

# Antioxidant Activity and Total Phenolic Content of Different Extracts of Delipidified Olive Oil Pomace

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## Introduction

The use of by-products as a source of bioactive compounds with economic added value is one of the objectives of the circular economy. Olive oil industry is a source of olive pomace, as a by-product.

The olive pomace used in the present study was the exhausted (delipidified) olive pomace, which is the by-product generated after drying and subsequent hexane extraction of residual oil from the olive pomace.

This exhausted olive oil pomace may contain remaining bioactive compounds, such as phenolic compounds, which can be of interest not only for the food industry, but also for the pharmaceutical and cosmetic industries.

## Objectives

Various types of green methodologies, such as solvent extraction (water and hydroalcoholic), ultrasound-assisted extraction, ultra-turrax-assisted extraction and enzyme-assisted extraction (cellulase; viscoenzyme) were used to obtain extracts rich in bioactive compounds from the exhausted olive oil pomace. The bioactivity of these extracts was evaluated through the antioxidant activity.



## Methods

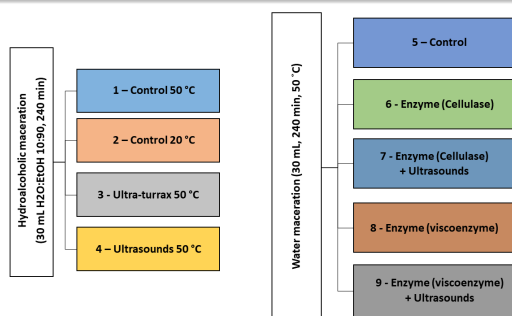


Figure 1. Green extraction experiments performed in this study.

**Yield of extraction:** The yield of extraction was calculated based on the amount of olive pomace used in each extraction method:

$$\text{Yield of extraction (g/100 g DW)} = \frac{\text{dried extract (g)}}{\text{dry weight of olive oil pomace (g DW)}} \times 100 \quad (1)$$

1g of olive oil pomace powder + 30 mL of an hydroalcoholic solution (water:ethanol 1:9), 50 °C, 120 rpm, 120 min (repeated twice). The suspension was filtered, the ethanol evaporated, and the extract resuspended in water and lyophilized. 40 mg of this dried extract were suspended in 2 mL of distilled water (20 mg/mL) for the determination of the total phenolic content and antioxidant activity.

**Total phenolic content (TPC):** Folin-Ciocalteu method [1,2,3].

**Antioxidant activity assays:**

- ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)) [4,5];
- DPPH (2,2-diphenyl-1-picrylhydrazyl) [5,6];
- ORAC [5,7].

## Results

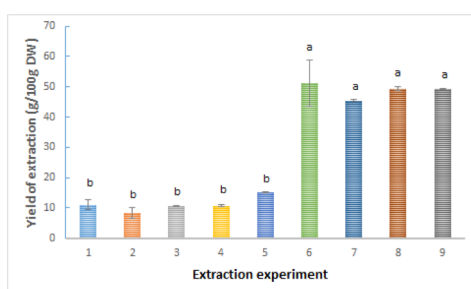


Figure 2. Yield of extraction obtained in the several experiments.

Table 1. Total phenolic content and antioxidant activity of the different extracts obtained of delipidified olive oil pomace in the several experiments.

Extraction experiment	TPC	ABTS	DPPH	ORAC
	(mg gallic acid equivalent/100 mg dried extract)	(μmol Trolox equivalent/100 mg dried extract)		
1	8.116 ± 0.465 <sup>c</sup>	58.421 ± 3.095 <sup>b</sup>	30.458 ± 2.489 <sup>b</sup>	187.625 ± 17.707 <sup>b,c</sup>
2	6.813 ± 0.347 <sup>d</sup>	37.415 ± 6.986 <sup>c</sup>	25.408 ± 1.776 <sup>c</sup>	170.896 ± 14.017 <sup>c</sup>
3	8.743 ± 0.533 <sup>b</sup>	57.152 ± 4.079 <sup>b</sup>	30.873 ± 1.322 <sup>b</sup>	205.297 ± 4.122 <sup>a,b</sup>
4	7.666 ± 0.245 <sup>c</sup>	63.528 ± 0.340 <sup>a,b</sup>	25.099 ± 2.161 <sup>c</sup>	201.182 ± 8.790 <sup>a,b</sup>
5	10.159 ± 0.741 <sup>a</sup>	69.155 ± 7.703 <sup>a</sup>	38.121 ± 1.614 <sup>a</sup>	215.522 ± 18.908 <sup>a</sup>
6	3.057 ± 0.141 <sup>f</sup>	18.760 ± 3.381 <sup>d</sup>	10.601 ± 0.968 <sup>d</sup>	69.336 ± 4.963 <sup>d</sup>
7	3.658 ± 0.245 <sup>e,f</sup>	18.665 ± 3.194 <sup>d</sup>	9.873 ± 0.847 <sup>d</sup>	66.555 ± 4.407 <sup>d</sup>
8	3.730 ± 0.342 <sup>e</sup>	24.103 ± 1.497 <sup>d</sup>	10.439 ± 0.36 <sup>d</sup>	63.979 ± 4.835 <sup>d</sup>
9	3.543 ± 0.293 <sup>e,f</sup>	24.102 ± 1.497 <sup>d</sup>	11.201 ± 0.755 <sup>d</sup>	71.459 ± 6.156 <sup>d</sup>

## Conclusions

Among all methodologies used the extractions with enzymes produced the best yields of extraction and the conventional extraction with water at 50 ° C produced the best results for the total phenolic content and antioxidant activity: ABTS, DPPH and ORAC.

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