DEFAST

TESTING A LOW COST DECENTRALISED FAECAL SLUDGE TREATMENT SYSTEM (DEFAST).

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WATER FOR PEOPLE- UGANDA

20/01/2015

FSM3

WATER RESEARCH COMMISSION

water for people
everyone | forever

INTRODUCTION

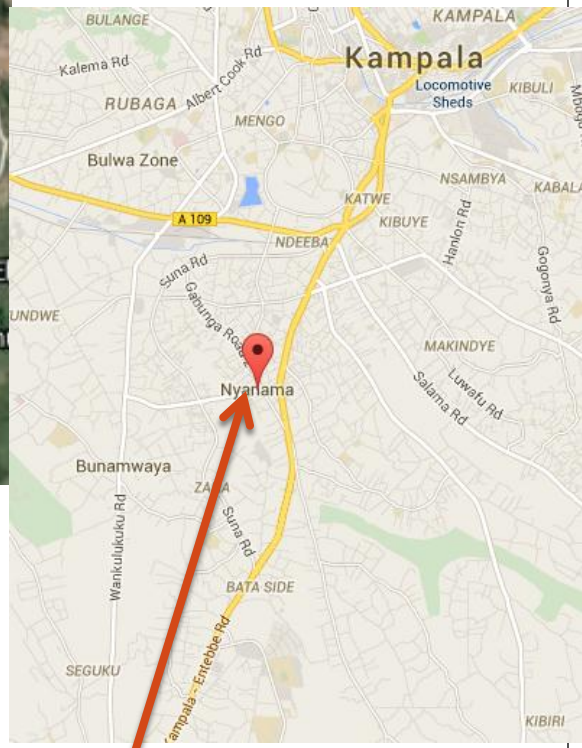
- Water for People is an international NGO based in the U.S.A.
- **Vision:** a world where all people have access to safe drinking water and sanitation, a world where no one suffers or dies from water – or sanitation – related disease.
- The Sanitation hub codenamed "***the Sanihub***" is a key program in ensuring we reach the goal of sustainable sanitation in Uganda through action research.
- It facilitates a process of technology development with local and international partners. They include fabricators, local NGOs, local governments, ministries and learning institutions.
- Key partners: WRC, KCCA, NWSC, Makerere University

Project location

Uganda

Kampala

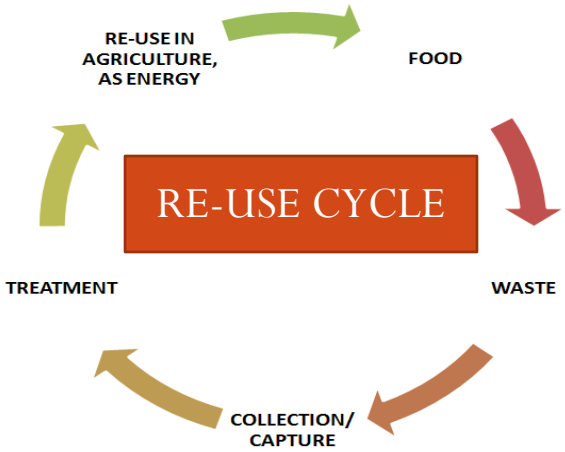
Lubaga and Makindye divisions



DEFAST Site

Faecal Sludge(FS) definition

- Faecal sludges (FS) are sludges of variable consistency accumulating in septic tanks, aqua privies, family pit or bucket latrines and unsewered public toilets.
- Faecal Sludge is raw or partially digested, slurry or semi-solid.
- Its management involves capture/storage, collection, transport, treatment and reuse.



Overview of FSM in uganda

- Most of the towns in Uganda are served by wastewater stabilization ponds, conventional wastewater plants and only one (Lubigi) is designed to intake faecal sludge.
- Some developing towns have no treatment plants

Faecal sludge situation in Kampala

- Kampala city has the highest sewerage coverage in Uganda of about 7% *(Semiyaga et al 2012)*.
- Key OSS: Ordinary pit latrines, VIP, Septic tanks, pour flush, etc
- Emptying is done by use of cesspool trucks, Gulpers and Manual emptiers. The common challenges these service providers face is high transport cost and high traffic jam to access wastewater treatment plants.

