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Anaerobic co-digestion of Food waste and Pruning waste under mesophilic range

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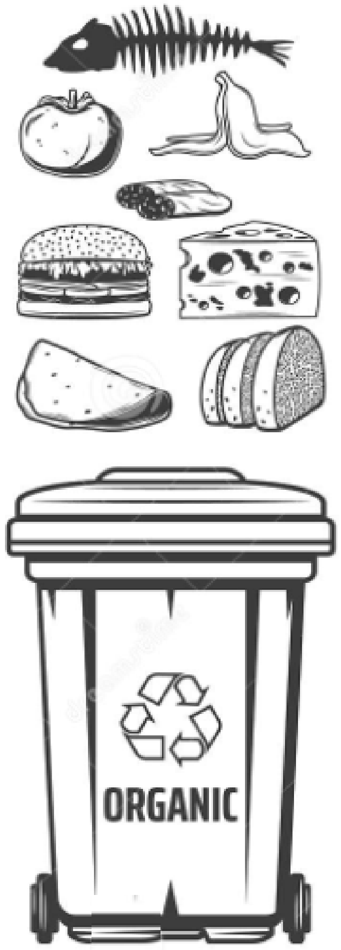
MSW

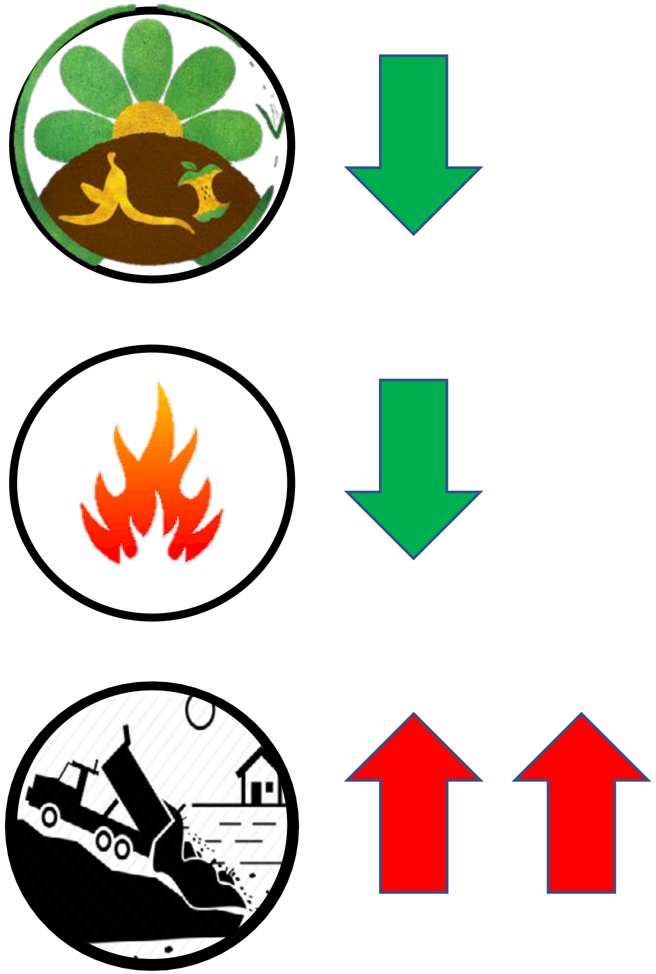
Food waste (FW)

Pruning waste (PW)

$2.0 \cdot 10^{12}$ t MSW/year (2017)

$3.4 \cdot 10^{12}$ t MSW/year (2050)





