PhD Open Days

GRAPE POMACE: A BIOACTIVITY CHARACTERIZATION

BIOTECHNOLOGY AND BIOSCIENCES (DBiotec)

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OPENING INSIGHTS

- Grape pomace (skins, seeds, stems, and residual pulp), a by-product of winemaking, comprises about 20-30% of the grape's weight.
- It is a widely available resource, particularly in wine-producing regions like Europe, which generates 56.2% of the world's wine[1].

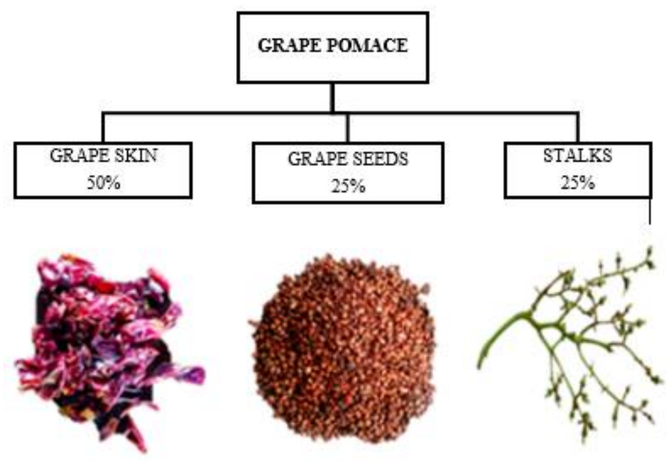


FIGURE 1: Grape Pomace Solids compositions

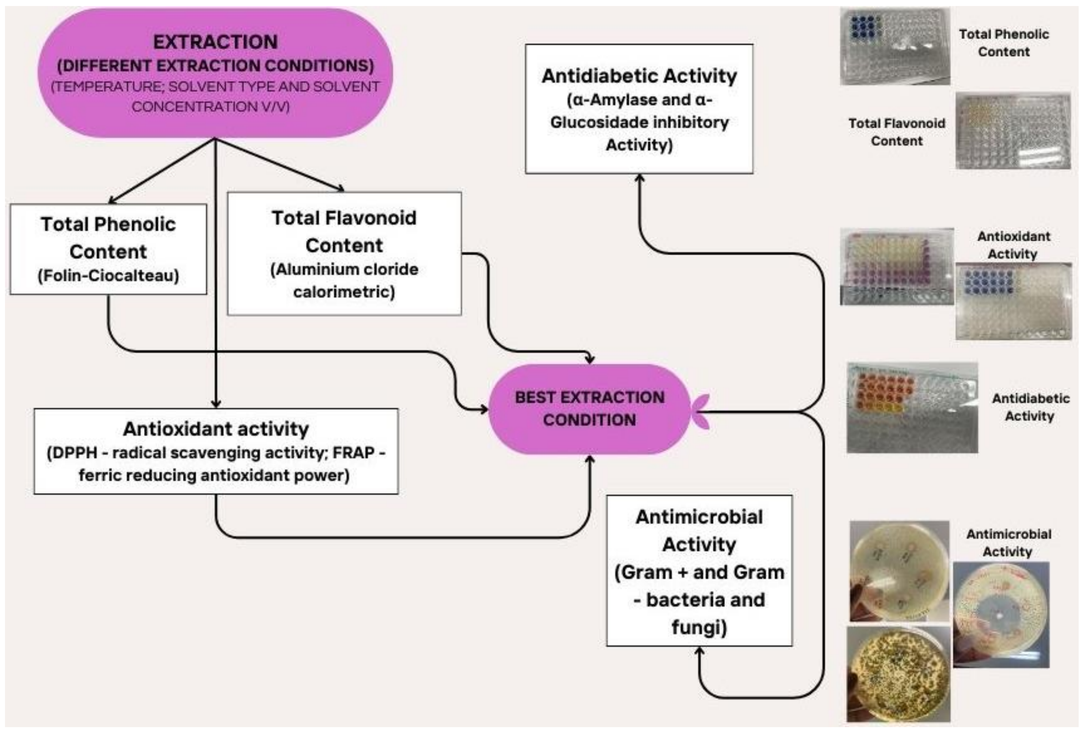
- Portugal, generate thousands of tons of grape pomace annually, which can be repurposed for its high bioactivity[1].
- Bioactive compounds contain antioxidant, antidiabetic, anti-inflammatory, anticancer, and antimicrobial properties, making it valuable for the pharmaceutical, cosmetic, and food industries[2].
- Using grape pomace in a circular economy reduces winemaking waste, providing a sustainable source of bioactive compounds. This supports several SDGs (responsible consumption, climate action, economic growth)[3].