Gulping and transportation to DEFAST

Emptying with Gulper II

Moving to pick up

Loading in bigger barrels

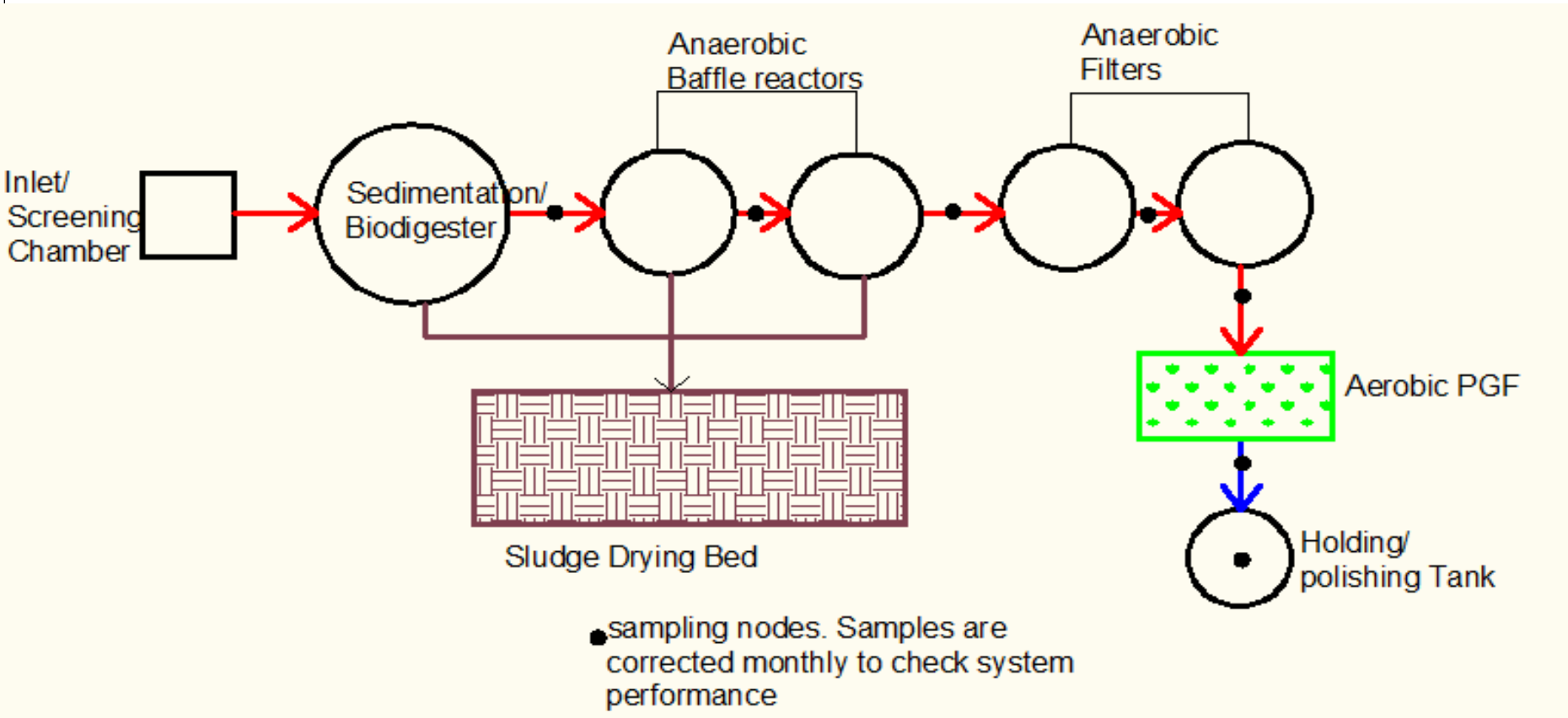
Transport to DEFAST

Loading the DEFAST inlet

THE DEFAST PILOT PLANT-Major units

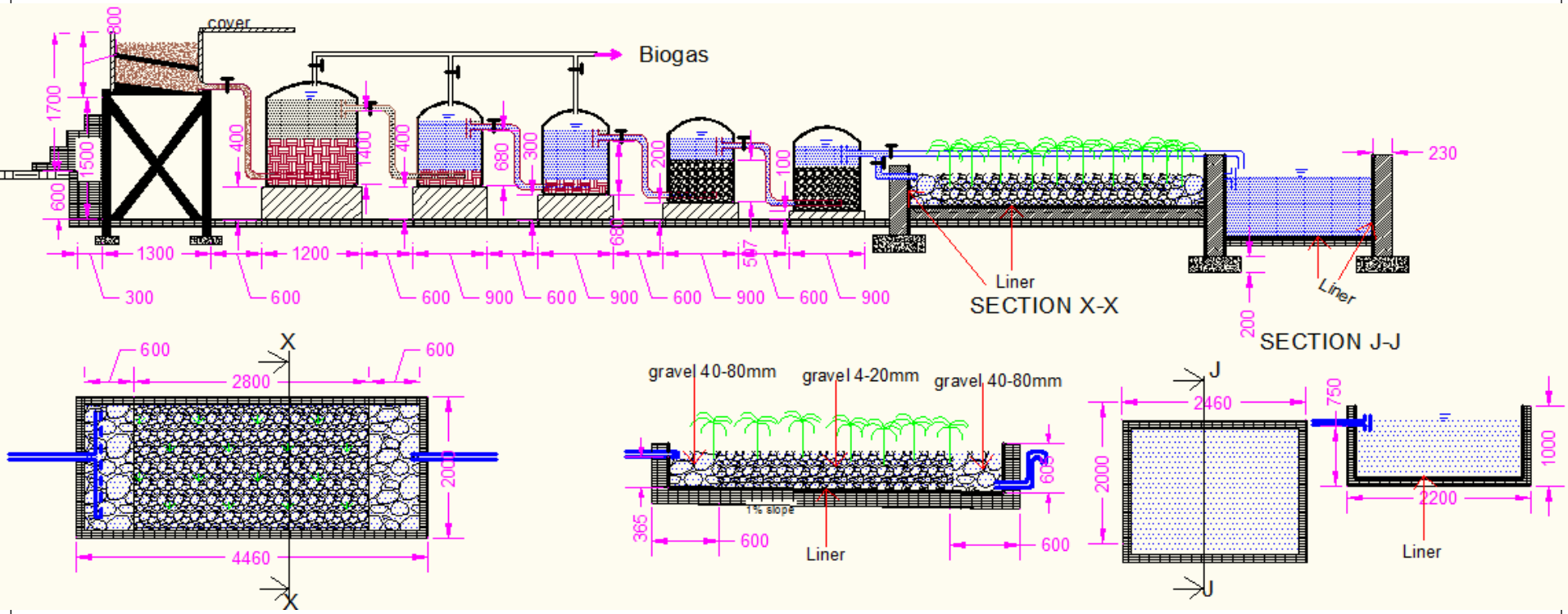
- **Inlet/screening**: to remove **non biodegradable** and large solid substances passing through gulper screens
- **Sedimentation:** For **dewatering**, **separation** and biodigestion.
- **ABR**: The sludge layer to 1/3 rd of tank height support growth of anaerobic microorganisms which degrade **organic pollutants**. Highest removal efficiency expected.
