Characteristics of Faecal Sludge generated from Onsite Systems located in Devanahalli

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Need for study

- Characteristics of Faecal Sludge (FS) differ widely between different households, cities and countries; and are influenced by many factors
- Research shows that with this heterogeneous nature, estimating FS characteristics for design is difficult
- In India, there is limited/No data available, to predict or estimate values of FS characteristics

Objective of study

- To assess the physical and chemical characteristics* of FS samples that are collected at the faecal sludge treatment plant (FSTP), Devanahalli
- To define ranges for different parameters of faecal sludge for design
- To study the effects of different factors like age, source, season on FS characteristics

* Parameters named in slide no 7

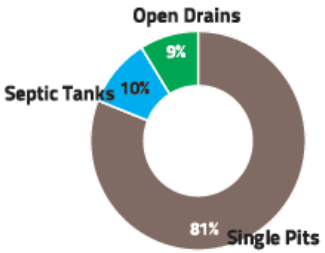
Project location: Devanahalli

- Devanahalli is a Town located in Bangalore Rural District
- No sewer systems
- Suitable for FSM implementation
- A baseline study has been conducted to understand the FSM Value chain

Population- 26309 (Census 2011)
Area -16 sq.km
Water supply- 60-80 lpcd

Project location: Devanahalli

- Flush toilets **16.4%**
- Pour flush toilets **83.6%**



- With bottom lining- 35%
- No outlets

- TMC- 1 No
- Private- 4-5 Nos

- FSTP- 6m^3

- Sludge – Compost

Methodologies

- FS samples (composite samples) are collected at the inlet of the treatment system at the time the trucks are discharging FS to the FSTP

- Collected FS samples are analyzed for
  - Physical : Color, Odour, Solids (TS, VS) and Turbidity
  - Chemical: pH, COD, BOD, NH_3-N, PO_4, Alkalinity

- Source data collected using Manifest form

- In this study, 250 FS samples collected over Dec 2015-Dec 2016 are considered for analysis

