

Towards a sustainable pit latrine management strategy through LaDePa technology

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South Africa, along with most of the developing world faces significant challenges in the provision of sanitation services in general but in particular to the urban poor. Although South Africa has made significant inroads into the backlog in sanitation by the provision of pit latrines, very little with regard to the management of pit latrines, once they are full, has been done, particularly with regard to their sustainability. Disposal of pit latrine sludge is a major health and environmental problem in the Third World. Furthermore, the sludge contains phosphates (a critical but diminishing resource) and other nutrients, which are generally wasted in current disposal methods.

LaDePa (Latrine Dehydration and Pasteurisation) is a machine that provides a containerized method of producing a nutrient-rich soil conditioner that is workable and improves sustainability on a number of fronts, by removing the detritus, pasteurizing and drying the sludge to beyond the sticky phase. Due to its use of low technology, the system relates well to the social environment where pit latrines are usually encountered in the developing world, urban environment, in that it provides both business and work opportunities for the poorly skilled.

The operation of the pilot LaDePa system in Durban and the Municipality's pit-emptying project, along with tests done on the product from the machine, indicate that it should significantly shift the pit latrine sludge management paradigm towards sustainability.

Roles of the various participants in the project

EWS is the Municipal department responsible for providing water services in Durban and the surrounding metropolitan area. In this project EWS has been both the project sponsor and a key contributor as patent holder and innovator of LaDePa as well as commissioning the pit emptying program. Particle Separation Systems Technologies (PSS) is a private company providing drying technologies primarily to the minerals industry. The company provided the key Parsep Dryer (a Medium Wave Infrared Radiation) and contributed as innovator (and co-patent holder) of LaDePa as well as taking responsibility for the construction of the pilot plant. SLB Consulting Engineers and GRP Plant Hire joint venture were responsible for the supply of pit latrine sludges and the operating of the LaDePa plant during the pilot project.

This article is based on the submission made by PSS and the eThekweni Municipality for the International Water Association's Project Innovation Awards in 2011. The submission won the Sanitation and Wastewater Hardware section of the Awards. More information on the Awards can be found at: www.iwa-pia.org/piadev_winners.html

Containerized LaDePa plant.





Inside the LaDePa: MIR arrays and exhaust waste heat hood

Major technical challenges

There are five major technical challenges associated with pit latrine management:

1. Space and access – prevents relocation of pit latrines in dense settlements and access for large scale mechanical equipment. In addition space is required for the final disposal of the sludge.
2. Human pathogen transmission.
3. Detritus disposed with the human faecal matter.
4. Material handling difficulties associated with the 'stickiness' of sludge.
5. Added transport costs associated with mass of excess water.

Simply assessed, the above five challenges focus the disposal of sludge as the crux of the pit latrine management problem.

From an environmental perspective, phosphates are a scarce, non-renewable resource found in urine and therefore deposited in pit latrine sludge. The current sludge disposal method not only wastes the phosphate and other nutrients, but also takes up air space on the landfill sites.

The social environment further complicates matters as the urban poor suffer from poor skills, particularly technical ones, and access to the mainstream economy.

Disposal of sludge at sewerage treatment works is not a viable option as it creates problems with the nitrification process and organically overloads the digesters.

The LaDePa system addresses the technical and environmental challenges directly and provides an opportunity to address some of the social challenges owing to its low technology which makes low technology pit emptying solutions viable.

Innovations

PSS's Parsep Dryer technology uses Medium Wave Infrared Radiation and a vacuum to draw air through a porous material or one with an open matrix. In LaDePa the sludge and detritus is separated by forcing the mix through a screw compactor with lateral ports through which the sludge is extruded while the detritus is ejected at the end of the screw. The extruded sludge falls onto a continuous porous steel belt in a thin layer of open textured material. The steel belt conveys the material into the Parsep dryer where it is dried and pasteurized.

The process can be containerized and powered by its own motor and generator for mobility, in which case pre-drying takes place using waste heat from the motor exhaust. The technology employed is, in the main, straight forward, basic mechanical and electrical engineering, which allows for low skills operation and maintenance.

The energy consumed by the plant per person is equivalent to approximately half that consumed on a conventional activated sludge plant.

The simplicity of operation allows for simple integration of the sludge treatment process with community needs, as it can be fed by simple pit-emptying technology,



Pasteurized 'Growetehk' fertilizer 80 – 90 % dry and bagged.

which in turn provides further jobs and up-skilling opportunities to the under-skilled.

Social and economic benefits and overall sustainability

The use of this technology can provide a healthy environment for people using pit latrines. It can also resolve the costly disposal problems facing municipalities and, in addition, would up-skill and empower pit-emptying contractors, thus creating an economic environment for otherwise unemployed people.

The product can also be reused as natural resources thereby empowering small-scale market gardening and self-sustaining gardeners. This would improve food security in many rural areas. There will be a substantial annual saving to the municipality concerned, due to low capital and operating costs and service delivery would be sustained.

Potential for replication and up-scaling

Pit latrines and their associated challenges as described above, are ubiquitous to the developing world providing a huge potential market for the technology. One of the



Inside LaDePa: MIR arrays viewed from the discharge end.

major advantages of the system is its small scale with low associated capital and operating costs which makes it ideal for cash-strapped municipalities or small-scale entrepreneurs to enter the market on a small scale and to systematically up-scale as finance become available.

Additionally, this process converts what was previously a waste into a saleable product, which offsets some of the cost associated with other disposal methods, thereby further enhancing the potential for commercialization of this technology.

In addition, wastewater treatment works, sludge also poses environmental challenges. This system potentially addresses this challenge as well and the combination of the opportunities posed by siting a LaDePa at a wastewater treatment works, further enhances the economic viability of the technology.



Motor exhaust heat transfer pipes into the LaDePa.

Conclusion

The deployment of the pioneering pilot LaDePa plant to treat the sludge produced from the Durban pit latrine emptying project was remarkably successful at producing a potentially marketable product from waste. The uninterrupted long production runs and the consistency of the product produced under working conditions bodes well for full commercialization. The eThekweni Municipality intends implementing a franchised continuous pit-emptying program anchored around LaDePa, starting when the next pit latrine emptying cycle is due. An environmentally safe sludge disposal technology is a critical component to the wellbeing of society and the environment and LaDePa's technology soundly addresses this.