OBJECTIVE

Characterizing the bioactive potential of grape pomace by analyzing:

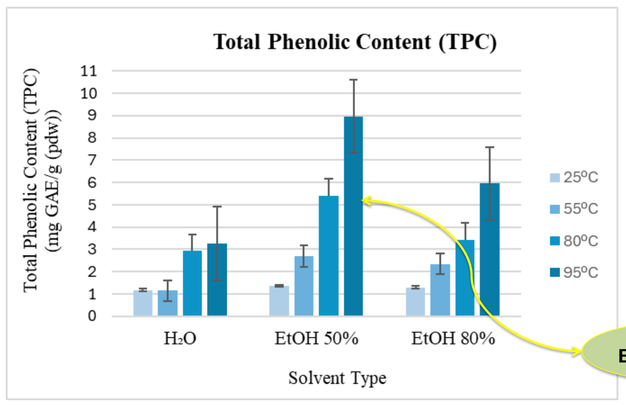
- Phenolic and Flavonoid Compounds Content
- Antioxidant Activity
- Antidiabetic Activity
- Antimicrobial Activity

METHODOLOGY



RESULTS

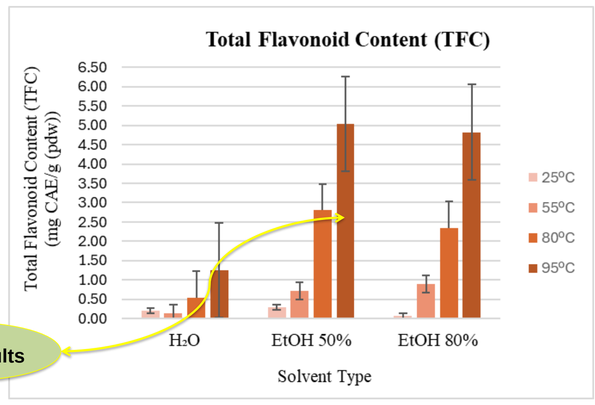
PHENOLIC AND FLAVONOID COMPOUNDS CONTENT



GRAPHIC I: Total Phenolic Content

GAE – Gallic Acid Equivalent; **pdw** – pomace dry weight

Best Results



GRAPHIC II: Total Flavonoid Content

CAE – Catechin Equivalent

ANTIOXIDANT ACTIVITY

TABLE I: Antioxidant Activity

Temperature	Sample	FRAP (mmol FSE/g pdw) Mean ± SE	DPPH EC_{50} (mg edw/ml H_2O) Mean ± SE
25ºC	EtOH 50%	0.012 ± 0.002 [e]	1.82 ± 0.052 [d]
	EtOH 80%	0.013 ± 0.001 [e]	2.008 ± 0.046 [d]
	H_2O	0.0132 ± 0.0012 [e]	5.61 ± 0.090 [b]
55ºC	EtOH 50%	0.032 ± 0.003 [c, d]	1.177 ± 0.0128 [f]
	EtOH 80%	0.029 ± 0.002 [d]	1.411 ± 0.0560 [e]
	H_2O	0.0080 ± 0.0003 [e]	6.131 ± 0.0320 [a]
80ºC	EtOH 50%	0.069 ± 0.002 [b]	0.782 ± 0.0404 [g]
	EtOH 80%	0.038 ± 0.002 [c]	1.090 ± 0.0386 [f]
	H_2O	0.0340 ± 0.0008 [c, d]	2.913 ± 0.0350 [c]
95ºC	EtOH 50%	0.121 ± 0.004 [a]	0.272 ± 0.0434 [h]
	EtOH 80%	0.067 ± 0.002 [b]	0.874 ± 0.0210 [f, g]
	H_2O	0.064 ± 0.002 [b]	1.946 ± 0.0396 [d]

Best Results

* Values are means ± standard error (SE) of measurements.
Means within each column with different letters (a–h) differ significantly ($p \leq 0.05$).
FSE – Ferrous Sulfate Equivalent
edw – extract dry weight
pdw – pomace dry weight

ANTIDIABETIC ACTIVITY

TABLE II: Antidiabetic Activity

	INHIBITIONS	α-AMYLASE EC_{50} (mg edw/ml H_2O) Mean ± SE	α-GLUCOSIDASE EC_{50} (mg edw/ml H_2O) Mean ± SE
95ºC	EtOH 50%	1.271 ± 0.148 [c]	3.66 ± 0.07 [b]
	EtOH 80%	2.122 ± 0.1134 [b]	3.53 ± 0.14 [b]
	H_2O	16.830 ± 0.224 [a]	9.56 ± 0.11 [a]

* Values are means ± SE of measurements.
Means within each column with different letters (a–c) differ significantly ($p \leq 0.05$).
edw – extract dry weight
pdw – pomace dry weight

Best Results

ANTIMICROBIAL ACTIVITY

- ✓ Among the analyzed microorganisms, only ***Bacillus cereus*** **indicated growth inhibition.** [C] = 25 - 200 mg (edw)/mL.
- ✓ Extracts **at higher concentrations** 100 and 200 mg (edw)/mL presented limited growth inhibitions against *Staphylococcus aureus, Escherichia coli*, *Candida albicans.*
- ✓ N**o growth inhibitory effect against** *Salmonella* Typhimurium*, Pseudomonas fluorescens*, *Listeria monocytogenes*, *Aspergillus fumigatus*, and *Penicillium spinulosum* at the tested concentrations.

CONCLUSION

- ✓ The extraction of bioactive compounds from grape pomace demonstrated significant antioxidant, antidiabetic, and antimicrobial activities.
- ✓ The optimal extraction condition was identified as EtOH 50% at 95°C.
- ✓ To further enhance extraction efficiency and increase the bioactive potential, future studies should explore the integration of an ionizing radiation as a pre-treatment step.

References:

[1] OIV. (1st April of 2023). International Organization of Vine and Wine.

[2] Barros et al., 2015). https://doi.org/10.1007/s11101-015-9421-5

[3] European Commission. (2015). Closing the loop - An EU action plan for the Circular Economy.

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