- **Anaerobic Filter:** The medium is expected to support the growth of biological film that traps some **pathogens, Suspended Solids** and other remaining pollutants.
- **Aerobic Planted Gravel Filter**: The flow is lateral and the unit removes **smell** and **color** plus some pollutants both organic and inorganic.
- **Non planted roofed drying bed**: Dewatering of digested faecal sludge

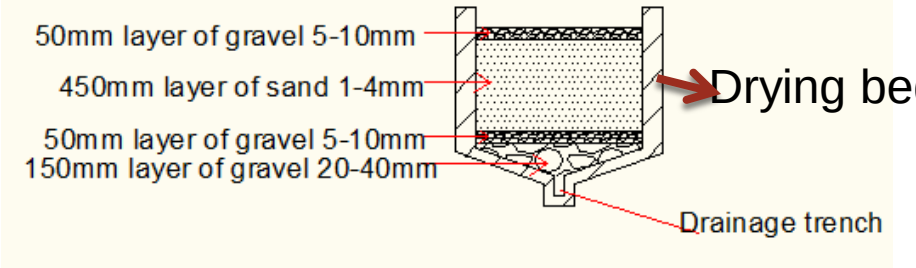
Schematic layout



Inlet tank made of steel -1000l
Biodigester (2000l), ABR and 500L each tank, all made out of plastic tanks and interconnected with HDPE Pipes.
PGF(3X2m) planted with papyrus as dominant plant
Drying bed 2.4x 2.2m