Sampling

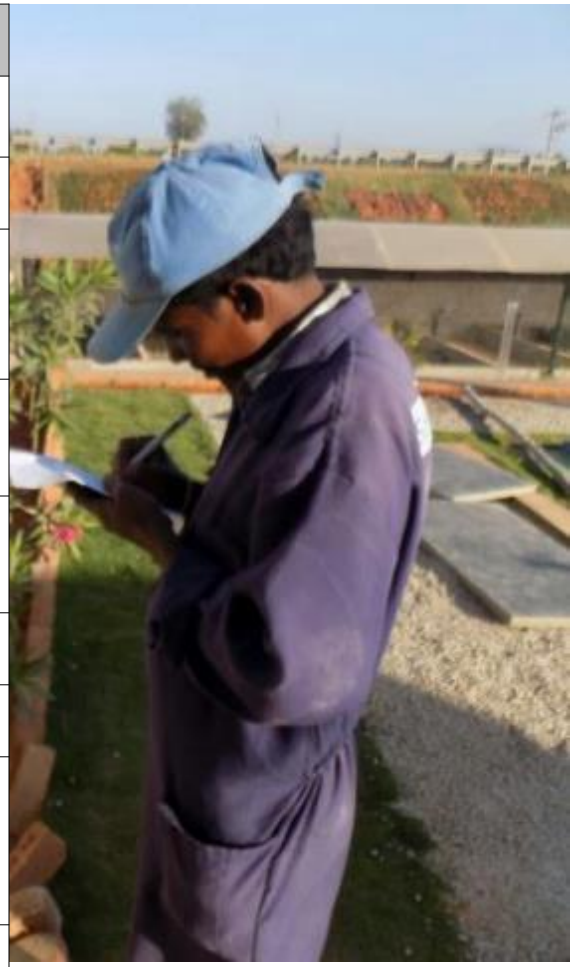
Feed to FSTP - Samples



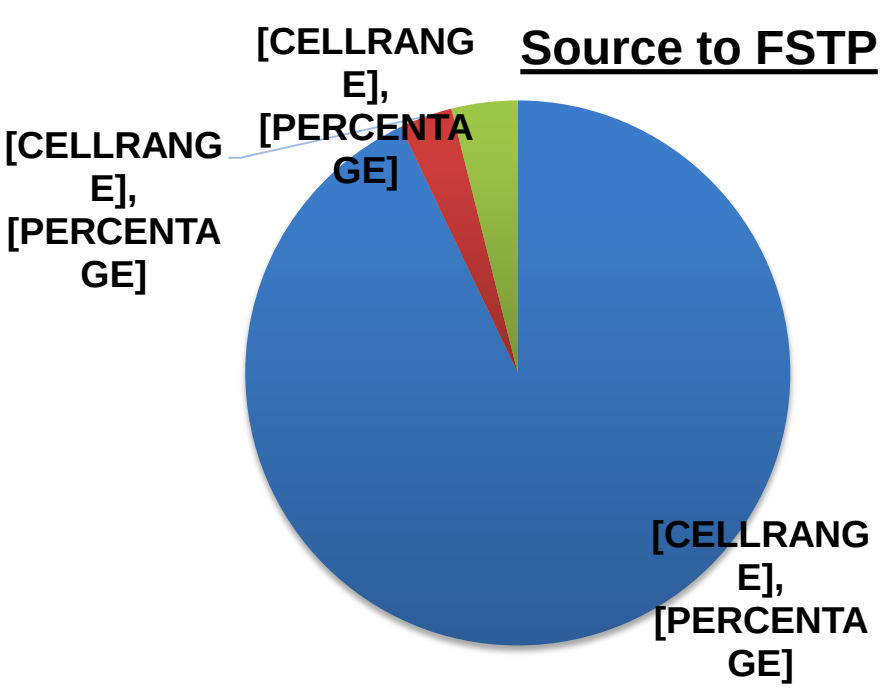


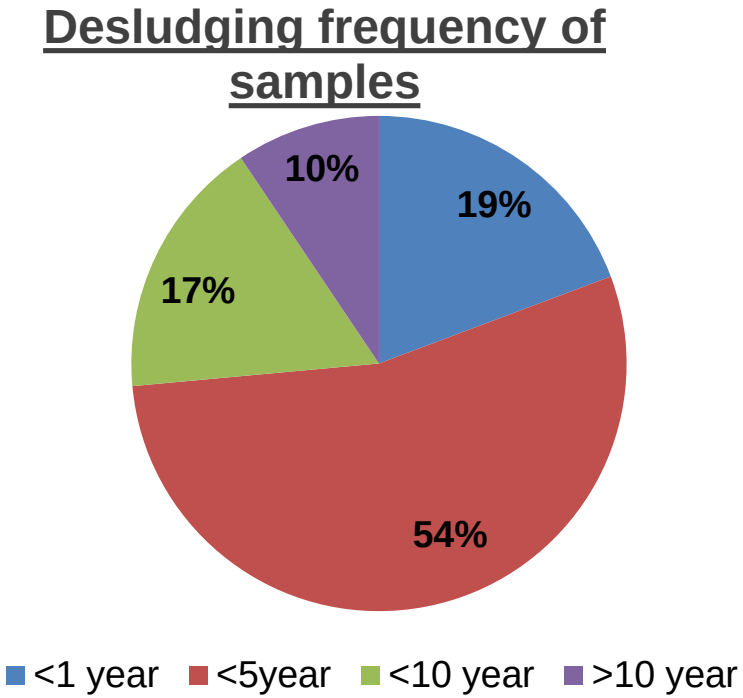

Manifest form: Source data collection

Particulars	Answers
Date of desludging	
Volume of FS, L	
Source	Household/ Commercial/ institute/ others
Type of containment system	Septic tank/Pit
Specifications of Containment system	
Age of FS	
Reasons of desludging	
Any additive added Type Quantity	
Address and contact details of source	



