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7th International Conference on Sustainable Solid Waste Management

Biogas production from co-digestion of food waste with liquid pig manure and olive mill wastewater

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The aim of the work

This study focuses on food waste and also on are presentative, seasonally produced agro-industrial waste with high organic content found in Greece and other Mediterranean countries: olive mill wastewater. Since OMW is seasonally available, it can be treated in existing facilities that already digest FW.

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Raw Materials

Food Waste (FW)

Olive Mill Wastewater (OMW)

Liquid Pig Manure (LPM)

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Raw Materials

- Composition of Liquid Pig Manure (LPM), Food Waste (FW), Olive Mill Wastewater

Parameters	Liquid pig manure (LPM)	Food Waste (FW)	Olive Mill Wastewater (OMW)
pH	7.4	4.2	4.2
TS (g/L or g/kg)	16.96	255.22	87.88
VS (g/L or g/kg)	11.32	240.50	76.94
TCOD (g/L)	4	151.3	180.88
d-COD (g/L)	2.2	-	68.6
N (g/L)	0.27	0.70	0.35

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Experimental procedure

- ✓ 2 type of feedstock
  - ➢ D1 : 75% LPM + 25% FW
  - ➢ D2: 75% LPM + 20% FW + 5% OMW
- ✓ Mesophilic AD, 37° C, HRT = 30 days
- ✓ Influent & effluent samples analyzed TS, VS, pH, TCOD, d-COD and methane content in

Digester no	Digester working volume (L)	HRT (days)	Time (days)	Feedstock	OLR (kg VS $m^{-3}d^{-1}$)
1	3	30	1 -90	75% PW + 25% FW	2.5 ± 0.2
2	3	30	1 - 90	75% PW + 20% FW + 5% OMW	2.3 ± 0.2

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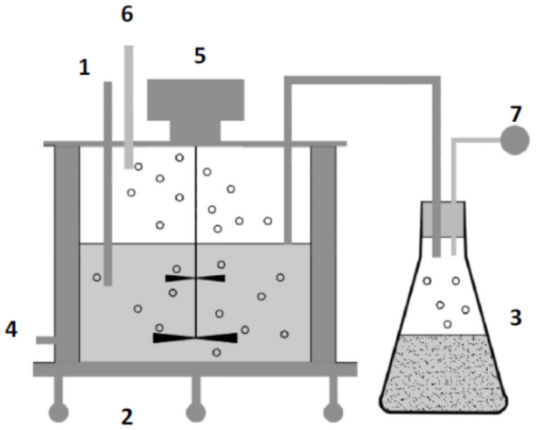
Lab scale digester



1 – influent pump for reactor, 2 – biogas reactor, 3 – effluent bottle, 4 – heating, 5 – mixer, 6 – gas sampling and 7 – gas collecting bag

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Feedstock

- Characteristics of experimental materials as feedstock

Parameters	D1: 75% PW + 25% FW	D2: 75% PW + 20% FW + 5% OMW
pH	6.7 ± 0.2	6.7 ± 0.1
TS (g/L or g/kg)	82.9 ± 6.5	78.6 ± 6.9
VS (g/L or g/kg)	73.5 ± 5.7	68.2 ± 5.2
TCOD (g/L)	108.5 ± 9.4	98.3 ± 17.1
d-COD (g/L)	36.1 ± 8.4	30.8 ± 8.2
N (g/L)	0.55 ± 0.05	0.47 ± 0.03

