PhD Open Days

Designing Value from Grape Pomace

DOCTORAL PROGRAM IN BIOENGINEERING AND BIOSCIENCES (DBE)

JANICE DA CONCEIÇÃO LOPES (janice.lopes@tecnico.ulisboa.pt)

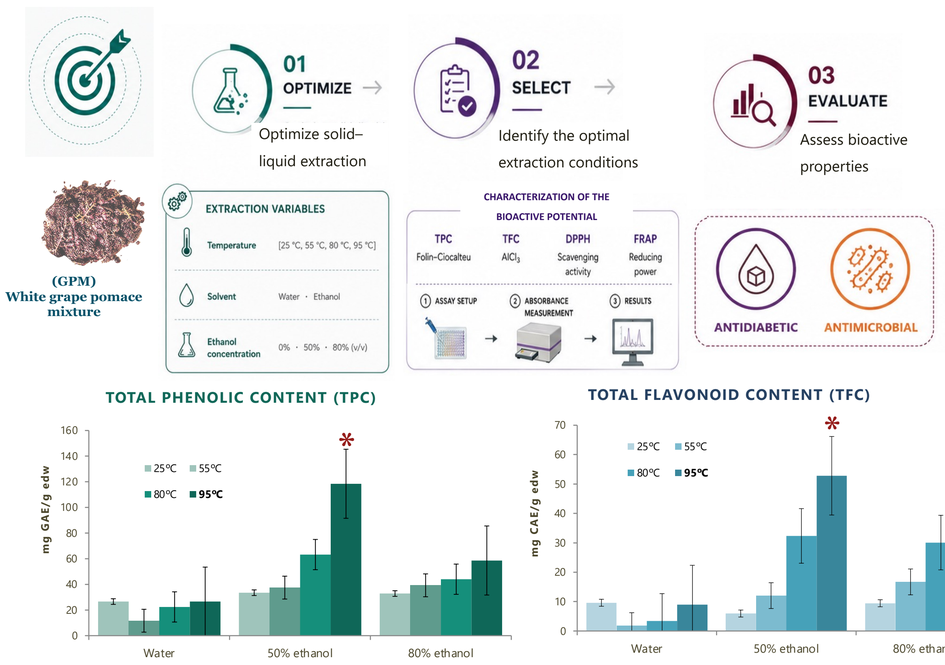
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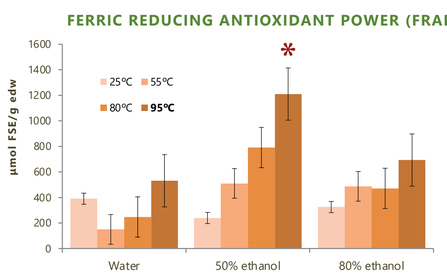
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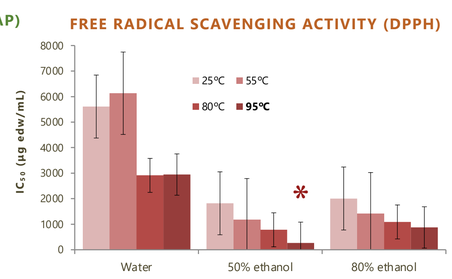
- Grape pomace, a major by-product of winemaking, represents a valuable source of phenolic compounds associated with diverse biological activities.

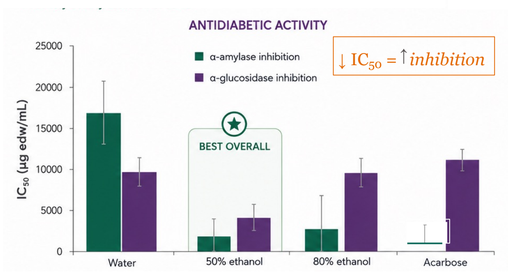
- However, unlocking its potential requires effective extraction strategies, as compound recovery depends on both processing conditions and raw material characteristics.

I. Mapping Extraction Conditions









OPTIMAL CONDITION

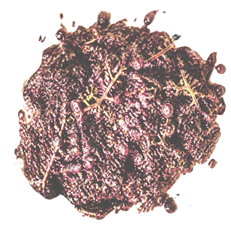
50% ETHANOL · 95 °C

Microorganism	MIC	MBC / MFC
B. cereus	≤ 12.5 mg/mL	50 mg/mL
E. faecalis	25 mg/mL	50 mg/mL
S. aureus	25 mg/mL	50 mg/mL
L. monocytogenes	100 mg/mL	100 mg/mL
E. coli	100 mg/mL	> highest concentration tested
P. fluorescens	50 mg/mL	100 mg/mL
S. Typhimurium	No detectable inhibition	—
C. albicans	50 mg/mL	50 mg/mL (MFC)

FILAMENTOUS FUNGI
A. fumigatus . *P. spinulosum*
No detectable activity under the tested conditions.

Gram-positive bacteria tended to be more susceptible to grape pomace extract than Gram-negative bacteria.

