This study was carried out within the Agritech National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1032 17/06/2022, CN00000022). This manuscript reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them.

28th Workshop on the Developments in the Italian Ph.D research on Food Science, Technology and Biotechnology
Catania, 18-20 September 2024

Fostering sustainability in the olive oil supply chain: valorization of local extra virgin olive oils and olive mill by-products

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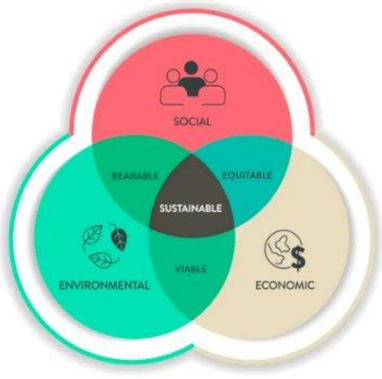
INTRODUCTION

Environmental sustainability:

Olive mill **by-products** can be **polluting** when spread on the fields (Gómez-Caravaca et al., 2014). At present day, most by-products are already valorized but leaves are not exploited by the millers.
AIM: experiment the addition of olive leaves in the olive mill wastewater (OMWW) for biogas production.



Socio-economic sustainability:

EU promotes the production of **geographical indications** (Menozzi, 2014), to generate positive effects on economic, social, and environmental aspects (Vandecandelaere, 2010).
AIM: in this project, virgin olive oils from Albania, Portugal and Morocco are instrumental and sensory characterized.

MATERIALS AND METHODS

Samples: OMWW and a mixture of OMWW and 4% of leaves (OMWWL).

Characterization:
Total solids (TS), volatile solids (VS) (Rice et al., 2012).
pH: pH meter.
Lipid content: Soxhlet extraction.

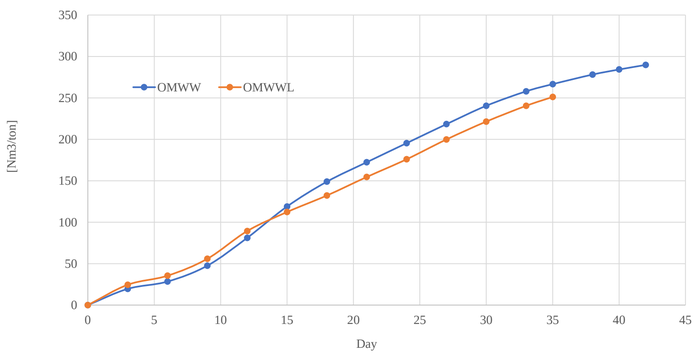
Analyses:
Biomethane Potential (BMP) analysis: Methan tube® digester.
Biogas composition: µGC.

Samples: two Albanian monovarietal extra virgin olive oils of **Kalinjot** cultivar (Kalnijot1 and Kalinjot2).

Analyses:
Peroxide values, free acidity, fatty acid profile, **spectrophotometric investigation in the ultraviolet** and **panel test** (EU Reg. 2022/2105).
Oxidation stability: Rancimat instrument.
Total phenols: Folin-Ciocalteau (Singleton and Rossi, 1965).
Phenolic compound analysis: HPLC-UV-VIS (IOC, 2017).
Volatile profile: SPME-GC-MS and HS-GC-IMS.

RESULTS

OMWW and OMWWL did not show any differences with a t-student test ($p>0.05$) in terms of biogas production, nor in gas composition.



BMP OMWW and OMWWL
Comparison of the accumulated biogas production of the BMP test between OMWW and OMWWL. Values are average of three replicates.

Content	OMWW	OMWWL
CH_4 (%)	50.71 ± 2.43	52.60 ± 0.44
CO_2 (%)	49.29 ± 2.43	47.44 ± 0.44

Gas composition of OMWW and OMWWL
Average of three replicates of gas composition of OMWW and OMWWL.

Quality parameters

Both samples, Kalinjot1 and Kalinjot2, met the criteria established by the EU for extra virgin olive oils and had a medium content of phenolic compounds (Montedoro et al., 1992).

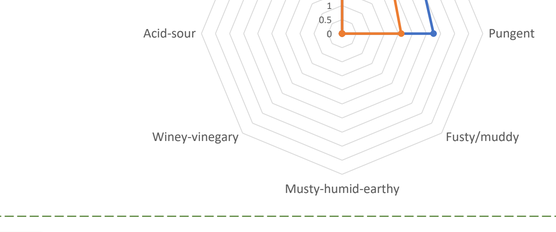
Sample	Free acidity (%)	POV (meq O_2/kg)	K_{268}	K_{232}	ΔK	OSI time (h)	Total phenols (mg GA/kg)
Kalinjot1	0.2 ± 0.0	6.0 ± 0.3	0.15 ± 0.02	1.80 ± 0.08	-0.003 ± 0.00	29.8 ± 1.7	250.23 ± 6.02
Kalinjot2	0.3 ± 0.0	6.7 ± 0.1	0.14 ± 0.01	1.84 ± 0.01	-0.002 ± 0.01	23.9 ± 1.1	268.17 ± 4.88

Volatile profile

33 volatile compounds were detected, among which (*Z*)-2-hexenal, hexanal, (*E*)-2-pentenal, (*Z*)-3-hexen-1-ol, 1-hexanol, 1-penten-3-one (green notes).

Sensory analysis

Panel test identified the samples as extra virgin.
Kalinjot1 presented two secondary positive attributes: **tomato** and **grass**.



CONCLUSIONS AND FUTURE PERSPECTIVES

By products biomethane potential (BMP) research: leaves combined with OMWW are a suitable substrate for biogas production. **Future experiments** will investigate the maximum amount of pulverized leaves that can be added to the OMWW.
Local Albanian olive oil characterization: the study confirms **peculiar quality characteristics** of **Kalinjot** virgin olive oils, however, it is important to verify the consistency of **positive secondary** attributes for the possible application of a designation of origin. **Future perspectives** include the characterization of other typical virgin olive oils with different geographical origins. Additionally, other analytical methods for oxidation based on microESR will be applied.

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