Thermochemical treatment

Pyrolysis Gasification Torrefaction Hydrothermal Carbonization

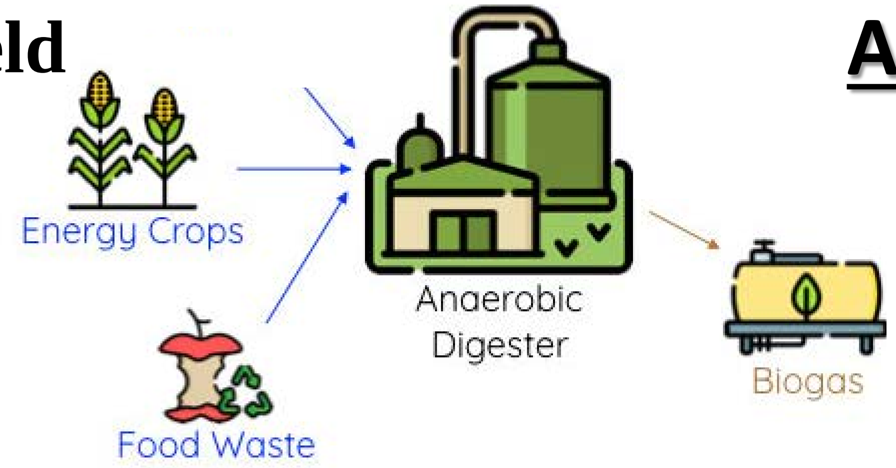
Biological treatment

Composting

Anaerobic digestion

ANAEROBIC DIGESTION PROCESS

Low biodegradability
Low methane yield



High biodegradability
Low C/N ratio

Anaerobic Codigestion (AcoD)

- ↑ **Biogas production**
- ↑ **Process Stability**

OBJECTIVE

To evaluate the viability of the co-digestion of the two most important urban residues, Food waste and Pruning waste, to determine synergistic effects on methane production

❑ <u>To evaluate biochemical methane potential (BMP)</u>

- Biogas Production
- Biogas Composition

❑ <u>To monitorize the process stability</u>

- pH
- Alkalinity
- Ammoniacal nitrogen
- Soluble chemical oxygen demand (SCOD)
- Volatile fatty acid content (VFA)

