Working Towards Improved Faecal Sludge Dewatering

As faecal sludge is comprised mainly of water, dewatering is one of the most important treatment processes. In collaboration with its research partners, Sandec is working on increasing the understanding of the dewatering process and developing appropriate solutions. Moritz Gold[1], Hidenori Harada[2], Richard Kimwaga[3], Charles Niwagaba[4], Linda Strande[1]

Introduction

Commonly, over 95 % of the faecal sludge collected by vacuum trucks is composed of water. Consequently, a truck with a capacity of 6000 litres transports 5700 kg of water and only 300 kg of solids. Improvements in dewatering could reduce faecal sludge management costs by:

- Reducing faecal sludge transport costs, e.g. through decentralized dewatering.
- Reducing treatment footprints by increasing treatment efficiency, e.g. use of conditioners to increase dewaterability.
- Increasing the resource recovery value of effluent and solids, e.g. producing faecal sludge that is 90 % dry, which can be used to generate energy.

This article gives an update on Sandec's research on the faecal sludge dewatering process and the development of efficient faecal sludge dewatering solutions for low- and middle-income countries.

Dewatering process

Dewatering properties, and hence the effectiveness of dewatering technologies and conditioners, vary between different sludge types. Among other factors, this is due to the different degrees of stabilisation and concentrations of total volatile solids, dissolved solids, sand, surface charge, particle size and protein content. Comprehensive research has been conducted on wastewater sludge dewatering, but is lacking for faecal sludge. Also, in urban areas, faecal sludge is normally collected from different onsite sanitation technologies, with different designs and operation and maintenance, causing a large variability in faecal sludge characteristics and dewaterability. To address this, we analysed more than 70 faecal sludge samples from different onsite sanitation technologies in Uganda, Vietnam and Japan for their dewatering and physical and biochemical properties. These are being compared with 18 wastewater sludge samples from Switzerland and values from a literature review.

Preliminary analysis shows that dewatering and the parameters influencing faecal sludge dewatering, for example, surface charge, which is a proxy for conditioner demand, vary between faecal sludge and wastewater sludge. The drivers for this variability are currently being analysed. This data is expected to inform how dewatering can be improved, for example, by operating onsite sanitation technologies differently or by pre-treatment, and to show whether wastewater sludge results are transferable to faecal sludge.

Geotubes

Apart from drying beds, geotubes, which are made from engineered geotextiles, are potentially an interesting technology for faecal sludge dewatering. In contrast to mechanical dewatering technologies (e.g. filter press or screw press), this technology does not rely on electricity or difficult to obtain parts for maintenance. Also, geotubes are already widely used for wastewater sludge dewatering, yet rarely in faecal sludge treatment. Solids in the sludge are contained in the geotube, while the free water drains out through the geotextile. Once the geotube is completely filled with solids, it is cut open so that they can be removed and used for resource recovery, and the geotextile is then disposed of.

In Kampala, Uganda, faecal sludge dewatering with geotubes is being investigated in laboratory and pilot scale experiments. Performance metrics, such as total suspended solid concentrations in the effluent, filtration rates and other factors, are being analysed. This study will also assess faecal sludge dewatering costs with geotubes, alternative geotextile materials, and reuse and disposal options for geotubes.

Locally produced conditioners

Worldwide, dewatering technologies are usually combined with conditioners to increase their performance and reduce treatment plant footprints. Chitosan has been identified as an effective conditioner for faecal sludge and has the potential to be produced locally from shrimp waste [1]. However, chitosan has only been researched in laboratory and bench-scale experiments with faecal sludge from septic tanks. In Kampala, Uganda, and Dar es Salaam, Tanzania, faecal sludge conditioning with chitosan is currently being evaluated with different types of faecal sludge, pilot-scale drying beds and geotubes (Photo 1). Along with optimal dosages, this research will also evaluate optimal operation (i.e. mixing time and speed, dosing location, etc.); this is required prior to full-scale implementation of chitosan as a faecal sludge conditioner.

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Photo 1: Faecal sludge dewatering research facility at the University of Dar es Salaam in Tanzania.

Conclusion

The goal of our research in this area is to produce results that provide solutions and can be implemented at full-scale, thereby, improving faecal sludge dewatering. Stay tuned for further results at www.sandec.ch/fsm_tools.

[1] Gold, M., Dayer, P., Faye, M.C.A.S., Clair, G., Seck, A., Niang, S., Morgenroth, E., Strande, L. (2016): Locally produced natural conditioners for dewatering of faecal sludge. Environmental Technology, 1–13.

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