

Human waste as a feedstock for AD in low income countries

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- Project context and background
- Human waste characterisation
 - Faeces and Urine
- Faecal sludge from different sanitation systems
 - Pit Latrines
 - Public ablution blocks
 - Portable toilets

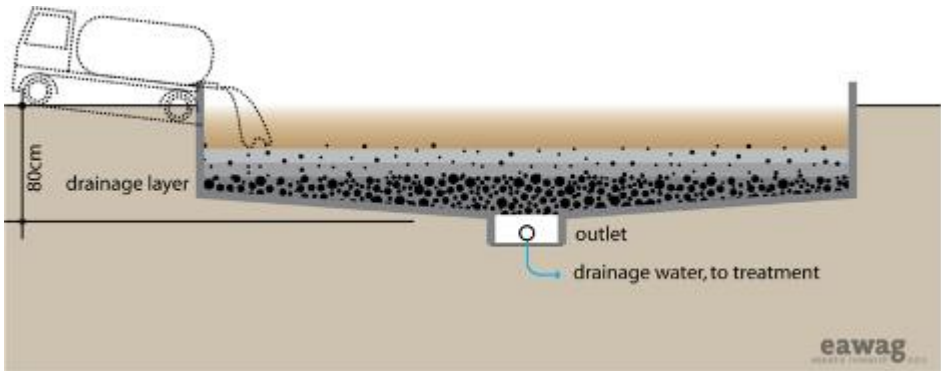
Context

- Inadequate sanitation facilities in low income regions
- Faecal sludge often disposed of untreated.
- Limited knowledge of human waste characterisation



Source: SuSanA, Flickr (2011)

**Drying bed
modification**



**Anaerobic
Digestion**

Source: Sandec/Eawag

**Human
Waste**



The need for waste characterisation

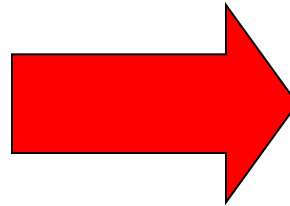
- Fresh faeces and urine characterisation for on-site sanitation technology development.
- Faecal sludge characterisation for semi-centralised treatment technologies