Source and Desludging frequency

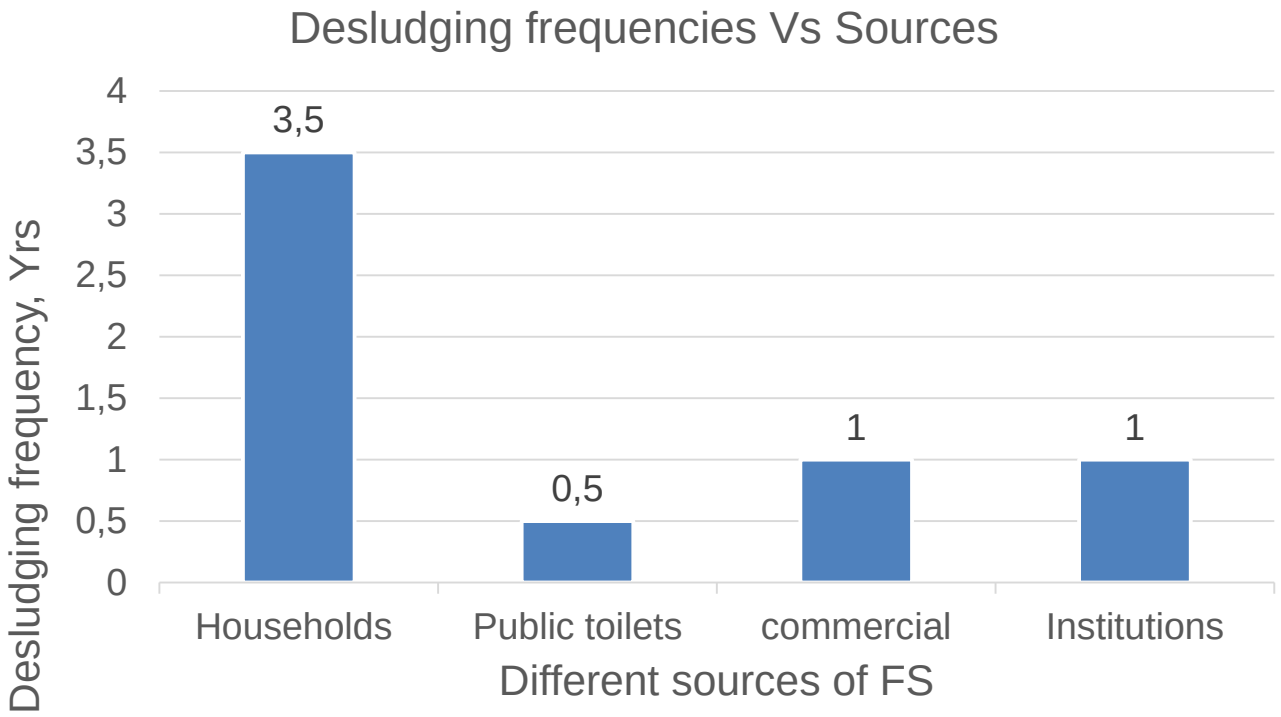




Key Observations

1. Majority of load has arrived from households
2. The majority of FS load delivery has age between 1-5 years