Materials and Methods

Characterization

Experimental Design

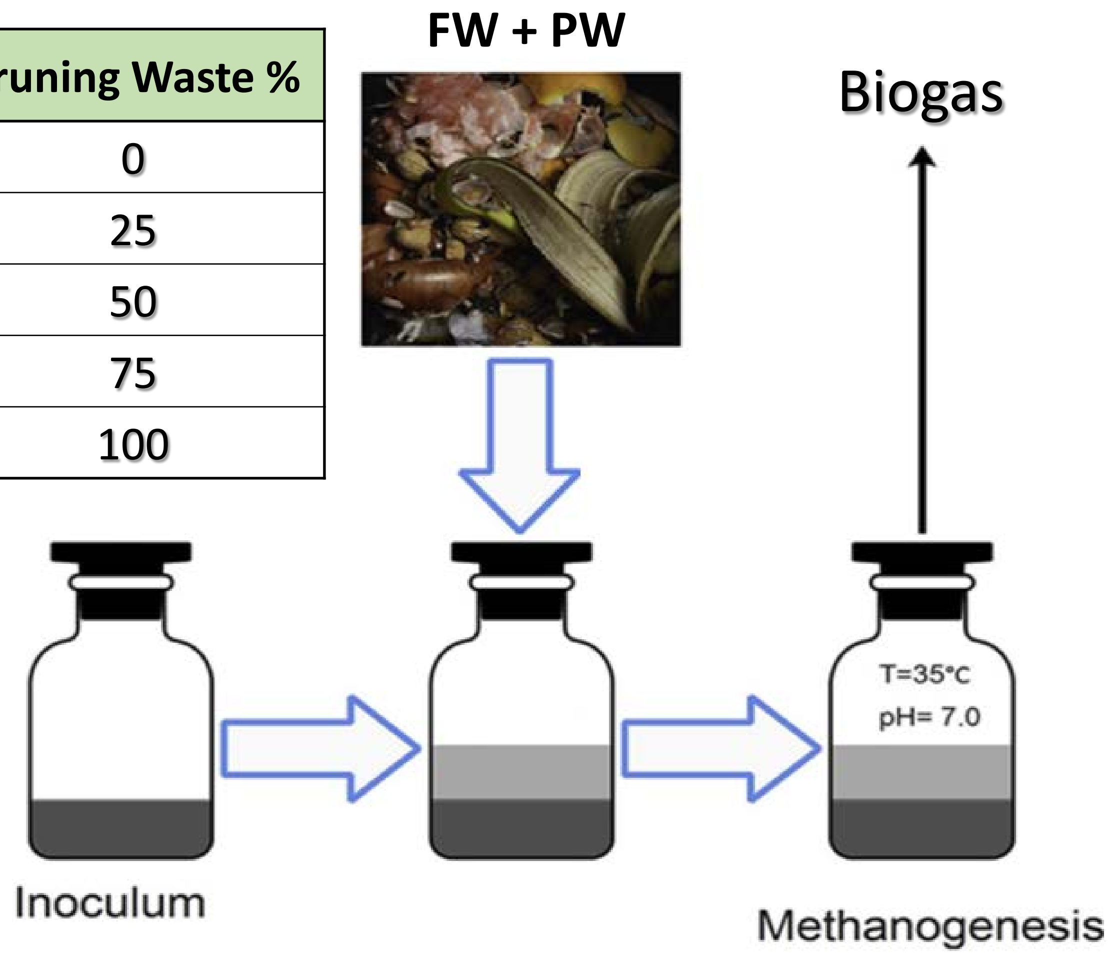
FEEDSTOCK CHARACTERIZATION

	Inoculum	Food Waste (FW)	Pruning Waste (PW)
TS (g/kg)	42 ± 2	130 ± 3	939 ± 1
VS (g/kg)	36 ± 2	120 ± 1	872 ± 2
COD (g/kg)	18.4* ± 1.4	186 ± 2	1144 ± 51
TKN (mg/kg)		1290 ± 59	980 ± 20
C (%)		44.5 ± 0.1	44.9 ± 0.1
H (%)		6.2 ± 0.1	6.1 ± 0.1
N (%)		1.9 ± 0.1	0.9 ± 0.1
S (%)		0.2 ± 0.1	0.4 ± 0.1
C/N ratio		23.6 ± 0.1	52.2 ± 0.1