Human waste characterisation

Urine



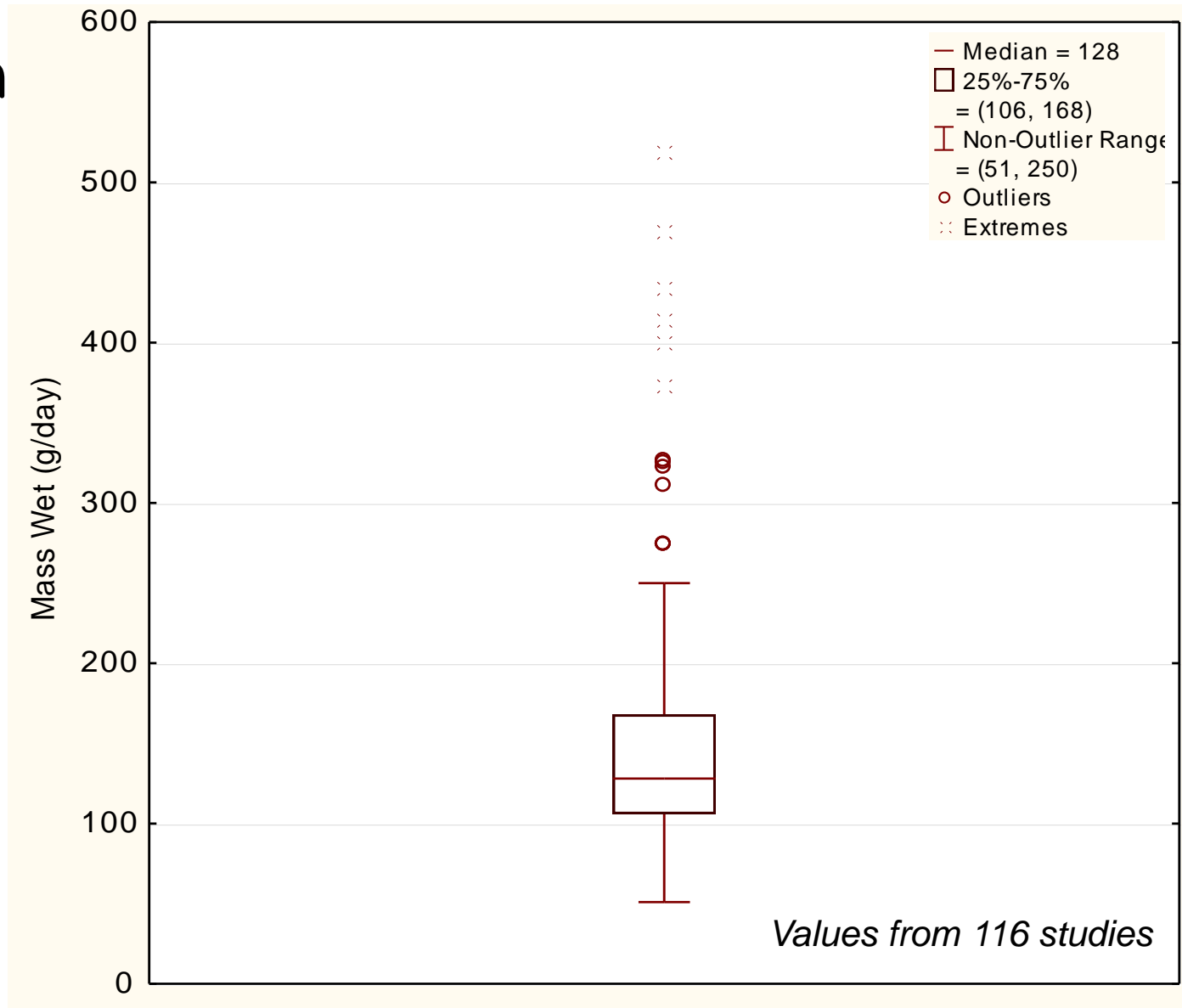
Faeces



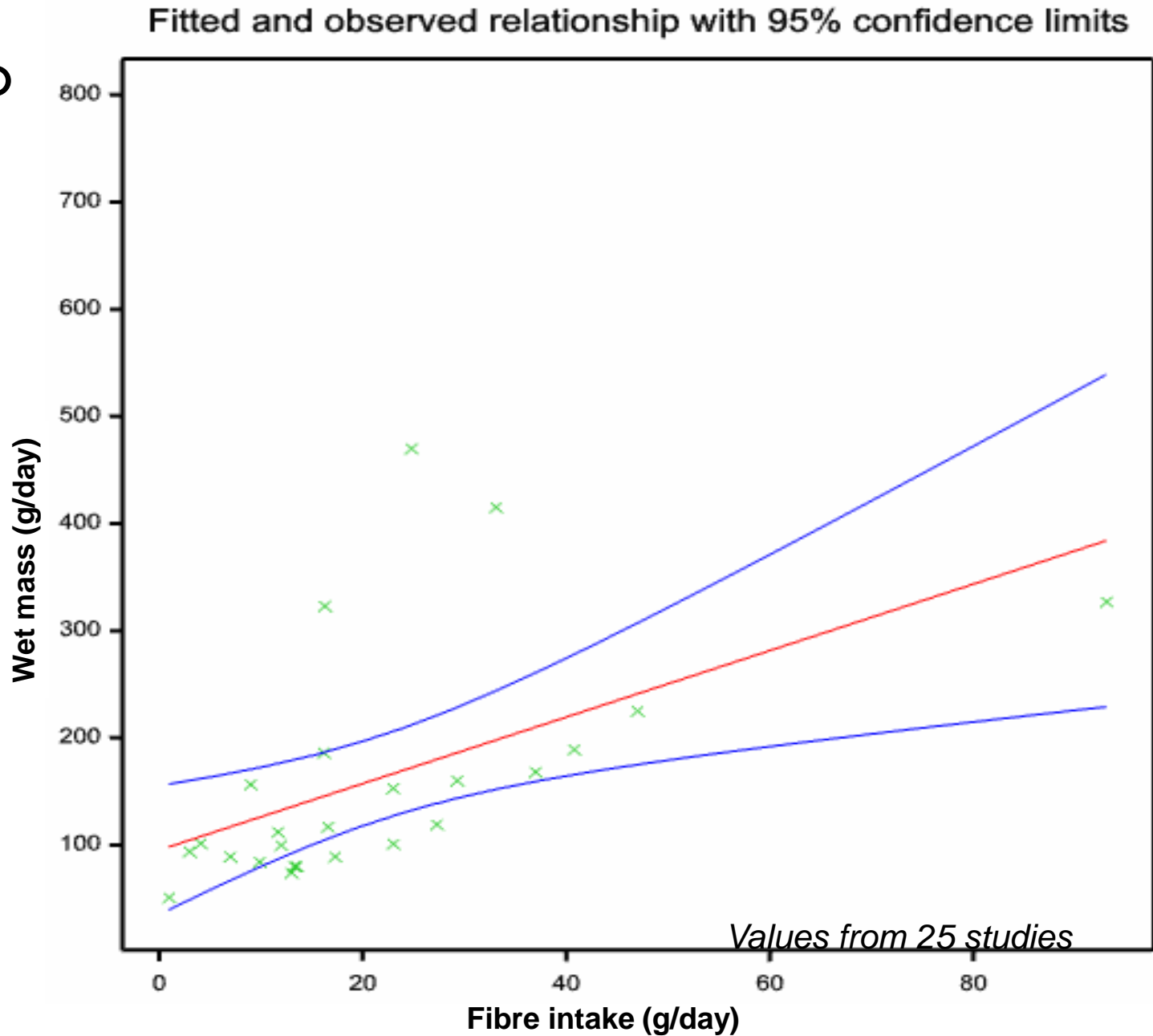
Faecal Sludge



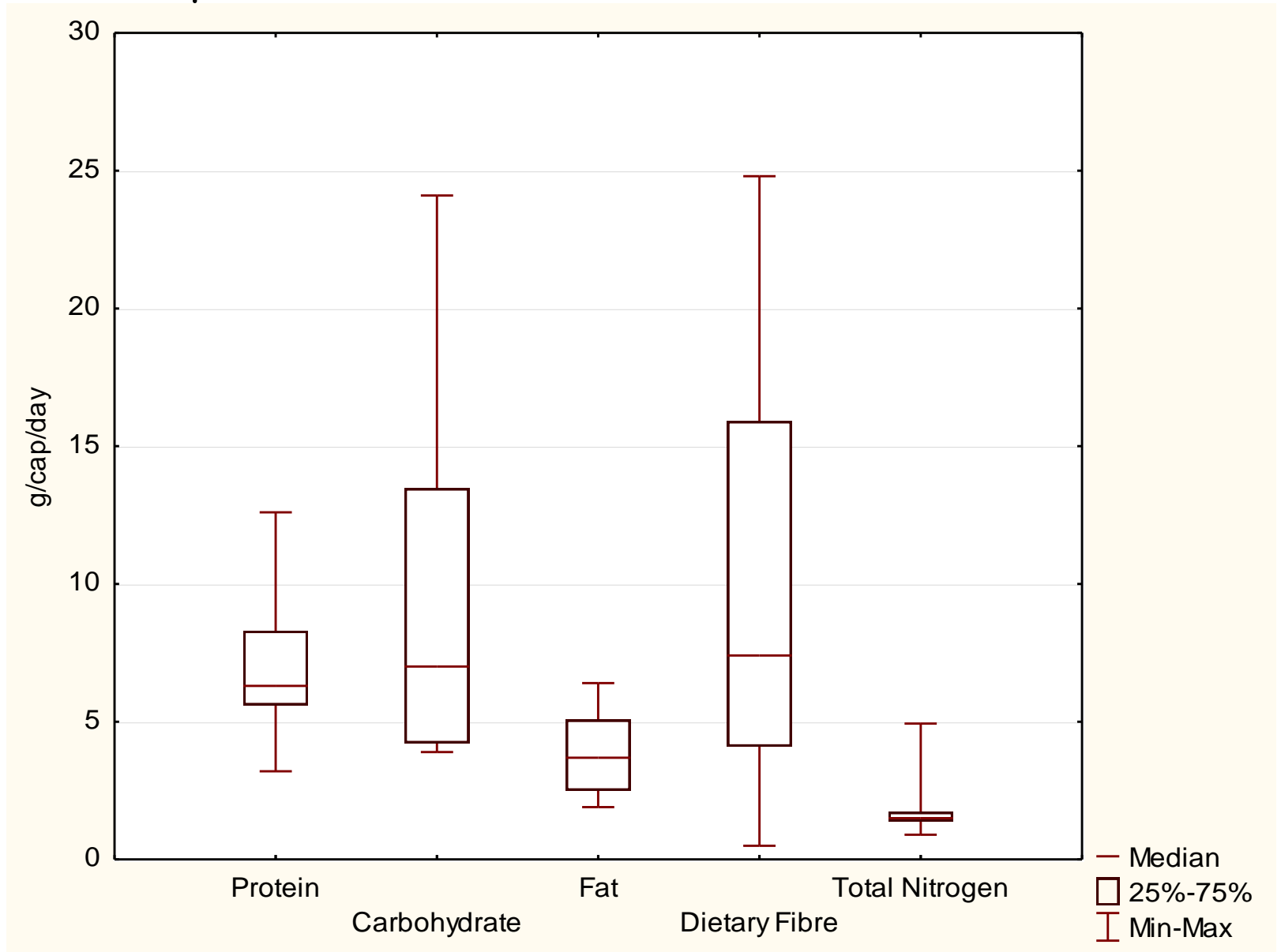
Faeces Production



Faecal mass in response to dietary fibre intake



Faecal Composition



Faecal sludge characterisation

Pit latrines



Public ablution blocks



Portable household toilets



Faecal Sludge from Pit Latrines

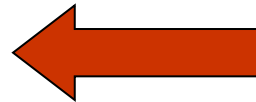
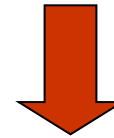
- Fieldwork undertaken in Lusaka, Zambia
- Newly implemented Faecal sludge management programme
- Tackling the problem of full pit latrines



Pit Emptying



Barrel Washing



Screening/Dilution/Digester

Transportation

Faecal Sludge Analysis

Chemical

- Total N
- Organic and Inorganic N
- Phosphorus
- Potassium
- Total/Soluble COD
- VFAs