Detailed drawings





Drying bed section

Pilot plant facts

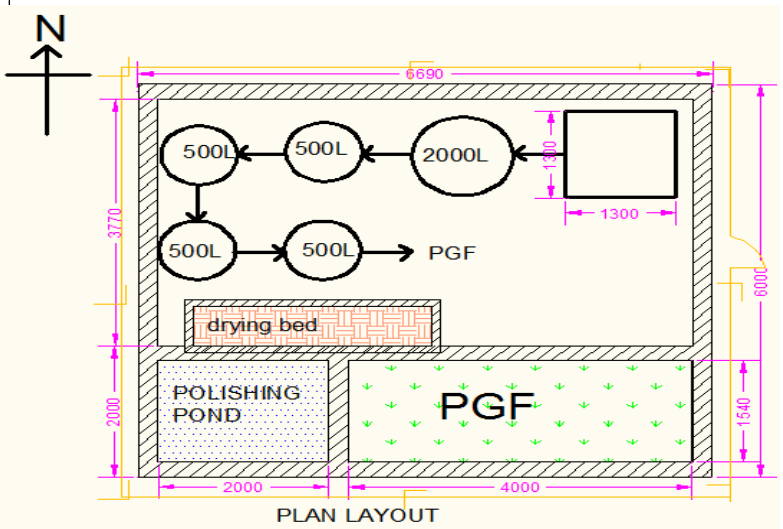
- The plant is on a 6x6m plot of land.
- Flow: upflow -semi batch process
- HRT 10 days under anaerobic conditions
- Loading rate : 500l/d
- Upflow velocity <0.5m/hr.
- Treated over 44m^3 of faecal sludge from gulpers
- Desludging through washouts,

3-5 weeks for Dewatering unit.

- Filtration media: aggregates 2-40mm
- PH: 7-9,Room temperature (25 degrees celicious)

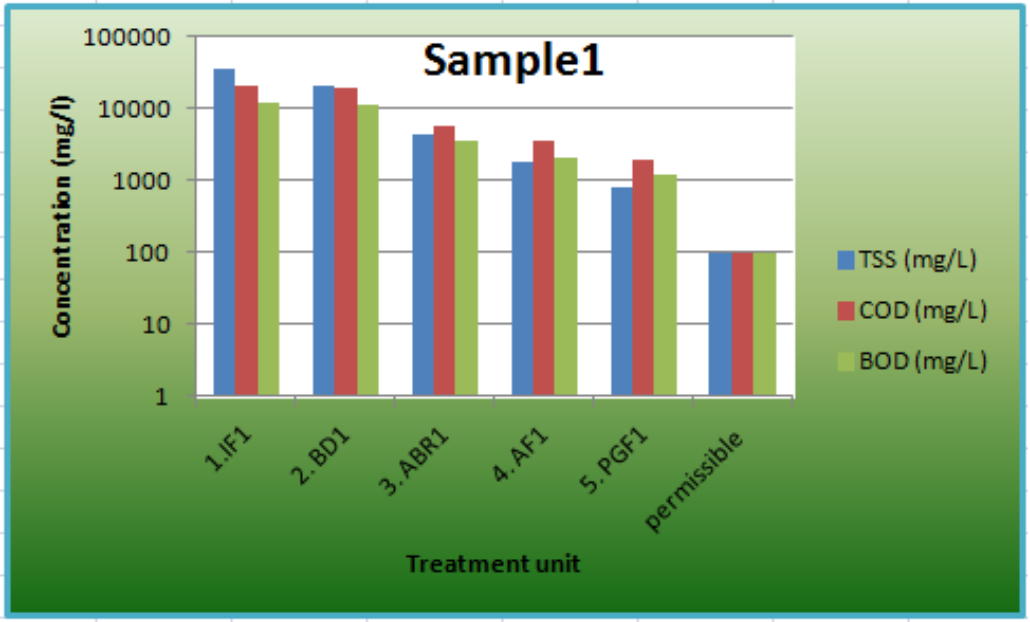
FS sampling in septic tank to guide in sizing

