INTRODUCTION
In most developing countries, pit latrines are the predominant form of excreta disposal. However, the management of pit emptying and treatment of pit latrine content has proven to be difficult due to its varied nature. The main global challenge is to provide a safe, sustainable and technically feasible solution to faecal sludge management. The main purpose of this research is to evaluate the feasibility of the pyrolysis of pit latrine content in developing countries as an alternative solution to faecal sludge management, with a focus on biochar production.

PIT LATRINE CONTENT
The physicochemical properties of pit latrine contents are affected by the initial characteristic (1), storage time and emptying method. Common indicators of pit latrine content characteristics are water content (2), organic content in the form of volatile solids (3), and inorganic content in the form of ash (4).

(1) Heterogeneous
More varied, less biochemically stable
Result in different reaction pathways
Varied yield and quality

(2) Decreases due to leaching, lead to higher sludge concentration
More varied
Must be high enough to facilitate removal, large energy consumption for sludge drying
High water content reduces biochar yield, promotes bio-oil yield

(3) Decreases due to different degradation processes
Pit latrine content ~58%
Sewage sludge ~34%
Affect the heat capacity of sludge
High volatile solids reduces biochar yield, promotes bio-oil and syngas yield

(4) Accumulate at pit bottom in the form of ash fraction of sludge
More non-biodegradable material
Affect the heat capacity of sludge
Ash content remains within biochar. High content increases biochar pH, reduces highest heating value (HHV)

METHDOLOGY

Step 1: Literature review
Pit latrine content
Biochar production

Step 2: Feasibility study
Energy analysis

Step 3: Predict characteristics of biochar produced Identify areas for further research

FEASIBILITY STUDY
Experimental data from 19 sewage sludge pyrolysis studies were used to calculate the total energy consumption \( Q_{\text{total}} \) and the net energy requirement of biochar production using the following equations:

\[
Q_{\text{total}} = Q_{\text{drying}} + Q_{\text{target}} + Q_{\text{pyrolysis}}
\]

\[
\text{Net energy requirement} = Q_{\text{total}} - \sum \text{HHV}_{\text{product}} \times \text{Yield}_{\text{product}}
\]

Results
• \( Q_{\text{drying}} \) accounted for 80% of \( Q_{\text{total}} \)
• Water content has greater impact on \( Q_{\text{total}} \) than volatile solids content
• A negative net energy requirement, where biochar production was considered feasible, was only found in the case where pit latrine content was air dried, pyrolysed at low highest treatment temperature (HTT), bio-oil or both bio-oil and syngas was harnessed for energy
• Lower HTT resulted in higher biochar yield, lower net energy requirement but lower BET surface area
• BET surface area of sewage sludge-based biochar was lower than the suggested value of 150 m²/g from the International Biochar Initiative, which indicate poor biochar performance in soil
• High biochar pH is derived from feedstock
• Varied nutrient retention and heavy metal immobilisation response, specific to feedstock and soil type

CONCLUSIONS
Biochar produced from pit latrine content is predicted to have high pH and low HHV due to high ash content and low BET surface area. The use of drying methods that require minimal energy prior to pyrolysis to reduce the water content will make biochar production a more attractive treatment process.

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REFERENCES