Preliminary mass balance on the BSFL facility in Durban

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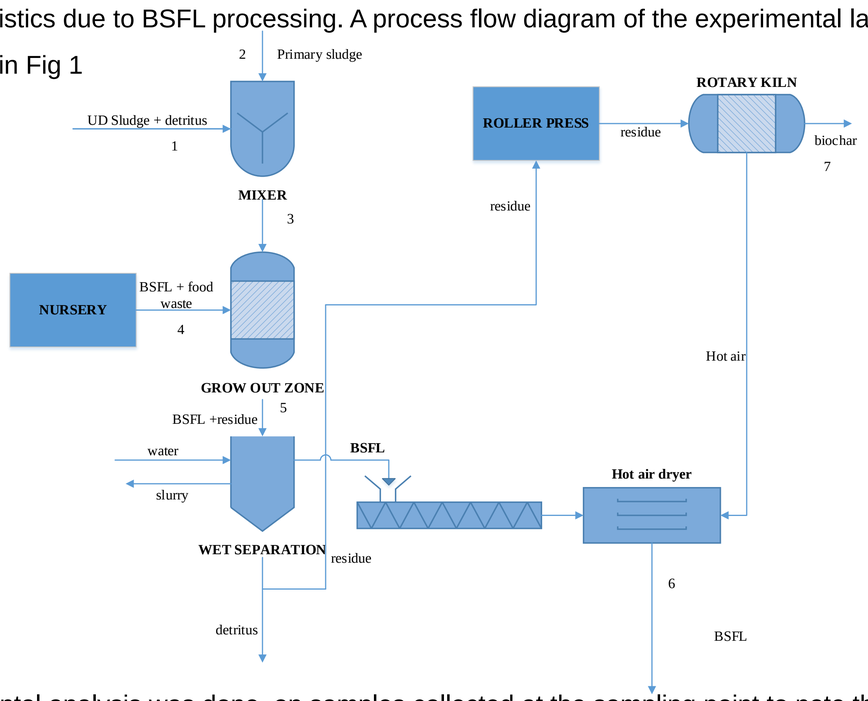
INTRODUCTION

Recycling of vital nutrients from urine diversion toilets (UDT) sludge in eThekwini was not done in a systematic way (Buckley et al., 2008b). There was a need to address the treatment of the faecal sludge and be processed into valuable products . Alternative methods for treatment of faecal sludge were needed from both economical and environmental perceptive. A viable solution for the faecal sludge is the use of the Black Soldier Fly Larvae (BSFL) which feeds on the UDT sludge thereby reducing waste volumes and the nutritional value of pre-pupae is approximately 44% dry matter containing 42% protein and 35% fat to provide a protein source for animal farming (Banks 2014). eThekwini Water and Sanitation are emptying approximately 80 000 UDTs in Durban . Khanyisa projects , with the funding from Bill and Melinda Gates foundation ,are investigating the treatment of faecal sludge at a Black Soldier fly (*Hermetia illucens*) larvae (BSFL) facility at Isipingo Wastewater Treatment works designed to treat up to 20 tons of faecal sludge per day. Data is not readily available on the characteristics of faecal sludge and the impact on the process.

METHODS

A mass balance of the relevant flows was done to quantify all material flows. Mass balances were carried out on approximately 1.5 tonnes feed of Primary Sludge and UDT faecal sludge under facility conditions. The experimental layout to accomplish the bioconversion rates and waste reduction was done on a smaller scale. Three trials of approximately 300kg were set up in the grow out area for monitoring in the change in characteristics due to BSFL processing. A process flow diagram of the experimental layout is shown in Fig 1

Fig 1;



Experimental analysis was done on samples collected at the sampling point to note the changes in the characteristics during processing with the BSFL after 13 days. The sample were analyzed for total solids to quantify the moisture content and volatile solids to quantify the organic matter s done were Total solids and moisture content, volatile solids which represented the organic.

RESULTS AND DISCUSSIONS

The mass balance was performed on the mixer and grow-out area. All data used was found experimentally. The mass balance of the mixer remained constant but the weighing bridge used has an error measurement of 5%.

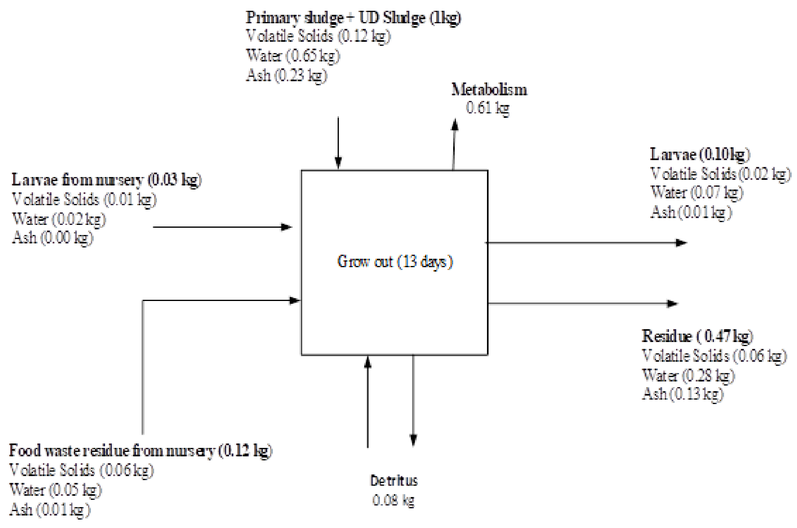


Figure 2: The mass balance of the grow –out area of the BSFL facility basis: 1kg of feed