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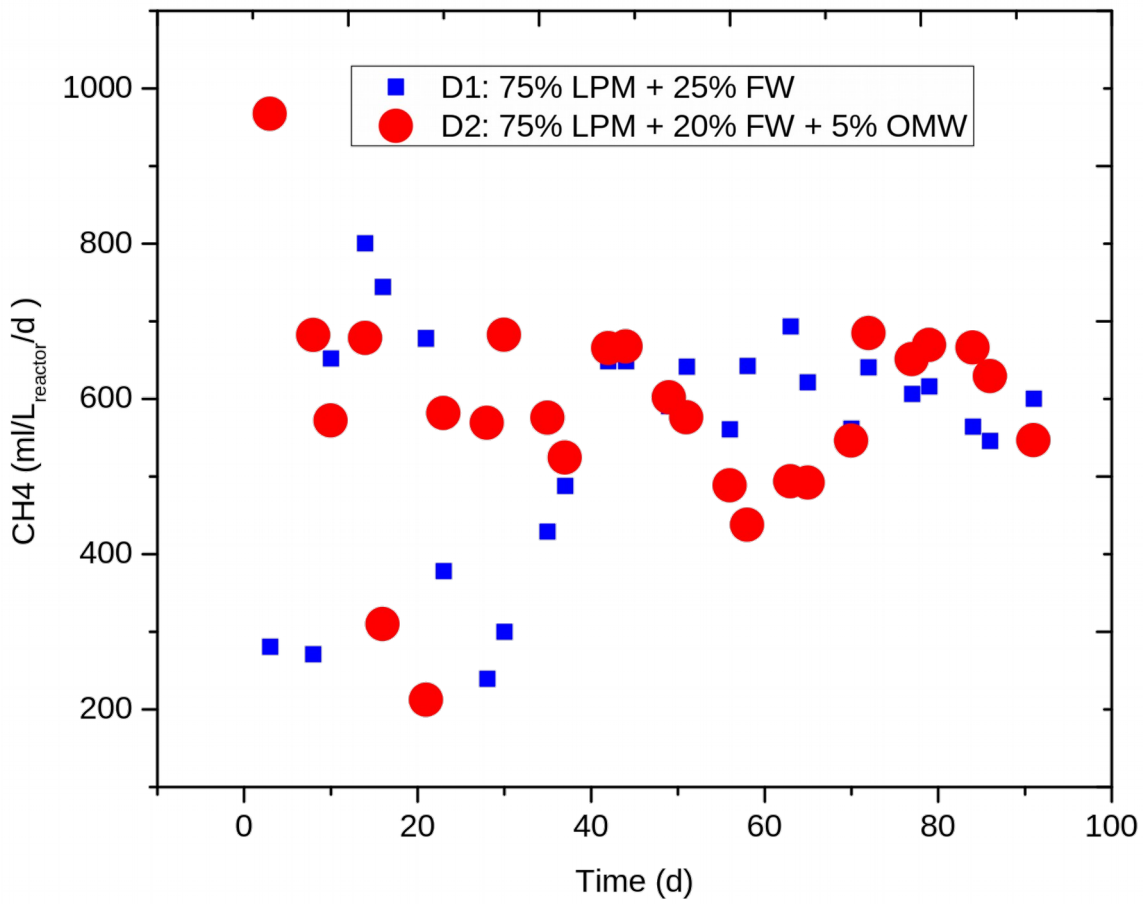
Results



- D1: 555.4 ± 150.5 ml/Lreactor/d
- D2: 583.3 ± 139.6 ml/Lreactor/d
- **Small increase of Methane Production for D2 feedstock (5%)**

