

FAQ: Faecal Sludge Quantification and Characterization – Kampala

Through the collaboration between Sandec, Makerere University and the Private Emptier Association Uganda (PEAU), a new methodology for quantifying and characterizing faecal sludge on a city-wide scale that was developed by Sandec is being field tested in Kampala, Uganda. Lars Schoebitz¹, Charles Niwagaba², Okello Francis², Fabian Bischoff¹, Linda Strande¹

Introduction

Quantifying and characterizing faecal sludge (FS) at a city-wide scale in low- and middle-income countries is essential for planning and designing appropriate FS treatment facilities. Yet, reliable data and accepted methodologies for representative characterisation and quantification do not exist. FS characteristics are highly variable and are influenced by a wide range of existing technologies (e.g., lined VIP latrines, unlined pit latrines, septic tanks) in use at the household level, mixed greywater and blackwater systems, cistern toilets and pour-flush systems, as well as by the number of users per system, average desludging intervals and physical factors (e.g., soil, permeability, water table). Existing characterization studies also focus on the household level, whereas significant amounts of FS are generated at public toilets, commercial entities, restaurants and hotels.

In terms of quantification, a wide range of methods exist that base their assessments on different factors, resulting in widely variable values. These include: FS accumulation rates in onsite systems due to anaerobic digestion processes, FS production based on actual and hypothetical desludging intervals, and the FS collection rates of service emptying providers. The first two require data about the population and the distribution of onsite sanitation technologies, while the third requires data provided by the service providers.

Objective

The objective of FAQ is to develop an affordable and simple methodology that can be used to quantify and characterize FS on a city-wide scale, and fill the present knowledge gap. It is based on the spatial distribution of demographic data and on the hypothesis that this data can be used as predictors of FS characteristics. For example, income could have a correlation to FS characteristics due to such indirect factors as the type of onsite sanitation technology used, users' diets, number of users and desludging intervals. FAQ is currently being field tested in Kampala, Uganda. Tests are also being done in Hanoi, Vietnam in collaboration with PURR - Partnership for Urban Resource Recovery Project (See pp. 6–7).

Methods

Taking enough samples for statistically viable results to characterize FS at a city-wide scale would be very resource and time intensive. Therefore, the FAQ method was developed to provide a representative sampling scheme. The first step is a stakeholder analysis that identifies the key players involved in FS management to ensure that background data for the development of the characterization sampling plan and sufficient numbers for quantification are gathered.

The second step is to collect information about the context of the city. Secondary

data collection and interviews are done to gather the following information:

1. Definition of city boundaries;
2. Identification of onsite sanitation technologies within the city's boundaries;
3. Identification of FS producers;
4. Identification of service emptying providers;
5. Identification of FS discharge points.

This data can be obtained through various sources, i.e., a national census, sanitation master plans, urban development plans and stakeholder interviews. The data needs to be carefully analyzed in terms of how old it is, its validity, and the validity of future projections. Doing a sensitivity analysis can help to ascertain the influence of these factors.

FAQ Implementation in Kampala

FS in Kampala is collected by either the PEAU or the Kampala Capital City Authority (KCCA) and transported to the Bugolobi wastewater treatment plant (WWTP). Vacuum trucks, ranging in size from 1.8 to 10 m³, are used to empty septic tanks and lined pit latrines in accessible areas. Inaccessible areas, where unlined pits are the common onsite sanitation technology, are emptied manually. To gain an understanding of how much FS is collected in Kampala and from what locations, the FAQ method's first step was to implement a two week long truck counting study. Each truck driver entering and discharging FS at Bugolobi received a questionnaire with eight questions regarding such factors as the kind of onsite sanitation technology that was emptied and where it was located.

The results indicated that approximately 114 trucks discharge FS per day at Bugolobi, delivering an average volume of 577 m³ FS. Although both weeks had similar results, they are not necessarily reflective of how much FS is delivered over the entire year as this is also influenced by conditions, such as the rainy and dry seasons.



Photo 1: Sampling of faecal sludge at the influent of Bugolobi WWTP, Kampala.

The results of the questionnaire, which comprise Figure 1, indicate that almost no unlined pits were emptied during the study, while there was an almost equal distribution between septic tanks and lined VIP latrines. A result that was unexpected was that only half of the delivered FS came from single and multiple households, as shown in Figure 2. This confirmed that a lot of the FS that accumulates in unlined pit latrines in Kampala remains uncollected. This is significant because 37 % of the urban households utilize unlined pit latrines (KSMP, 2004). The amount of FS that was collected from industrial and commercial sources was unexpectedly high, as was the amount from schools and public toilets. This information was very valuable for the development of the sampling plan for the characterization study.