Based on the mass balance there is a relative waste reduction of 56% on a wet basis and 41% on a dry basis. The waste to biomass of the BSFL conversion was 10% (g live BSFL/g wet mass added) and 17 % (g volatile solids/g volatile solids in the feed)

Physical and chemical characteristics

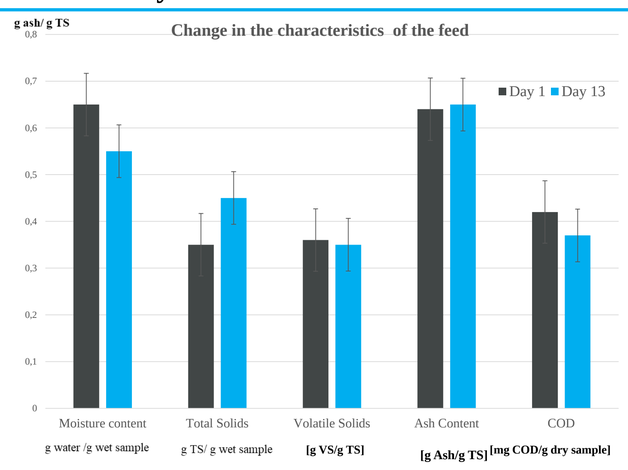


Figure 3: The change in characteristics of the feed due to the processing with BSFL

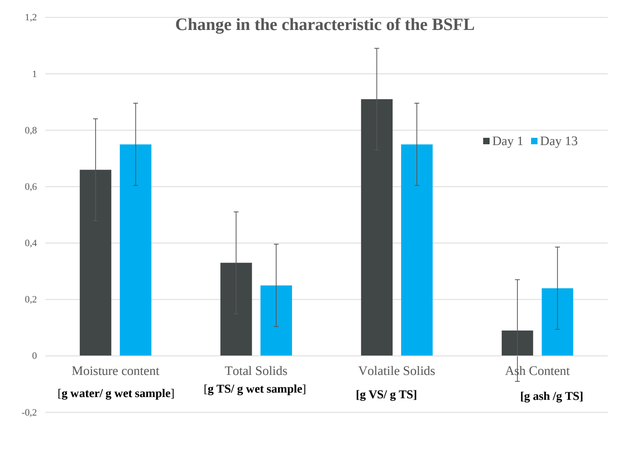


Figure 4: The change in characteristics of the BSFL due to the processing of the UDT

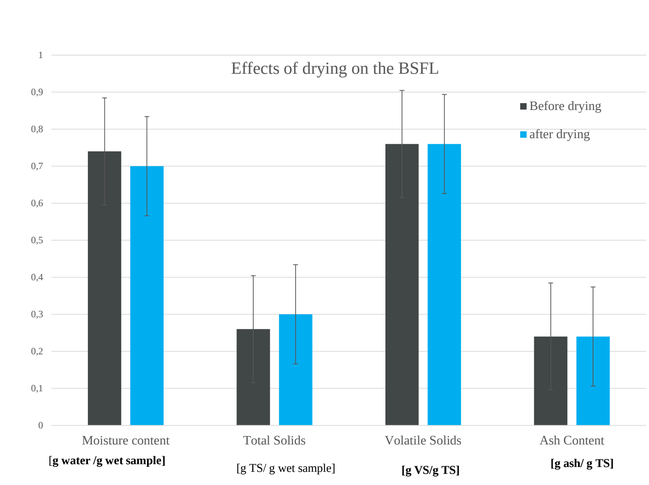


Figure 3: The change in characteristics of the BSFL due the drying process

CONCLUSIONS

- BSFL are capable of reducing the UDT sludge.
- The characteristics of the UDT sludge has a direct effect on the BSFL and this can reduce the market value.
- The plant still needs to be controlled and adjustments to be made to increase its efficiency

References:
BANKS ,I.J .2014.To assess the impact of Black soldier fly (Hermentia illucens) larvae on faecal reduction in pit latrines.Citeseer
BUCKLEY, C., FOXON, K., RODDA, N., BROUCKAERT, C., MANTOVANELLI, S. & MNGUNI, M. 2008b. Research into Urine Diversion, Ventilated Improved Double Pit Toilets (UD/VIDP) in eThekwini. Part A: Physical and Health-Related Characteristics of UD/VIDP Vault Contents 2008. *Water Research Commission: Pretoria, South Africa*, 69.

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