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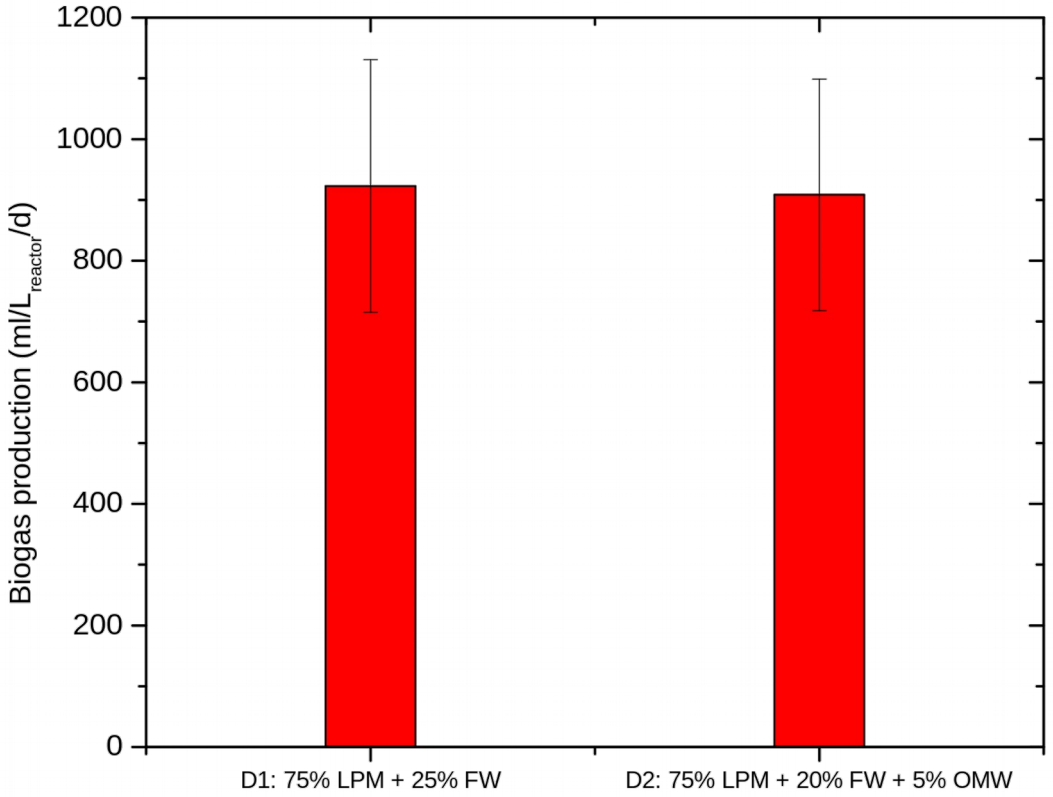
Results



- Analysis of variance for biogas production showed that there were significant differences among the combinations tested (p = 0.69)

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Results

- Biogas and biomethane production, biogas composition for the two digesters

Parameters	D1: 75% PW + 25% FW	D2: 75% PW + 20% FW + 5% OMW
Biogas production ($ml/L_{reactor}/d$)	922.98 ± 207.89	908.43 ± 190.46
Biogas composition (%) CH_4	62.27 ± 0.08	65.30 ± 0.05
Biomethane production ($ml/L_{reactor}/d$)	555.45 ± 150.50	583.26 ± 139.59

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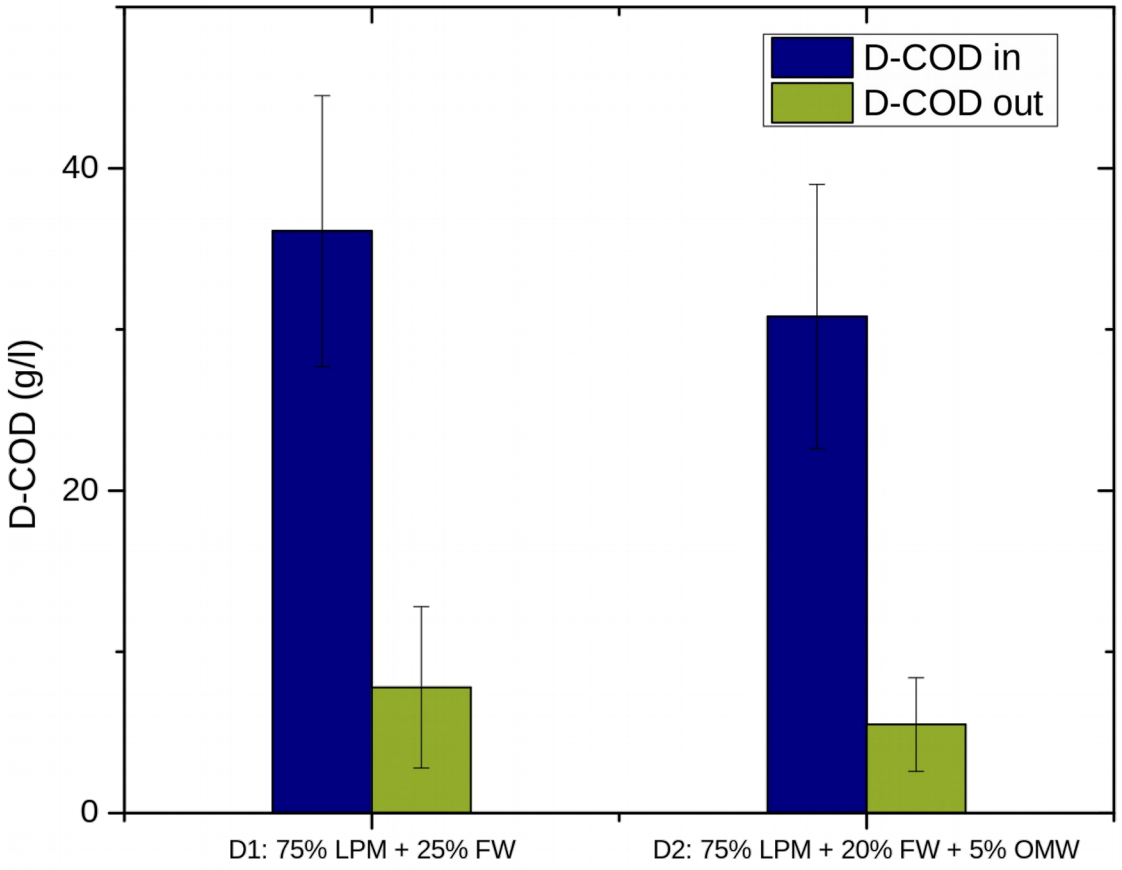
Results D-COD



