

From Food Waste to High-Value Compounds: Sustainable Green Approaches for Product Development

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Spoke: 8; Work Package: 8.1; Task: 8.1.1

Abstract

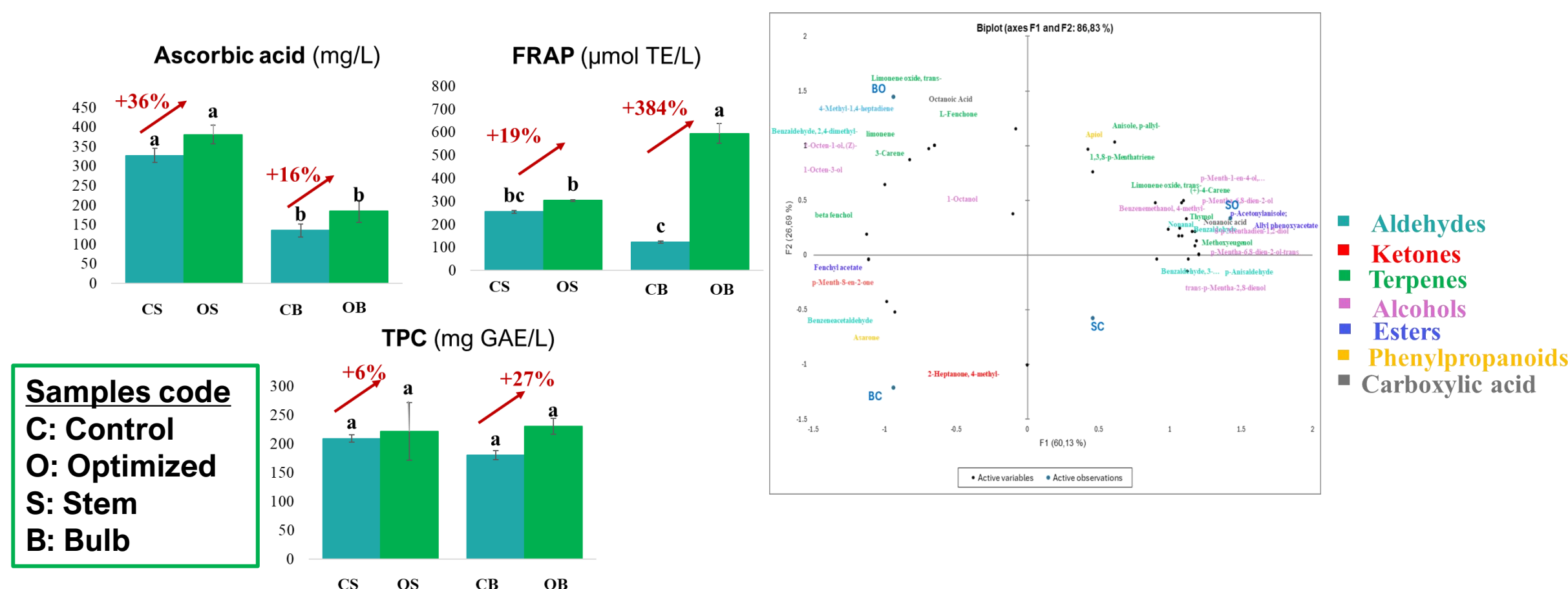
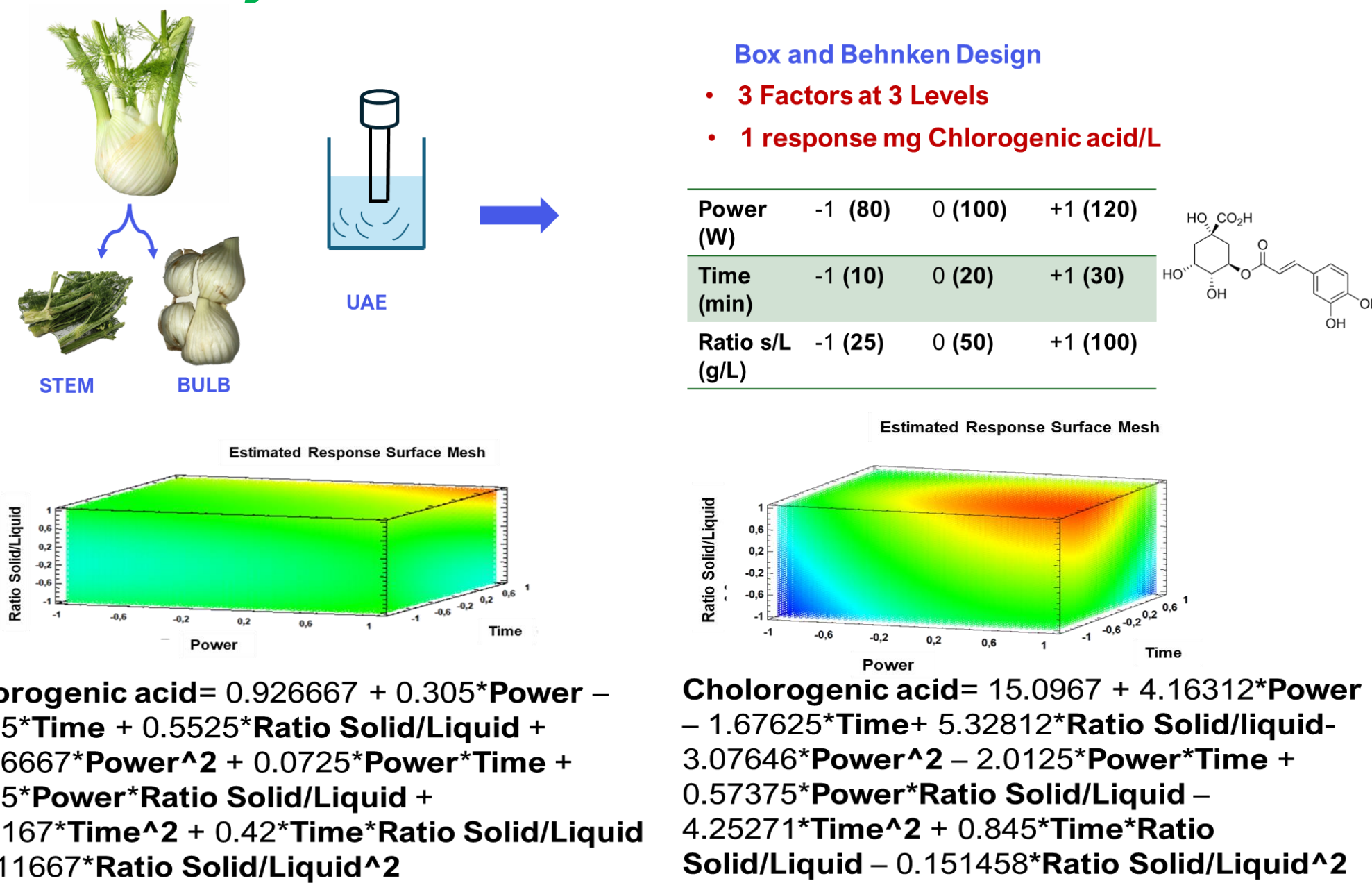
Nowadays there is a growing interest in food waste recovery by both consumers and companies. Food waste of plant origin is a source of bioactive compounds such as phenolic acids, anthocyanins, flavonoids, phytosterols, carotenoids, and tocopherols with well-known antioxidant, anti-glycemic, and antimicrobial properties. Food waste recovery combined with the use of green and sustainable technologies is a viable alternative with broad prospects.