Plan and as built pictorials



Results from plant monitoring

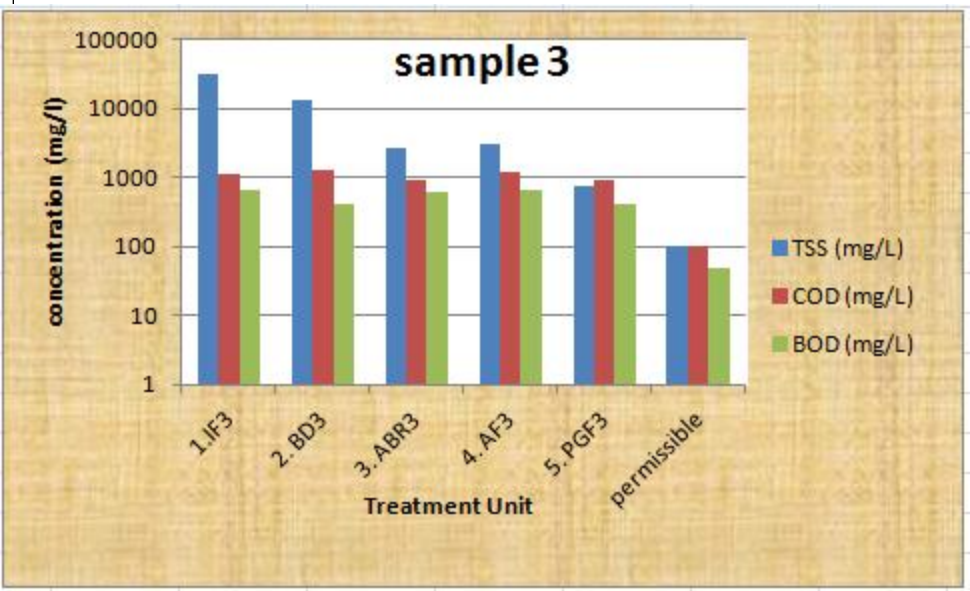
The graphs show the trend of pollutant concentrations across the system for 5 samples

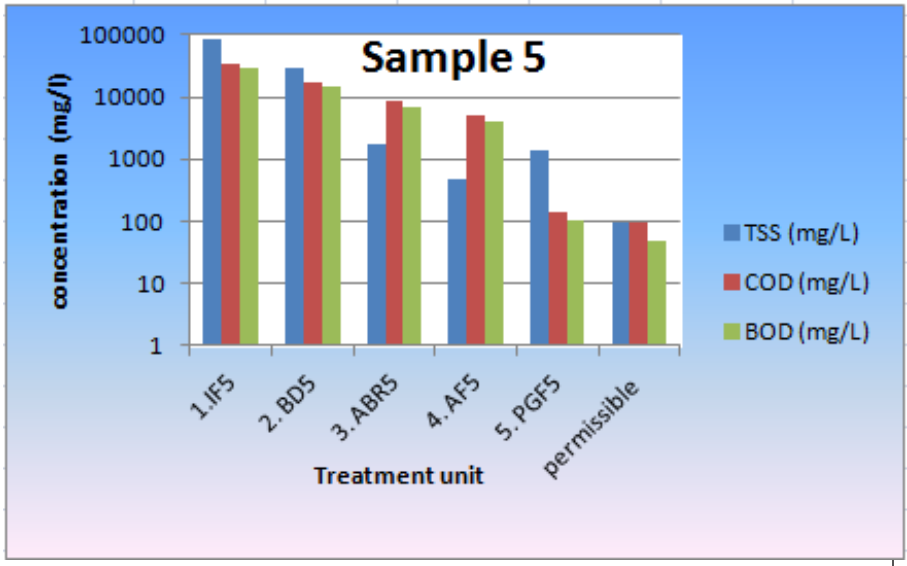


General reduction in pollutant concentrations across the system. Highest removal efficiency is in ABR

Sample source	1.IF1	2. BD1	3. ABR1	4. AF1	5. PGF1	permissible for discharge	over all efficiency
TSS (mg/L)	35967	20305	4489	1877	792	100	97.8
COD (mg/L)	20570	19580	5748	3535	1886	100	90.8
BOD (mg/L)	12100	11250	3500	2150	1180	100	90.2