- D1: 78.52% removal
- D2 : 82.11% removal

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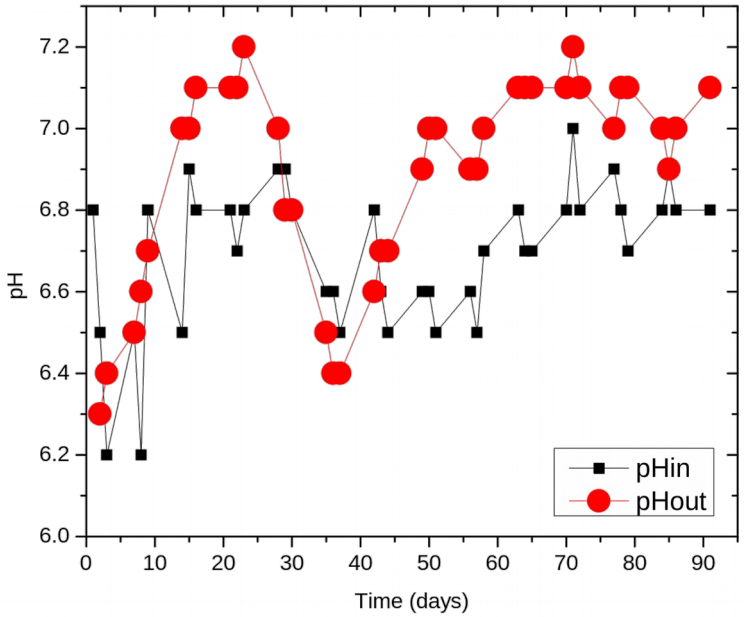
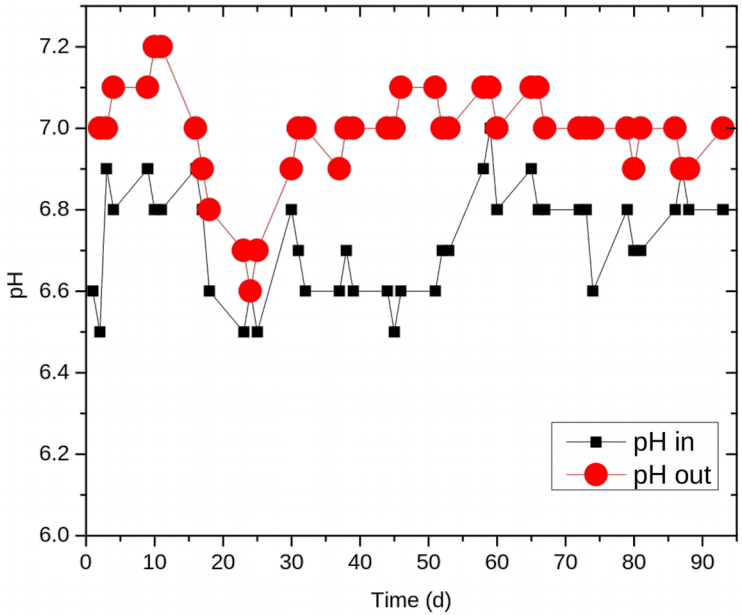
Results - pH





