issues such as fecal sludge management, wastewater recycle and reuse, minimization of greenhouse gas emission from wastewater achieving clean air environment and recovering urea, N, P, K from urine through this mass public toilet project. The core wastewater treatment technology is based on one-time implementation of ASBT which requires minimal maintenance and monitoring.