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Sunflower (*Helianthus annuus* L.) bioresidues: a source of phenolic compounds and bioactive potential

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Introduction & Aim

The sunflower (*Helianthus annuus* L.) is an extensively cultivated crop that produces significant by-products. Typically, the seeds are used by the industry, while the rest of the plant is discarded, although it is a rich source of molecules with high added value that can be used in the food industry [1]. In this sense, this work aimed to valorize these by-products by studying different parts of the plant that are discarded after harvesting the seeds - FOG (leaves and stems) and FLG (flowers).

Methodology

Acquisition of samples through a local producer (Bragança, Portugal, in 2024)

Separation (leaf/stem and flower) and freeze-drying of samples

Identification and quantification of individual phenolic profile (LC-DAD-ESI-MS^n)

Evaluation of bioactive properties

Antimicrobial activity

Antioxidant activity: TBARS | PR | DDPH

Results

Table 1. Concentration of Predominant Phenolic Acids in Sunflower Leaves (FOG) and Flowers (FLG) (mg/g of extract).

Main Phenolic Compounds	Leaves (FOG)	Flowers (FLG)
3-*O*-caffeoylquinic acid	0.191 ± 0.003	0.417 ± 0.012
5-*O*-caffeoylquinic acid	0.078 ± 0.000	3.5 ± 0.1
4-*O*-caffeoylquinic acid	0.158 ± 0.003	0.35 ± 0.01
3,4,5-tri-caffeoylquinic acid	0.137 ± 0.002	0.39 ± 0.01
Total chlorogenic acids	2.43 ± 0.04	10.1 ± 0.2

Table 2. Antioxidant activity of extracts obtained from sunflower bioresidue samples.

Antioxidant activity (value of EC_{50}, mg/mL)	Concentration		
	FOG	FLG	*p*-valor
TBARS	32.46 ± 0.40	55.3 ± 0.5	<0.01
DPPH	0.022 ± 0.001	0.025 ± 0.001	<0.01
PR	0.73 ± 0.030	1.90 ± 0.06	<0.01

EC_{50} values: Concentration of extract corresponding to 50% of the antioxidant activity. Metabisulphite (positive control) EC_{50}=0.23 mg/mL (TBARS inhibition); EC_{50}=0.043 mg/mL (DPPH inhibition) and EC_{50}=0.025 mg/mL (PR inhibition).

Twenty compounds were identified in the FOG sample, while fifteen were identified in the FLG sample. 3-*O*-caffeoylquinic acid was the most abundant in FOG (0.191 ± 0.003), whereas 5-*O*-feruloylquinic acid was predominant in FLG (3.5 ± 0.1). FOG demonstrated greater antioxidant potential, reflected by a lower EC_{50} value, indicating more effective lipid peroxidation inhibition. Regarding antimicrobial activity, both extracts exhibited antibacterial action, with FOG showing superior performance against ***Enterobacter Cloacae***, ***Escherichia coli***, ***Morganella morganii***, ***Listeria monocytogenes***, and **MRSA**.

Conclusion

Overall, these results are valid arguments to support the use of sunflower by-products as underexploited alternative sources of bioactive phenolic compounds with potential health benefits for consumers. This integral use aligns with the 2030 Sustainable Development Goals, promoting a healthy and circular economy.

Conflict of Interest - The authors declare no conflicts of interest

References

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