Results ct'd





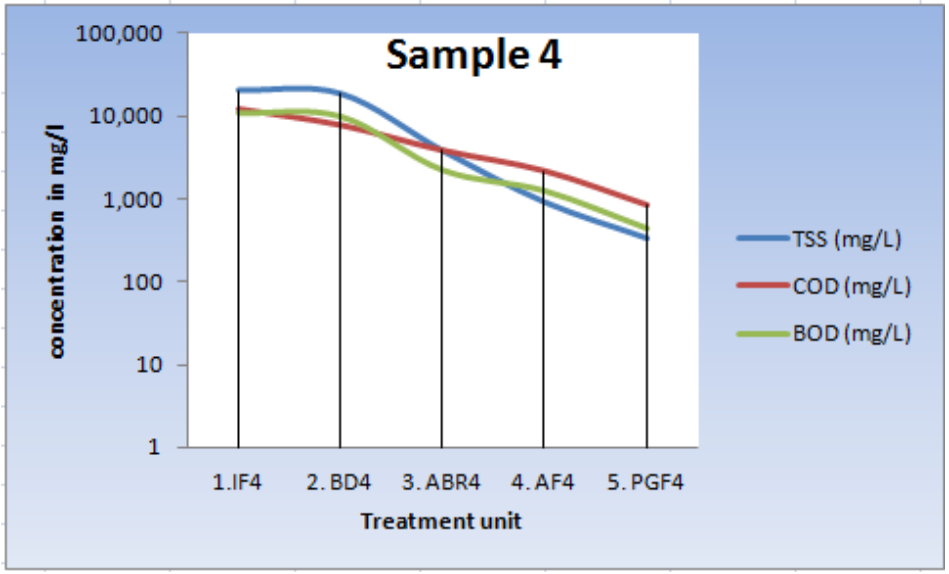
BOD and COD values were very low compared to other results. Percentage reductions across system was insignificant. Attributed to loading with septic tank sludge which was stable.

Sample source	1.IF3	2. BD3	3. ABR3	4. AF3	5. PGF3	permissible	over all efficiency
TSS (mg/L)	31060	13520	2750	2970	749	100	97.6
COD (mg/L)	1134	1255	916	1197	899	100	20.7
BOD (mg/L)	658	406	624	672	402	50	38.9

Highest efficiency achieved so far (over 98%). Key factors plant age, rainy season

Sample source	1.IF5	2. BD5	3. ABR5	4. AF5	5. PGF5	permissible	overall efficiency
TSS (mg/L)	82688	29308	1728	488	1348	100	98.4
COD (mg/L)	33447	17651	8560.6	5046.9	143.31	100	99.5
BOD (mg/L)	29591	14452	6713	4005.1	100.52	50	99.7