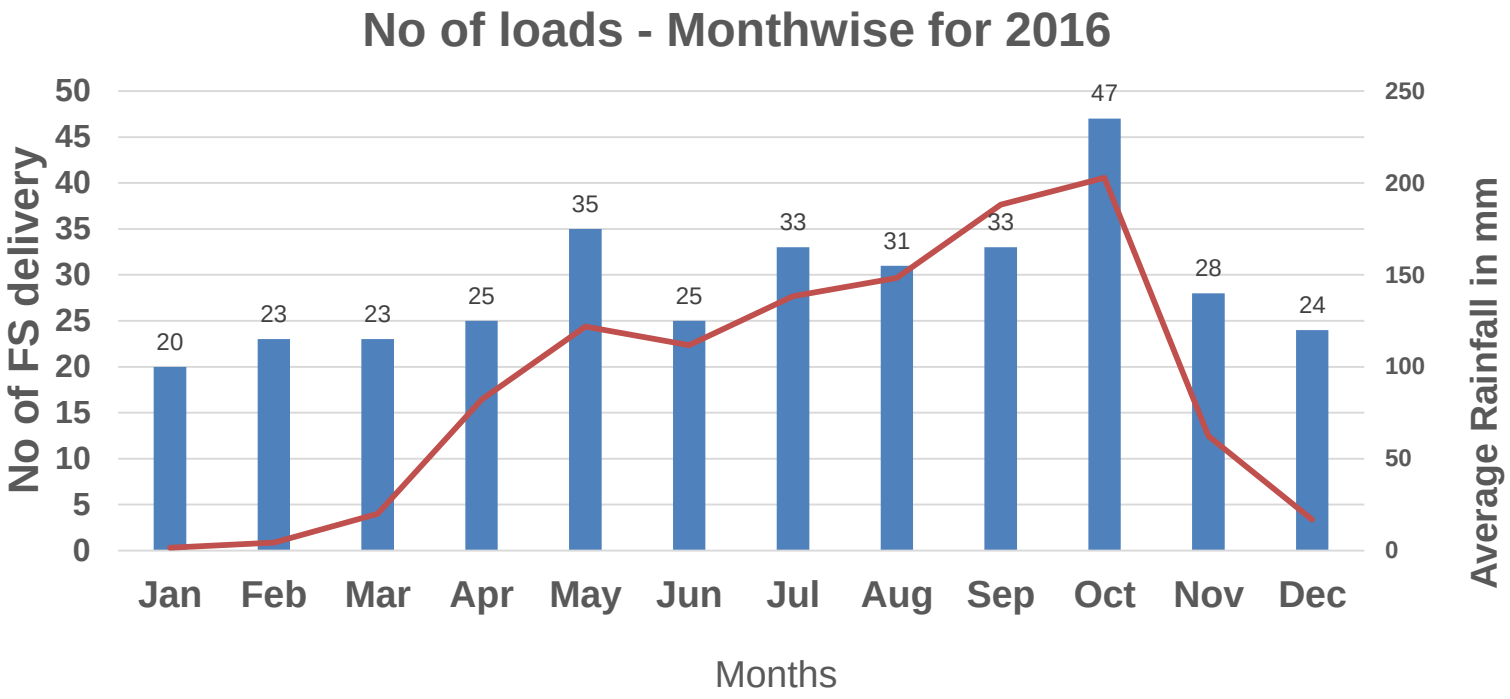
Desludging frequency Vs Source



Source

Households- Individual, group of households (230 samples)
Commercial- Hotels, Restaurant
Institutions- Hostels, school