Dried solid analysis

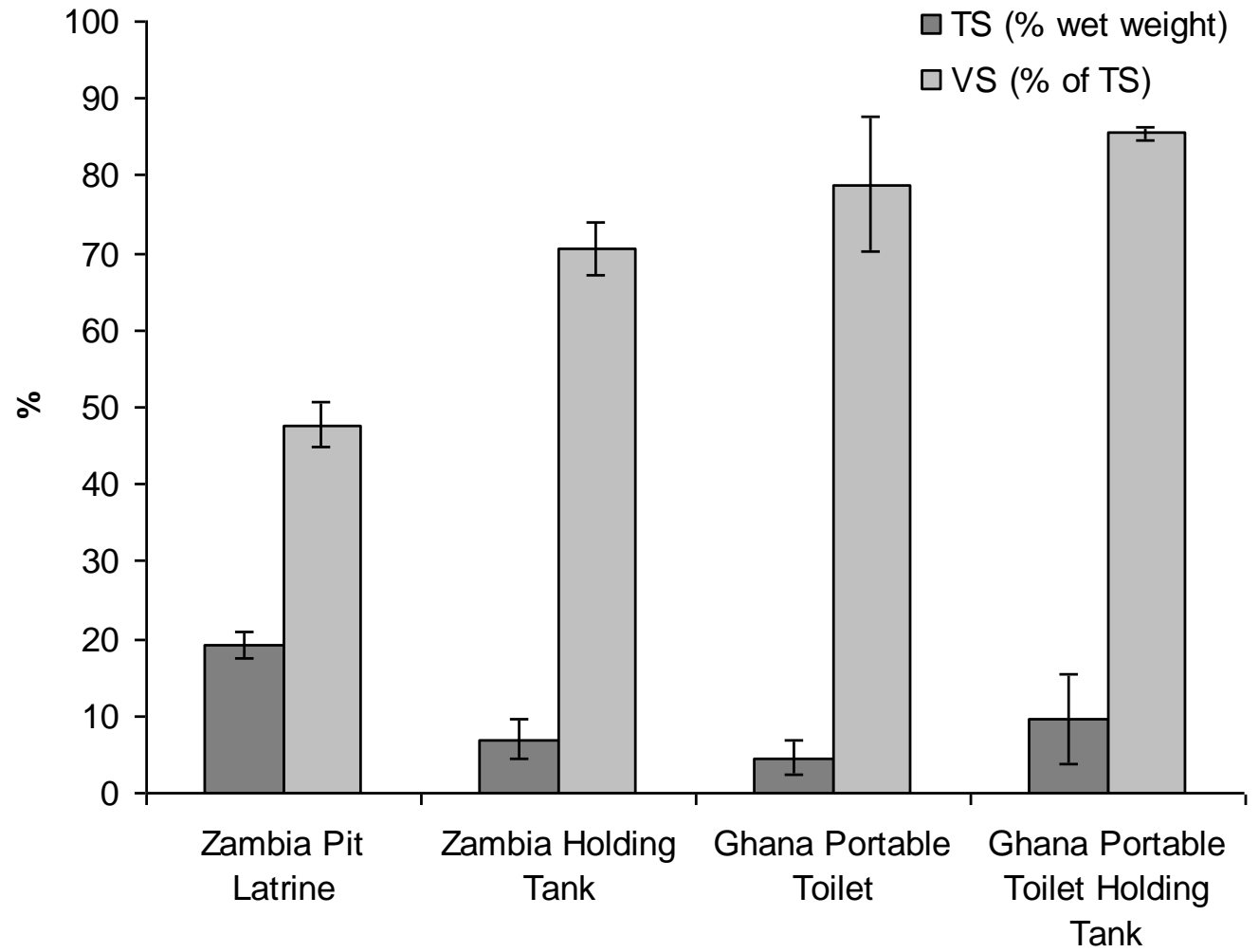
- Total CHN
- Total P
- Heavy Metals

Biological

- Faecal Coliforms
- Bio Methane Potential Tests

Physical

- Total Solids
- Volatile Solids
- Particle Size Distribution



Pit latrine sludge as an AD feedstock

- Pit latrine FS characteristics:
 - High TS content (19%)
 - Low VS content (50% of TS)
 - High $\text{NH}_4\text{-N}$ (1800 mg.L)
 - High organic N (2700 mg.L)
 - High pathogen load
 - No limiting heavy metals
 - High inorganic solid waste



Faecal sludge from pit latrines

Solid Waste

4 barrels of rubbish
removed from 12 barrels
(60L) pit latrine sludge



Above: 33% Solid Waste

Below: 3% Solid Waste

- Solid Waste can be up to 50% of volume removed
- Usually 10-20% of FS volume

Quantity removed from
12 60L barrels of
ECOSAN waste



Conclusions

- High strength concentrated sewage stream.
- Large variation within and across studies.
- Very dry pit latrine conditions observed in Zambia.

Questions?

References

Prüss-Üstün, A., Bos, R., Gore, F. and Bartram, J. (2008), *Safer water, better health: costs, benefits and sustainability of interventions to protect and promote health*. World Health Organization. Geneva.

Water.org (2012) Banesa's slum get a toilet, embraces health, available at: <<http://water.org/post/banesas-slum-get-toilet-embraces-health/>> (accessed 19th November 2012)

WHO/UNICEF (2012), *Progress on drinking water and sanitation; 2012 update*, MDG assessment report, Joint Monitoring Programme for Water Supply and Sanitation, U.S.A.

Project background

- Characterisation of human waste inputs
- Re-using the outputs of anaerobic digestion
- Nutrient Recovery through modified drying beds