D1: pHin = 6.7 ± 0.2

pHout = 6.9 ± 0.3

D2: pHin = 6.7 ± 0.1

pHout = 7.0 ± 0.1

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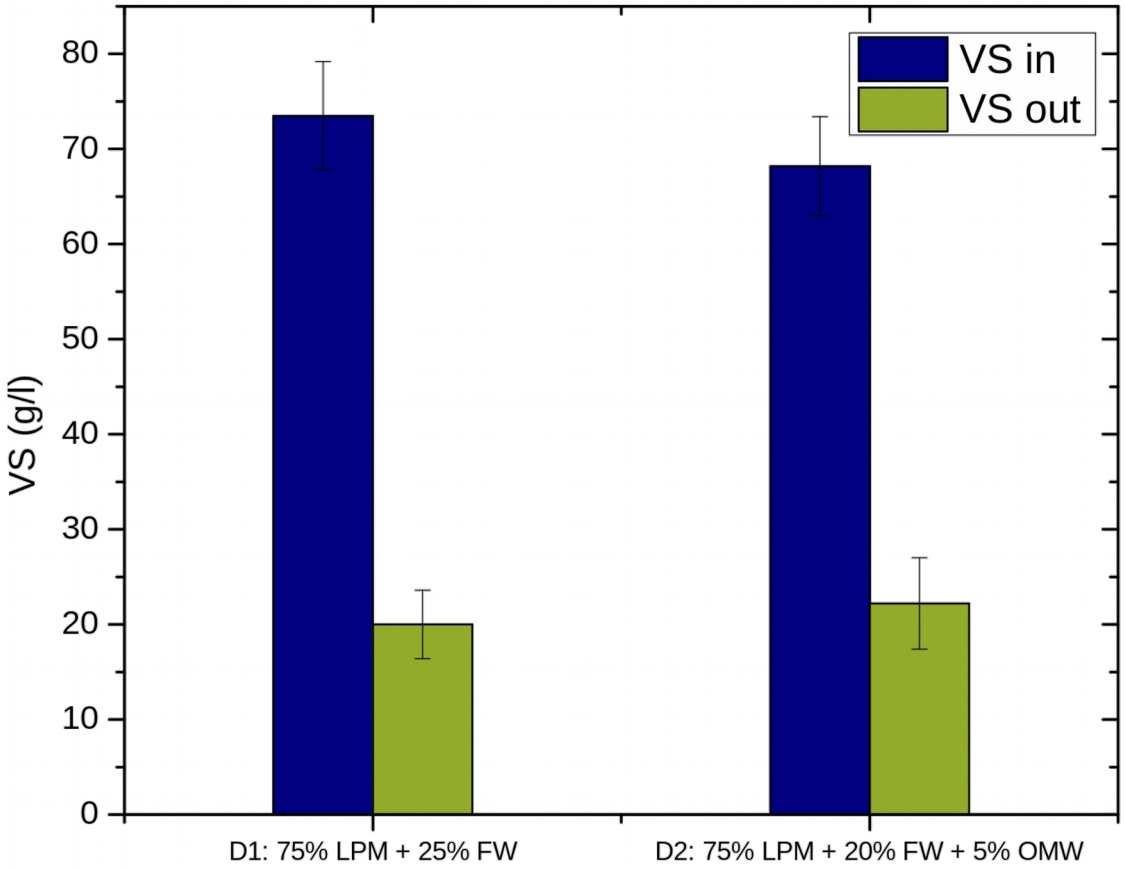
Results VS



- D1: 72.75% removal
- D2 : 67.43% removal

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Conclusions

- All co-digestion experiments are exhibited a successful operation up to the loading rates and mixing ratios that were examined.
- The differences in biogas production, composition COD and VS removal was very small which leads us to the conclusion that both feedstock have the same behavior in anaerobic digestion and we can replace the amount of FW with OMW without affecting the biogas production.

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Thank you