Seasonal variation of FS load to FSTP

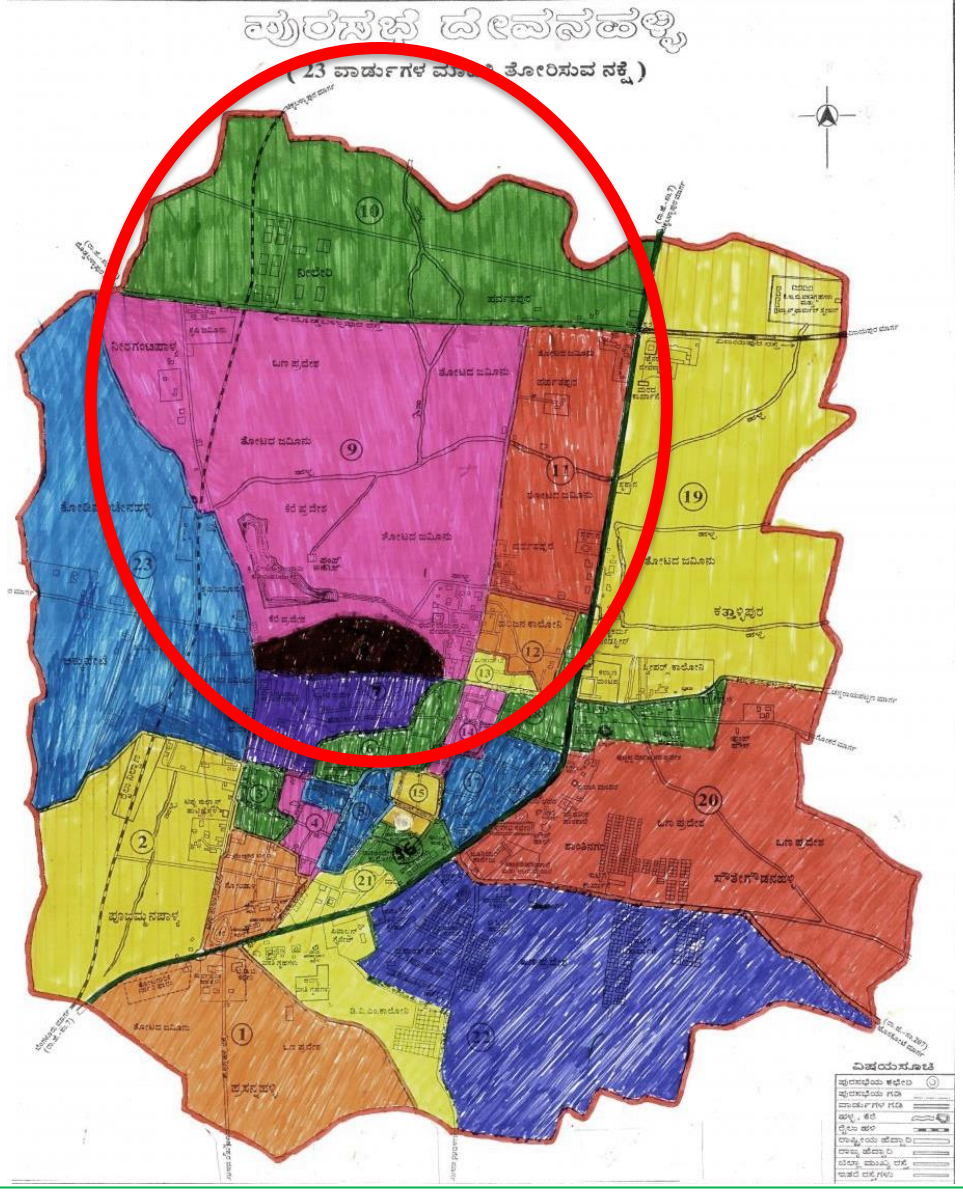


Key observations:

1. Feed to the plant is increased during the rainfall months

1 FS delivery= Avr.2000L, Capacity of plant- 6000L/d
Total FS Quantity(340 Samples)- 700m^3

Source: https://www.worldweatheronline.com/devanhalli-weather-averages/karnataka/in.aspx



Key observations:

