Optimising biogas plant design: why BMP tests alone are not enough

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Introduction

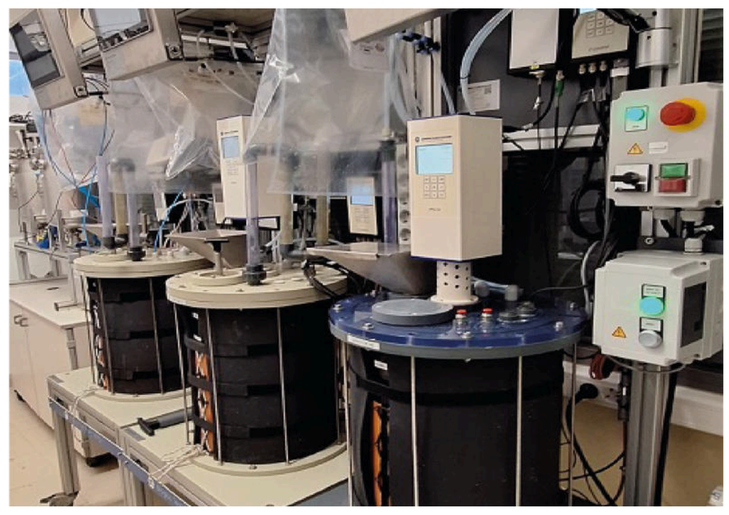
BMP assays are widely used to estimate the methane potential of organic substrates. Nevertheless, industrial anaerobic digesters operate under continuous feeding conditions, where process stability becomes critical. Semi-continuous tests provide key information for process scale-up and plant design.

Objectives

The objective of this study was to determine whether BMP assays provide sufficient information for biogas plant design or if semi-continuous assays are required to accurately predict real process performance.

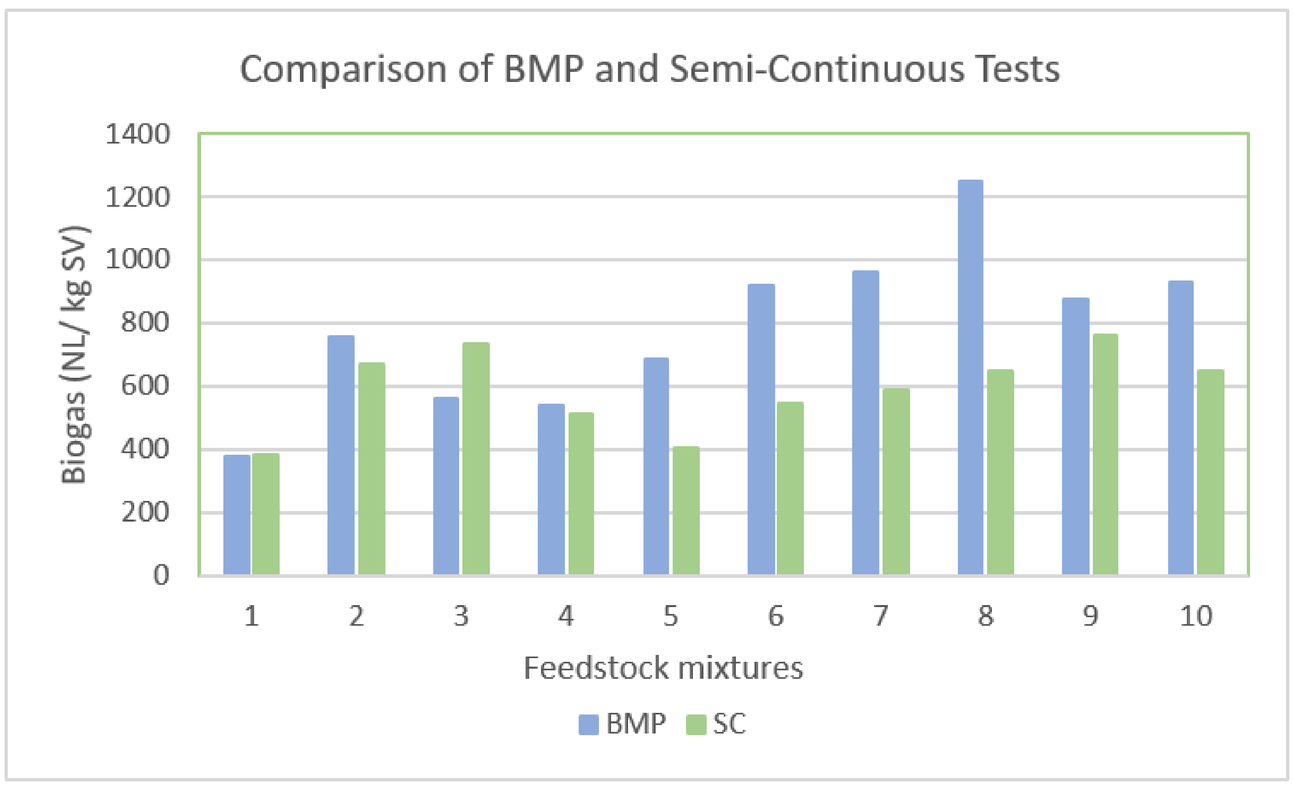
Materials & Methods

BMP assay	SC assay
Batch operation	Semi-continuous operation
Working volume 2 L	Working volume 30 L
Mesophilic conditions	Mesophilic conditions
Biogas production monitoring	Daily feeding and real-time monitoring of biogas flow rate and composition.
Short-term evaluation of methane potential	Long-term evaluation of process performance and stability



Results

In total, ten substrate mixtures were assessed in both semi-continuous (SC) and BMP systems. These mixtures comprised a broad variety of feedstocks, including pruning residues, sewage sludge, manure, and other organic wastes.



Feedstock mixture	Difference (%)*
1	1,21
2	-11,93
3	31,35
4	-5,26
5	-41,34
6	-40,28
7	-39,00
8	-48,44
9	-12,90
10	-30,18

* difference (%) calculated using BMP results as the reference.

Conclusions

BMP tests proved to be a rapid and effective tool for estimating the energy potential of organic substrates; however, they generally overestimated the biogas yields achieved under semi-continuous operating conditions. Across the ten substrate mixtures evaluated, differences between both systems ranged from +1.2% to -48.4%, with the largest deviations observed for more heterogeneous feedstock mixtures. While BMP assays are valuable as a fast screening tool, semi-continuous tests provided a more realistic assessment of process performance by identifying operational limitations, stability constraints, and potential inhibition effects. Therefore, semi-continuous testing generates more reliable and scalable data for anaerobic digestion process optimization, plant design, and industrial scale-up.