Based on the truck counting results and secondary data, a sampling plan was developed for onsite sanitation technologies in different income categories and the percentage of FS emptied from households, public toilets, schools, restaurants, hotels and commercial areas. This study did not collect samples from unlined pit latrines because vacuum trucks rarely empty

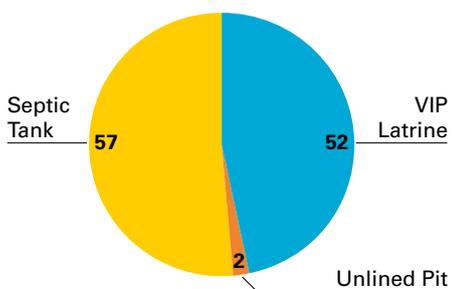


Figure 1: Average number of types of onsite technologies for faecal sludge delivered to Bugolobi.

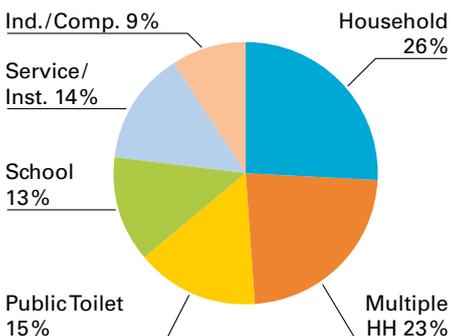


Figure 2: Percentage of faecal sludge from different sources delivered to Bugolobi.

these systems due to cost and their potential to collapse. In addition, the future use of unlined pits in urban areas of Kampala is not advocated for environmental protection reasons.

Characterization and quantification

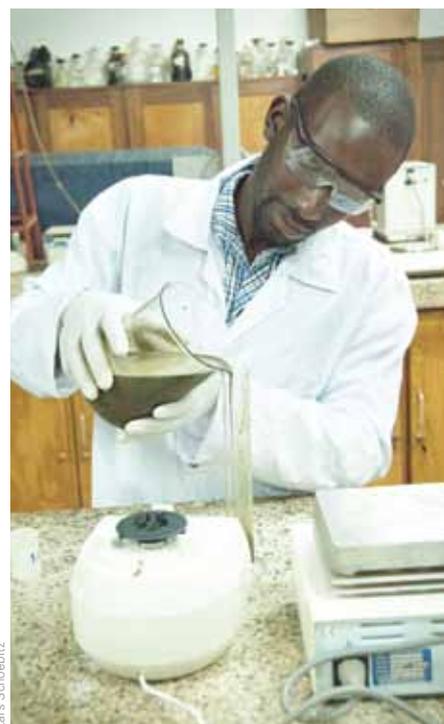
For the characterization and quantification study, a more comprehensive questionnaire was used that included information from household interviews. Data was collected about 18 parameters at the household level (e.g., number of users, greywater entering the system, desludging intervals, and use of bio-additives). The research team rode along with the truck driver during each individual emptying event to ensure the validity of the responses.

FS samples were also directly collected during the discharging process at Bugolobi (See Photo 1) and analysed at Makerere University (See Photo 2). 185 samples were collected over 22 weeks by a team of three people and were analysed for TS/VS, TSS/VSS, COD, TN, NH₄, NO₃, TP, and PO₄. Data analysis will evaluate the correlations between the FS characteristics and the household data. For example, more stabilized sludge has a lower TS/VS ratio, and usually correlates to a low number of users and longer desludging intervals.

The quantification of FS in Kampala will be based on the projection of the number of users of onsite sanitation for 2013, and this projection is based on an evaluation of 10 000 households [1]. The existing figures will be compared with the results of the truck counting study. By comparing the amount of FS that is collected with the distribution and accumulation at onsite sanitation facilities, it will be possible to estimate the quantity of sludge produced that is not collected and/or delivered to Bugolobi.

Conclusion

The implementation of the FAQ method in Kampala and Hanoi is on-going and final results of the characterization and quantification study will be presented in future publications. Several important lessons, however, have already been learned. For instance, conducting this study, especially the sampling, required the confidence and trust of the truck drivers, and this was developed due to the strong partnership established with PEAU. Also, weather and



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Photo 2: Faecal sludge analysis at the laboratories of Makerere University, Kampala.

traffic conditions, i.e., heavy rain and traffic congestion, significantly impact sampling procedures and have to be taken into account. Lastly, the logistics of the sampling process were continually optimized throughout the study.

[1] National Water and Sewerage Corporation (NWSC), Sanitation strategy and master plan for Kampala city. Vol. 2. Main report. Beller Consult-Germany, Mott MacDonald-UK and M&E Associates of Uganda for NWSC, Kampala, Uganda, 2004.

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