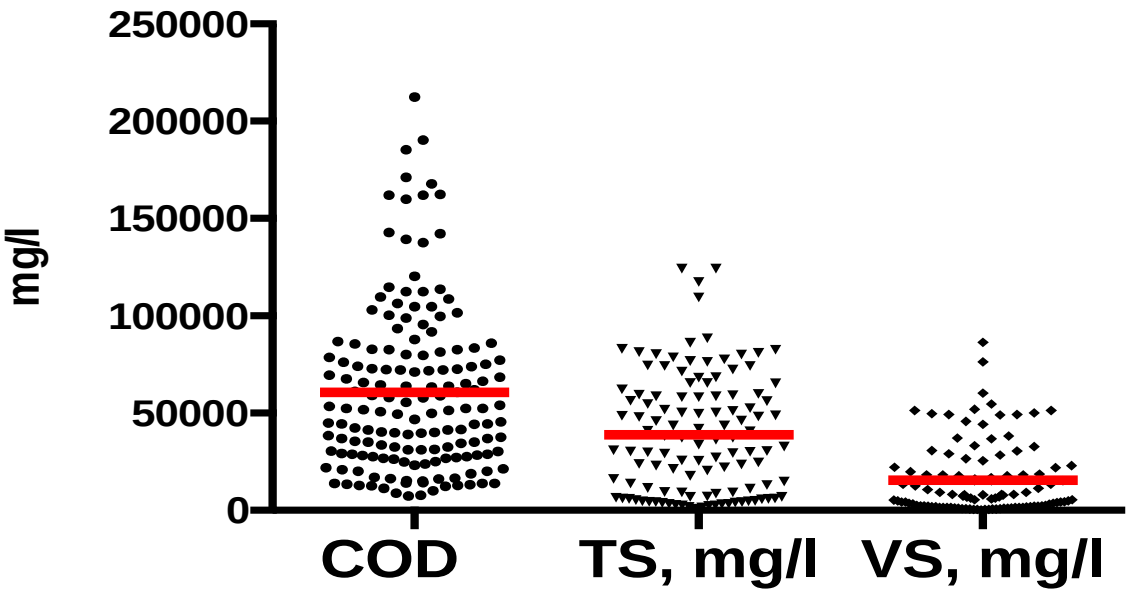
1. Majority of loads from surrounding of lake area

Results- Sample analysis

Parameters	Average	Maximum	Minimum	Standard Deviation	Median
pH	7.4	9.4	6.4		
COD, mg/l	59,745	1,90,300	7,450	42,839	50,825
TS, mg/l	42,395	1,24,375	868	30,568	31,605
VS, mg/l	15,223	86,390	265	17,565	21,005
NH_3-N, mg/l	1,323	10,800	100	1,422	1,000
PO_4, mg/l	1,001	8,240	100	1,525	640

As per Strauss, 1997, the faecal sludge samples analyzed fall under the category of Type “A” high strength (highly concentrated)