Materials & Methods

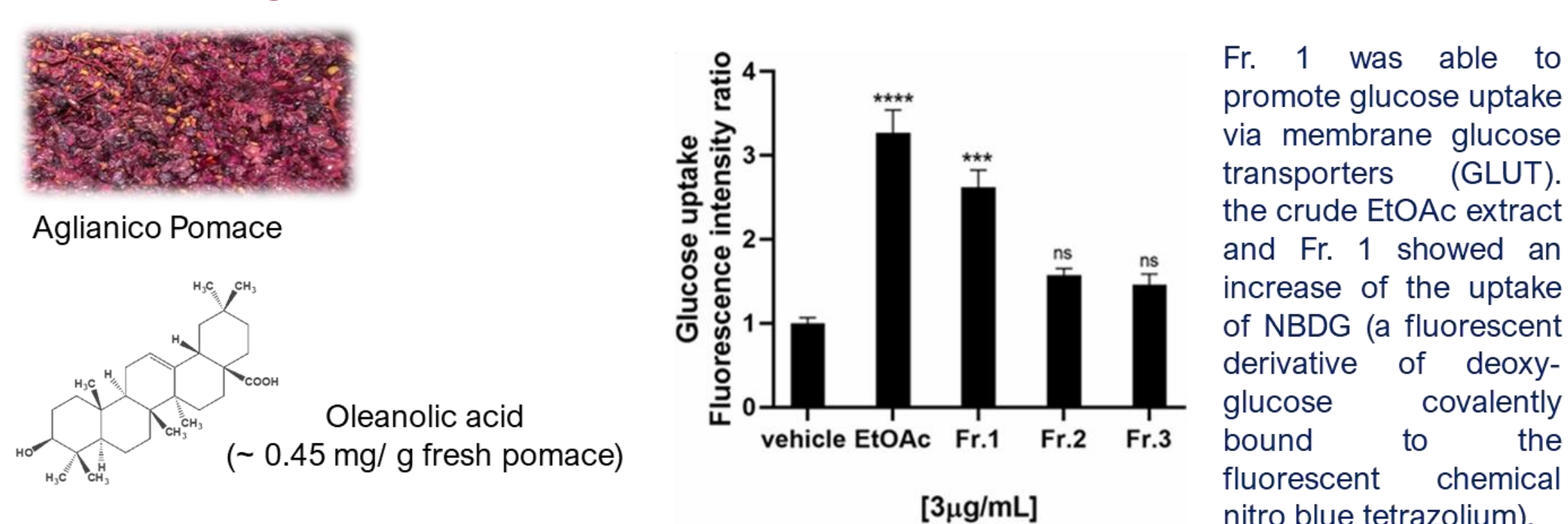
- Fennel stems and bulbs were subjected to ultrasonic-assisted aqueous extraction (UAE) and optimization by Box-and-Behnken design using three factors: power, time and s/L ratio at three different levels. The response was expressed as chlorogenic acid content (mg/L). Extracts were characterized to assess antioxidant activity, volatile organic compounds (VOCs) by GC-MS analysis, ascorbic acid content by HPLC and total polyphenol content (TPC).
- The extraction efficiency of oleanolic acid in five solvents (ethyl acetate, acetone, n-butanol, dimethyl carbonate (DMC) and 2-methyltetrahydrofuran (2-MeTHF) was tested. In addition, it was evaluated whether the Aglianico pomace extract obtained from EtOAc enriched in oleanolic acid Fr. 1 was able to promote glucose uptake via glucose membrane transporters (GLUT) and two other fractions (2 and 3 - both lacking oleanolic acid)
- The preparation of hydrogels from soy protein isolate (SPI) and polyphenols (caffeic, gallic and chlorogenic acids) of natural origin under mild air oxidation conditions was evaluated.
- The *in vitro* antimicrobial activity of extracts from spent coffee grounds (SCGs) was tested. Four different extracts obtained from liquid CO₂ (CO₂Liq) and supercritical CO₂ (CO₂SCR) were tested, each conducted in the presence or absence of 5% EtOH and complexed with hydroxyapatite (HA). *Staphylococcus aureus* and *Staphylococcus infantis* were used as a reference microorganism. The growth of bacteria in the presence of LB medium as a general control or different concentrations of SPC formulations was measured by optical density at 600 nm after 18 hours of incubation.