*g/L

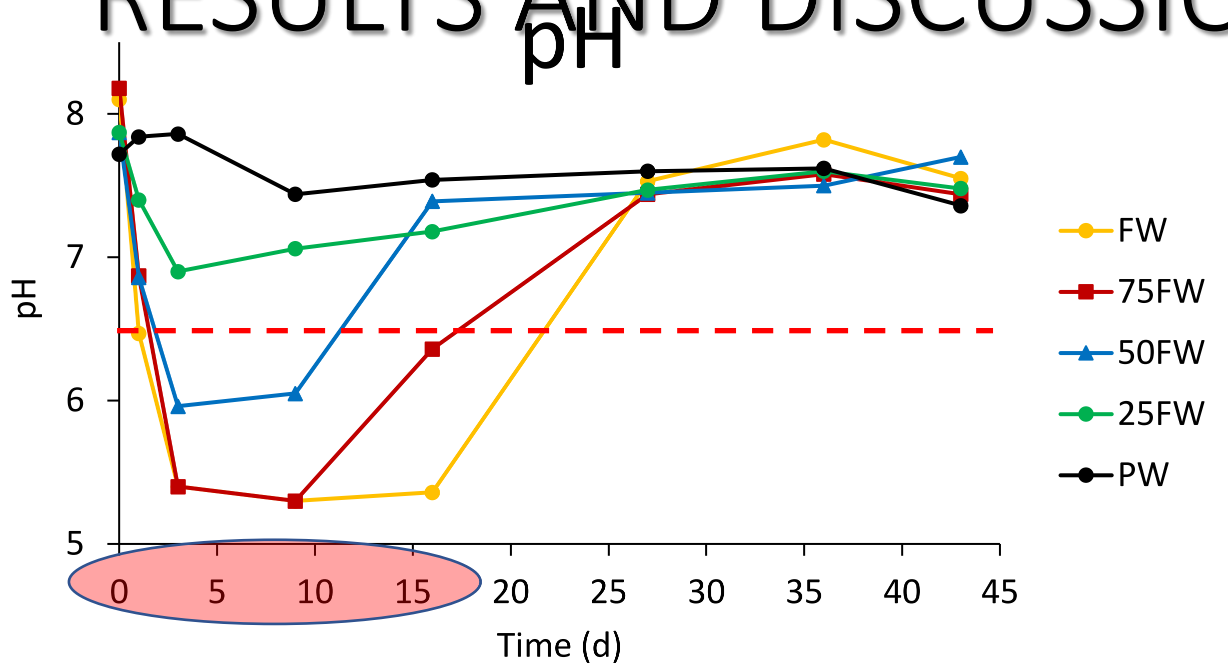
EXPERIMENTAL DESIGN

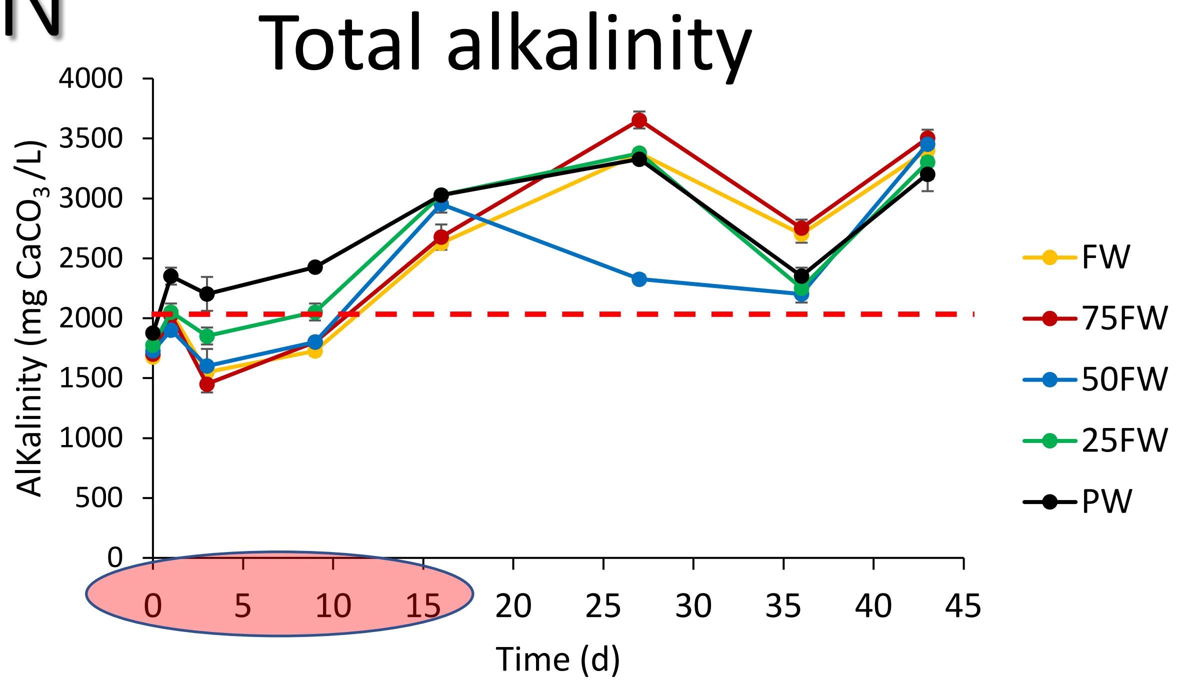
	Food Waste %	Pruning Waste %
FW	100	0
75FW	75	25
50FW	50	50
25FW	25	75
PW	0	100



[INOCULUM] (VS) (g/L)	15
ISR	2

RESULTS AND DISCUSSION





- Initially trials based on FW showed a significant decrease in the pH and buffer capacity
- Trial based mainly on PW mantained stable during the process