COD & Solids



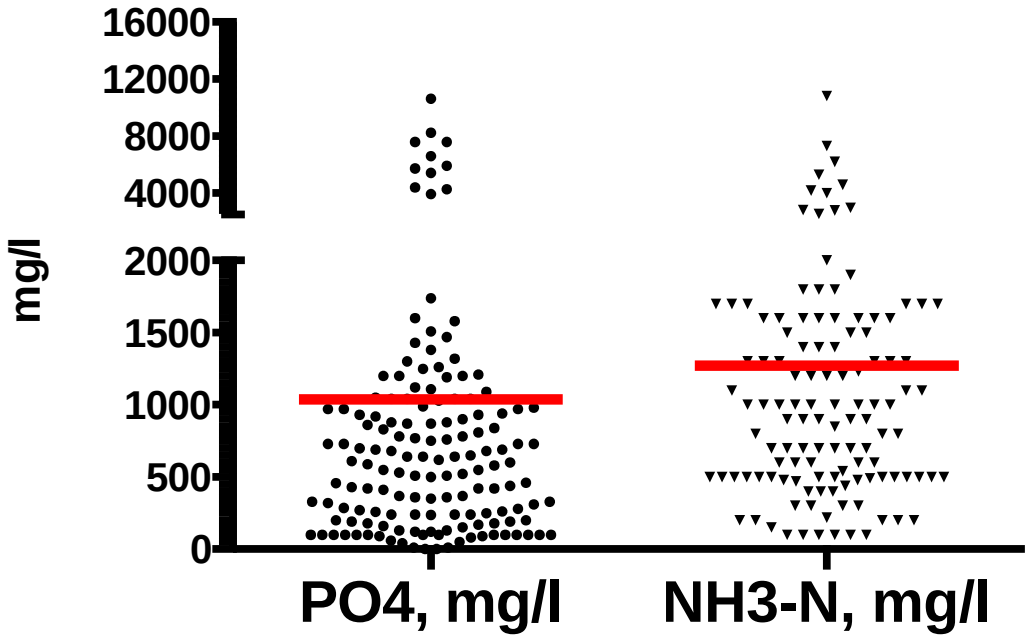
Key results- COD
Avearge-59745mg/l

Key results- Total solids
Average -42395 mg/l

Key results- Volatile Solids
Avearge- 15223 mg/l

As per Strauss, 1997, the faecal sludge samples analyzed fall under the category of Type “A” high strength (highly concentrated)

Nutrients

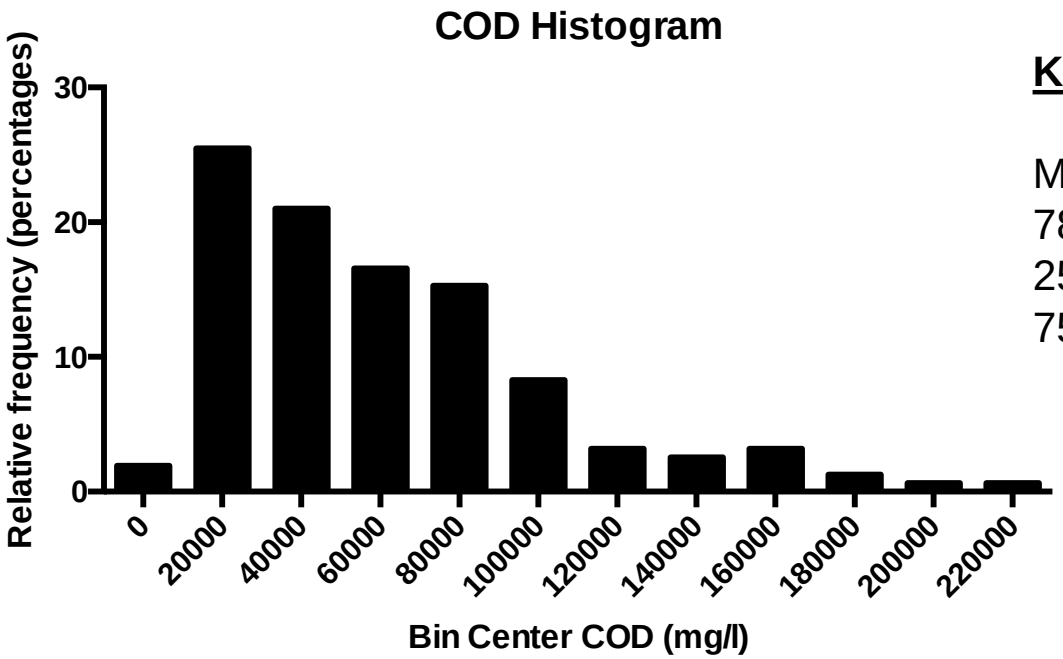


Key results- PO_4
Avearge-1001mg/l

Key results- NH_3-N
Average -1323 mg/l

As per Strauss, 1997, the faecal sludge samples analyzed fall under the category of Type “A” high strength (highly concentrated)