Results

1st Study



2nd Study



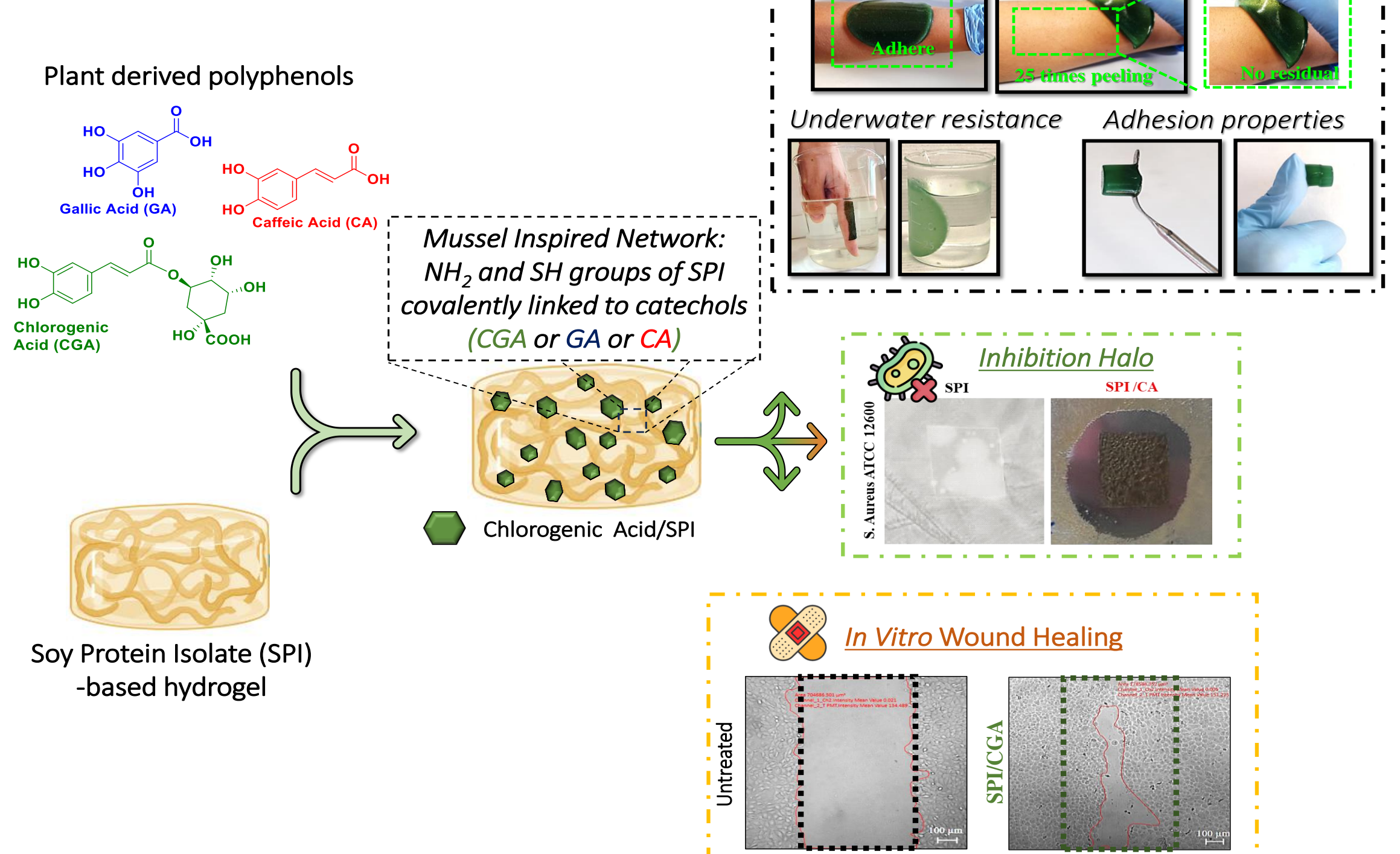
Studies on the extraction of Oleanolic Acid from red grape pomace

Composition of extracts by NRM and LC-MS-based.