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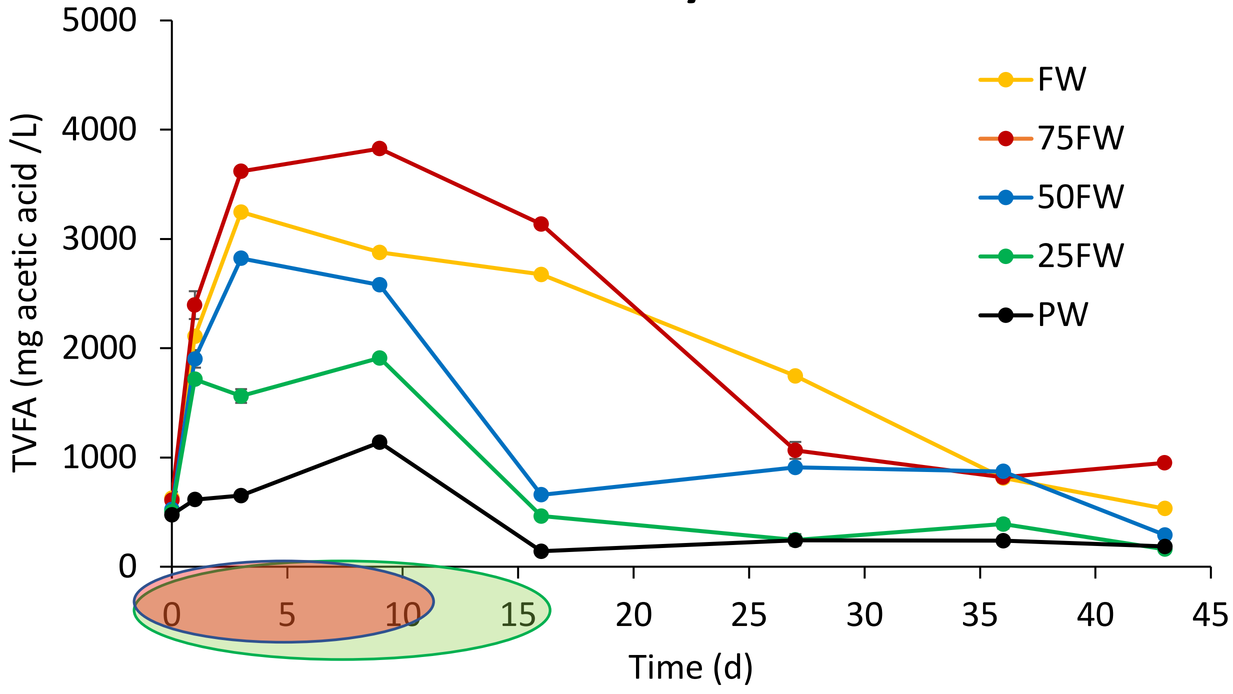
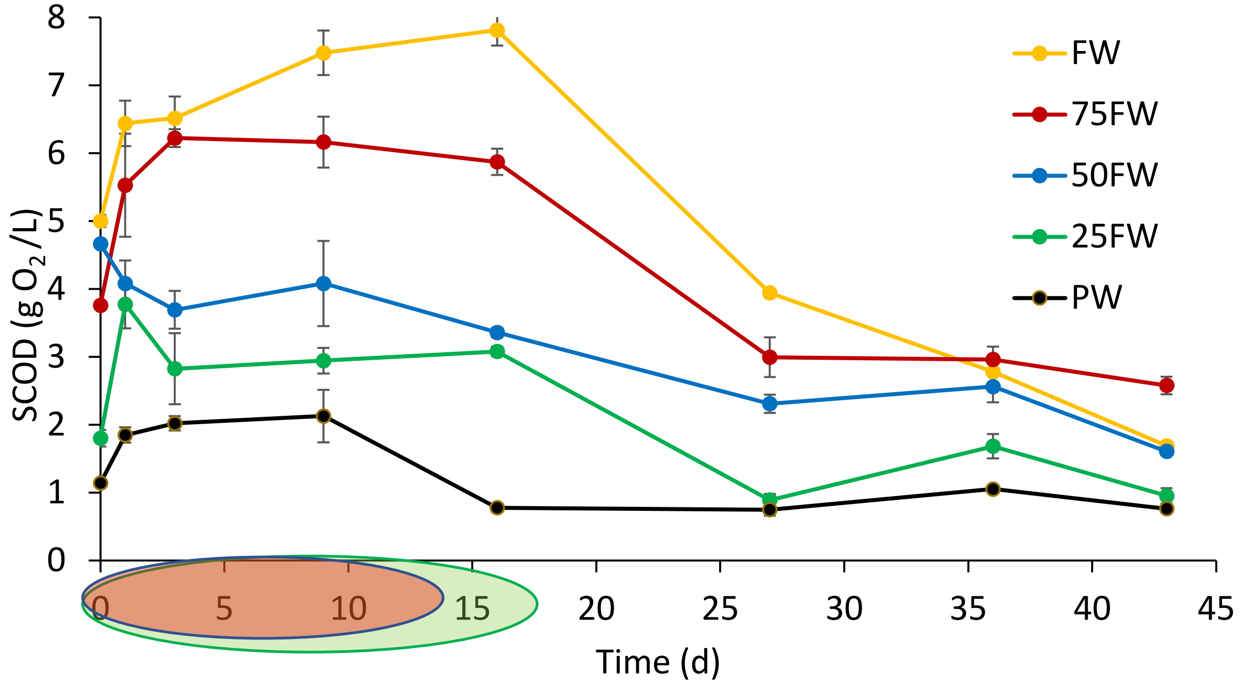
Volatile Fatty Acids



Higher VFA content related to pH decrease and exhaustion of buffer capacity was observed at higher FW percentage.