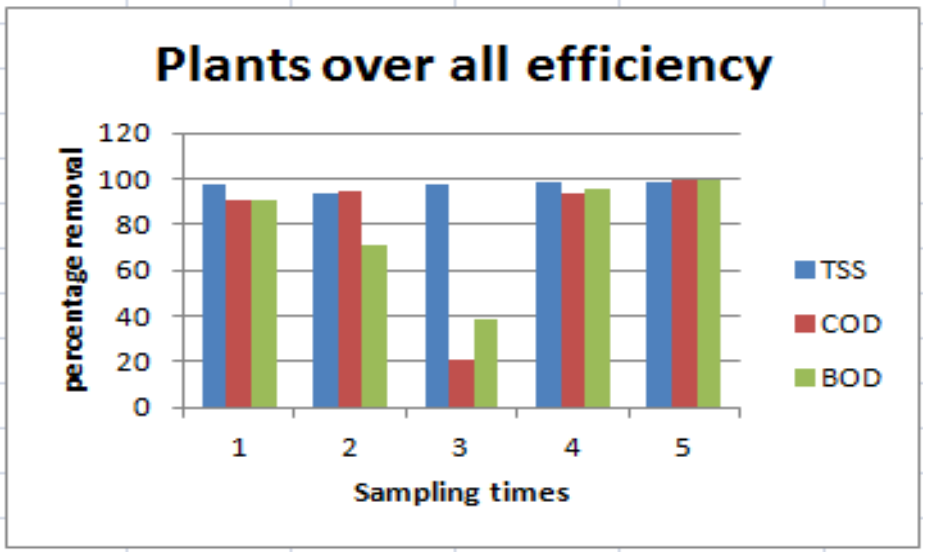
Results ct'd

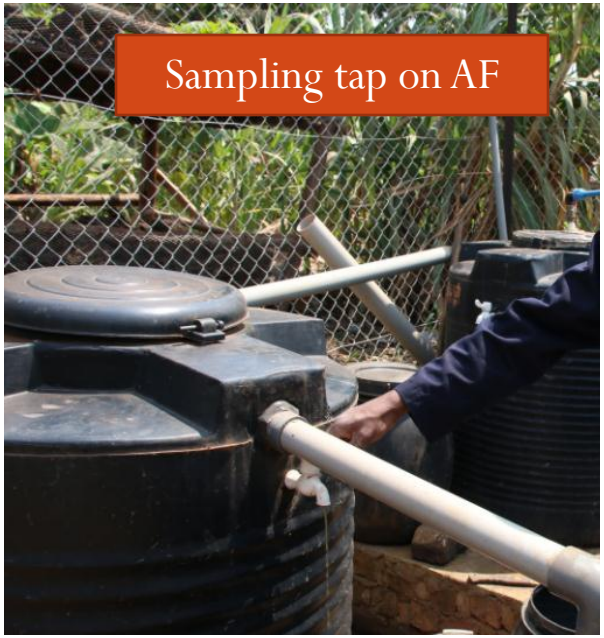


Sample source	1.IF4	2. BD4	3. ABR4	4. AF4	5. PGF4	permissible for discharge	over all efficiency
TSS (mg/L)	20,300	18400	3800	920	340	100	98.3
COD (mg/L)	12,250	7800	3840	2150	830	100	93.2
BOD (mg/L)	10,700	9700	2200	1240	440	50	95.6

- General reduction in concentration of pollutants across the system. Efficiency estimated over 93%.
- Doesn't meet Uganda discharge standards.
- Due to variations in parameters of raw faecal sludge, its difficult to compare treatment efficiencies with time.

Summary of general plant efficincy





parameter	June	August	Sept	Nov	Dec
TSS (mg/l)	792	5400	749	340	1348
COD(mg/l)	1886	2400	899	830	143.31
BOD(mg/l)	1180	579	402	440	100.52
EFFICIENCY					
TSS	97.8	93.3	97.6	98.3	98.4
COD	90.8	94.7	20.7	93.2	99.5
BOD	90.2	71.1	38.9	95.6	99.7

Due to high pollutant concentration of faecal sludge, the removal efficiency is high but final effluent still doesn't meet discharge standards,

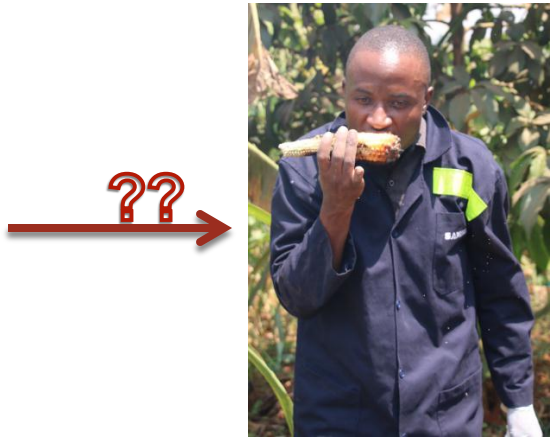
Physical observations and challenges

Challenges

- Variation in properties of sludges.
- Too much non-biodegradable solids
- Difficulty in loading
- Slow dewatering ability
- Biogas breaking tank covers
- Accumulation of scum in biodigester

Screens

Reuse in progress



- Soil conditioners
- Use tiger worms to produce vermicompost.
- Biogas
- Making briquettes

Conclusion and recommendations

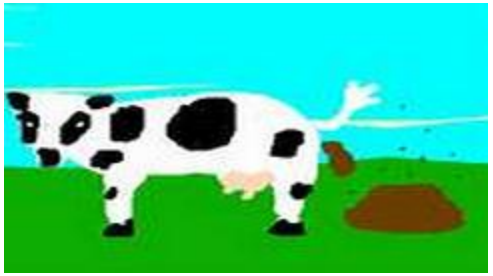
- Removal efficiency for selected parameters BOD, COD, TSS is in range of 70-99%
- Effluent quality not yet reached permissible discharge standards for Uganda. More tertially treatment techniques are required in order to meet discharge requirements.
- Due to high variation in influent sludge properties, there is need for an equalisation tank.
- Quick dewatering techiniques are required to reduce space requirement.

Shit, the un realised **"resource"** that everyone healthy contributes too daily

Gabbage in

Gabbage out

Pathogenic feeds →



Happy to use Cow dung →

Delicious food

→

→

Very harmful product

Pollutants

THANK YOU

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