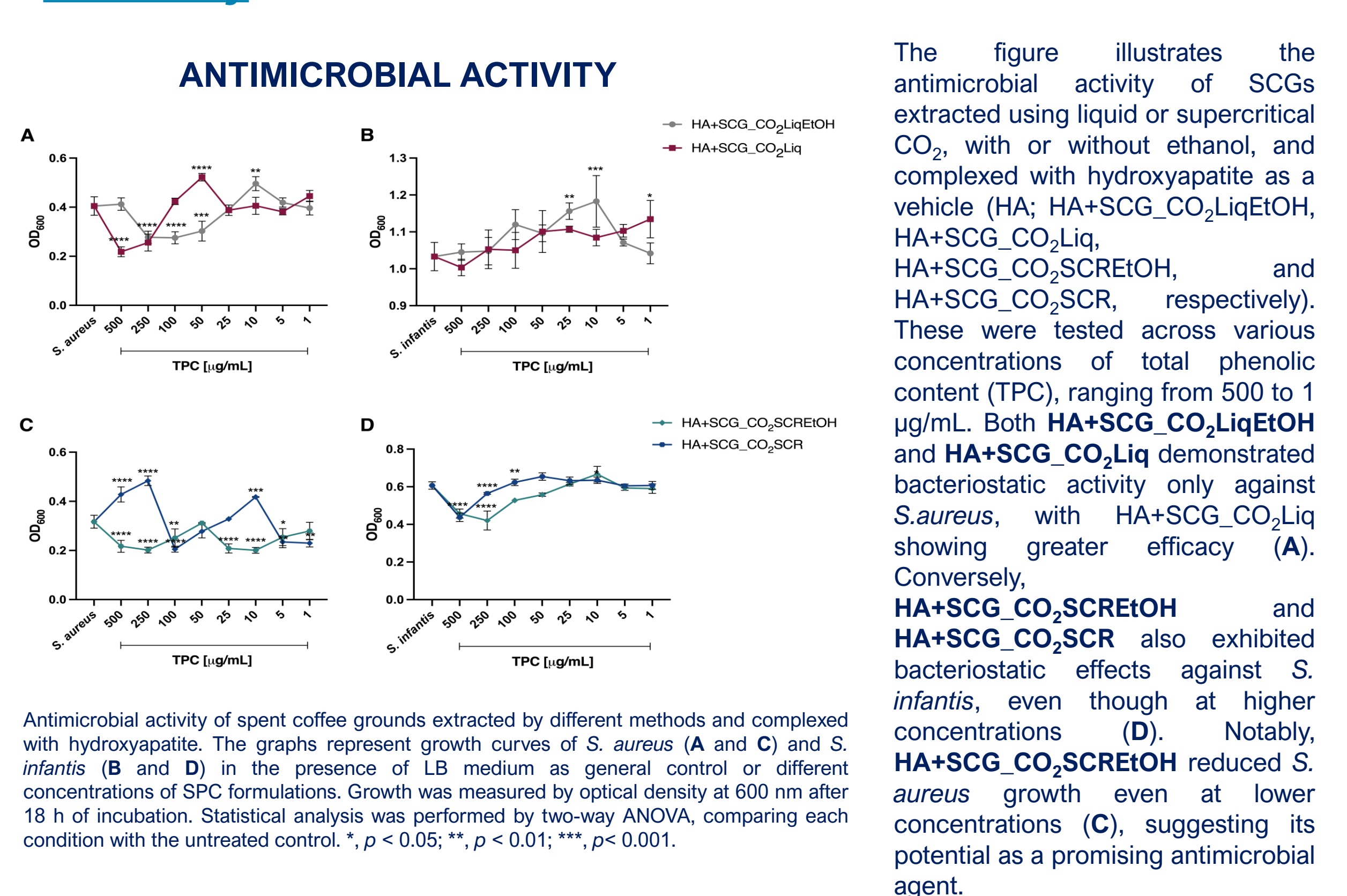
Extract	Oleanolic acid	Glycerol	%2,111(5)CLA	Malic acid	Citric acid	Glucose and Fructose	Proline
EtOAc	0.34 ± 0.01 Bb	0.38 ± 0.01 Da	0.06 ± 0.01 Ac	0.06 ± 0.00 Cc	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
DMC	0.38 ± 0.03 Ab	0.45 ± 0.01 Ca	0.02 ± 0.00 Bc	0.04 ± 0.00 Ec	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Acetone	0.11 ± 0.01 Dc	0.60 ± 0.03 Aa	0.01 ± 0.00 Cd	0.08 ± 0.00 Bc	0.02 ± 0.00 Bd	0.17 ± 0.01 Bb	0.00 ± 0.00
2-MeTHF	0.18 ± 0.01 Cb	0.47 ± 0.01 Bca	0.03 ± 0.01 Bc	0.09 ± 0.00 Ad	0.03 ± 0.00 Ac	0.12 ± 0.02 Cc	0.00 ± 0.00
Butanol	0.04 ± 0.00 Ede	0.51 ± 0.02 Ba	0.01 ± 0.00 Cc	0.05 ± 0.00 Dd	0.02 ± 0.00 Bde	0.25 ± 0.02 Ab	0.10 ± 0.01 Ac

DMC emerged as the best solvent for oleanolic acid extraction according to the green chemistry principles

3rd Study



4th Study



Reference

- Argenziano, R. et al. All natural mussel-inspired bioadhesives from soy proteins and plant derived polyphenols with marked water-resistance and favourable antibacterial profile for wound treatment applications, *Journal of Colloid and Interface Science*, 652, 2023, 1308-1324, 10.1016/j.jcis.2023.08.170.
- Errichiello, F. et al. Oleanolic acid: A promising antidiabetic metabolite detected in Aglianico grape pomace. *Journal of Functional Foods*, 104, 2023 105548, 10.1016/j.jff.2023.105548
- Romano, R. et al. The Use of Carbon Dioxide as a Green Approach to Recover Bioactive Compounds from Spent Coffee Grounds. *Foods*, 12(10), 2023, 1958, 10.3390/foods12101958