Soluble Chemical Oxygen Demand



Higher reduction of SCOD for trials based on high FW content due to the difference of biodegradability of the residues.

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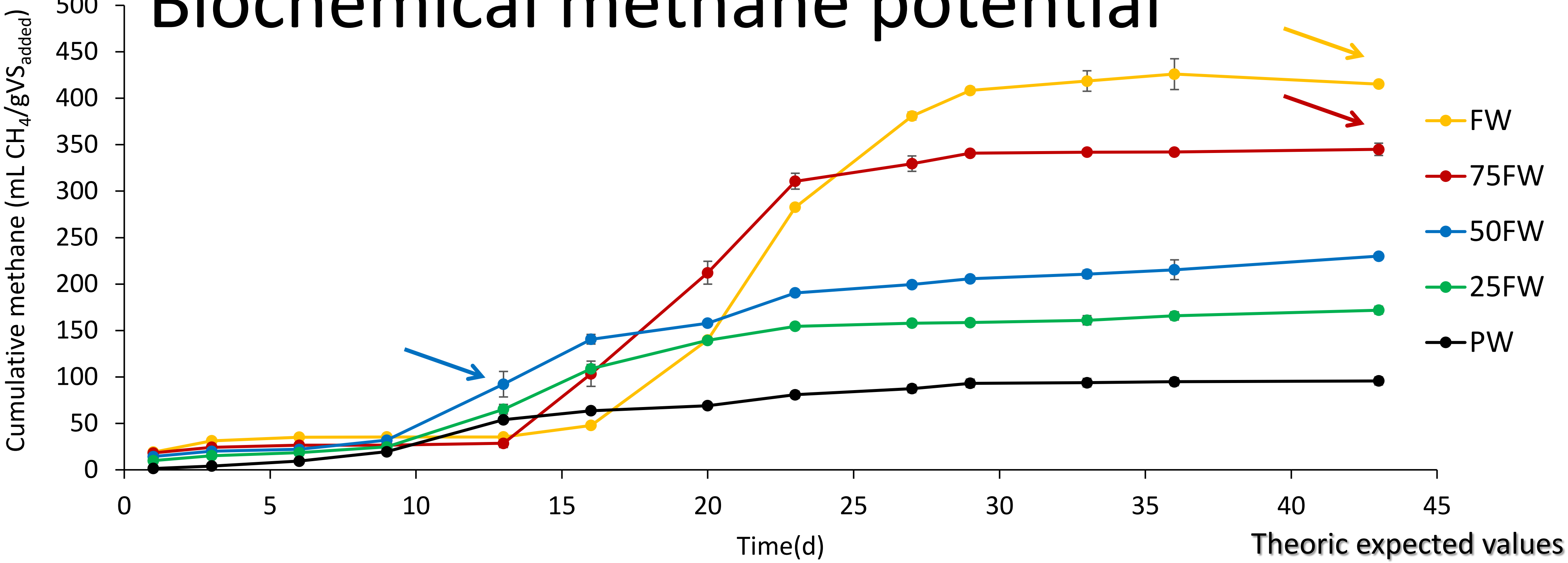
Biochemical methane potential



- Trial based exclusively on FW reported the highest methane yield
- 50FW showed the fastest start up
- 75FW reached the highest methane yield among co-digestion trials

Theoric expected values

	75FW	50FW	25FW
Theoric expected values	342.5	258	176.5
Experimental values	345	230	172

Sinergy

CONCLUSIONS

- AcoD of FW and PW enhance the process stability balancing C/N ratio and biodegradability rate differences.

- The anaerobic co-digestion trial, 75FW, showed the most promising results in terms of methane yield.

- AcoD of FW and PW turns out interesting from the perspective of energetic valorization of PW but yields for 50FW and 25FW are still low suggesting the requirement of pretreatments for PW.

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THE END

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