COD Values

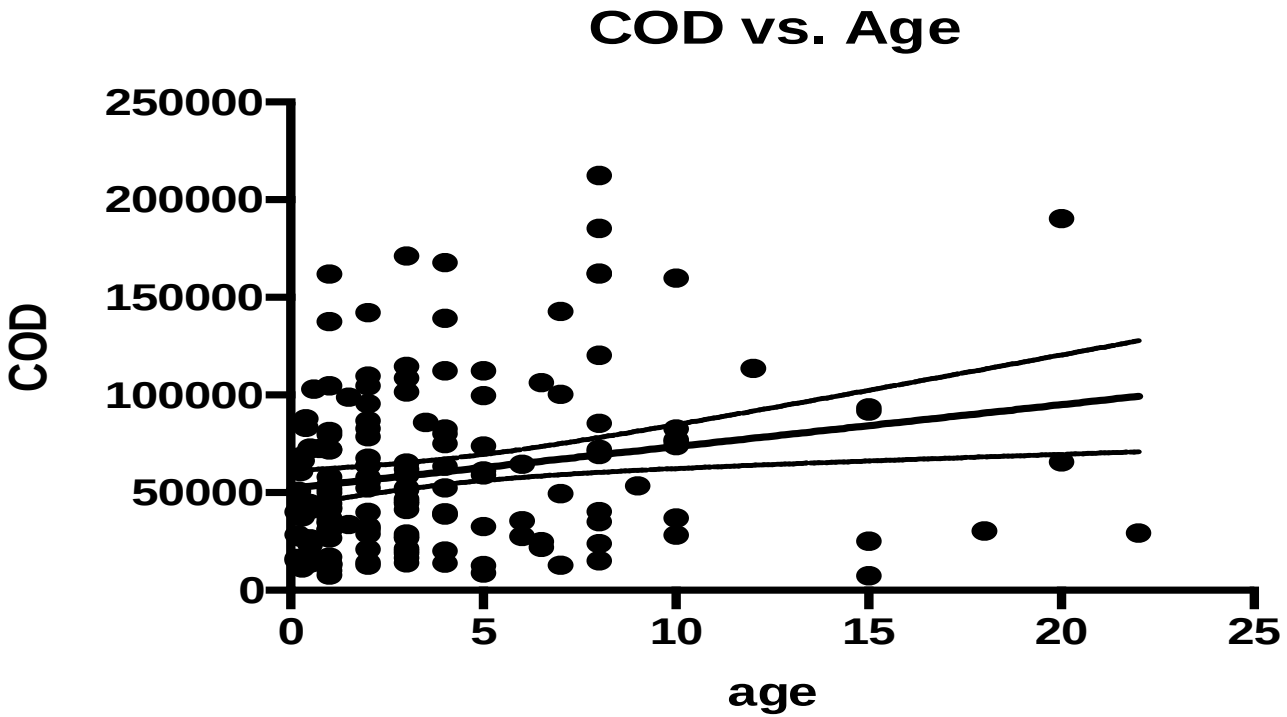


Key results

Mean- 60000 mg/l
78% of COD values between 20-80000mg/l
25% samples are < 28000 mg/l
75% of samples are <82000 mg/l

Key results:
1. 75% of samples are < 82000 mg/l

COD Values Vs Age



Correlation between Sludge age and COD:
Positive relation r=0.21 and r^2= 0.04

Key results:
1. The statistical analysis shows a positive correlation between COD and age

Outcomes

- This study again proves the highly variable nature of faecal sludge (Refer Slide 13;SD for COD ±42,839, TS ±30,568, VS±17,565, NH_3-N±1422, PO_4±1,525)

- Variations in characteristics were observed in relation to age of sludge (positive correlation between COD and age), type of sources like commercial, household, institutes

- The FS delivery to FSTP increases during rainy season (No of deliveries/month increases from 23 to 47 loads)

Further Studies

- Further analysis for biodegradability, pathogen and heavy metal content of FS samples

- Correlation between different aspects to FS characteristics
  - Seasonal variation and FS characteristics
  - Type of containment and FS characteristics
  - Impact of additives to FS characteristics
  - Determination of Calorific values of FS

- More samples to be analyzed for different sources for better understanding of FS characteristics

Key take away

- Implication of FS analysis results
  - Designers

    Can we use these data for other cities of same tropical conditions, what are quality checks ??

    What are the values to be considered for design of FSTP??

  - Policy makers
    - What are the technologies and discharge/reuse standards to be recommended ??
    - What measures to be taken to handle the FS (frequent desludging)??

Thank You!

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