II. Beyond the Variety



(GPM)

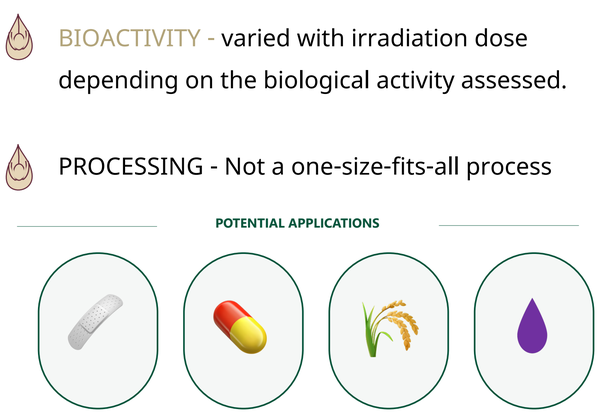


(AGP) Aragonez/Tempranillo

Criterion	GPM	AGP
Total phenolic content (TPC) * — significant difference	◐◐○○○	●●●●●
Total flavonoid content (TFC) ns — not significant	●●●●●	●●●●◐
Antioxidant capacity (FRAP) * — significant difference	●◐○○○	●●●●●
Radical scavenging (DPPH) * — significant difference	●●◐○○	●●●●●
α-Glucosidase inhibition * — significant difference	◐○○○○	●●●●●
α-Amylase inhibition * — significant difference	◐○○○○	●●●●●

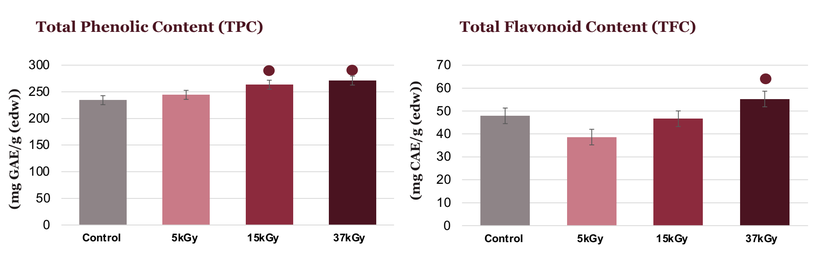
- RAW MATERIAL MATTERS
  Composition and bioactivity vary between grape pomace matrices.
- MICROORGANISM-SPECIFIC RESPONSES
  GPM inhibited a broader range of microorganisms.
- BIOACTIVITY DEPENDS ON THE GRAPE POMACE VARIETY
  No single matrix performed best across all evaluated parameters.

- BIOACTIVITY - varied with irradiation dose depending on the biological activity assessed.
- PROCESSING - Not a one-size-fits-all process



III. Gamma Irradiation for Valorisation





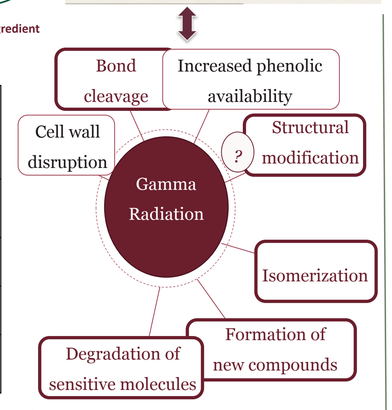
TPC increased at 15 and 37 kGy.

Only 37 kGy showed difference compared to the control.

● *are significantly different from control ($p < 0.05$)*

Antidiabetic activity	α-Amylase inhibition IC_{50}(µg edw/mL)	α-Glucosidase inhibition IC_{50}(µg edw/mL)
Control	94 ± 4[a]	253 ± 8[a]
5kGy	103 ± 2[a]	229 ± 7[a, b]
15kGy	91 ± 2[a]	**226 ± 6[b]** ✓
37kGy	**64 ± 2[b]** ✓	231 ± 6[a, b]

Irradiation dose differently affected α-amylase and α-glucosidase inhibition.



Beyond enhanced extraction, radiation may induce changes.

IV. A second life

Solid Biomass (Residual material) → Agronomic assessment with lettuce

Extracts (Bioactive compounds)



Ongoing assessment: benefits not yet established



- The cultivation of lettuce in soil fortified with 3% grape pomace suggested a positive effect on plant growth.
- The remaining solid biomass is also a resource.

fct Fundação para a Ciência e a Tecnologia

Funding: This research was funded by Foundation for Science and Technology (FCT, Portugal), BD Project **[UID/04349/2025]** and **[UI/BD/154696/20239]**

Acknowledgment:
The authors are grateful to *Família Margaça* wine production company for providing the samples.

TÉCNICO UNIVERSIDADE DE LISBOA

SUPERVISORS: Sandra Cabo Verde

Joana Madureira

BIOENGINEERING AND BIOSCIENCES (DBE)

phdopendays.tecnico.ulisboa.pt