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Topic: Innovative and sustainable food ingredients and products

Exploitation of Sunflower (*Helianthus annuus* L.) Bioresidues: Nutritional Value and Chemical Composition

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Introduction

Food waste contradicts sustainable development goals, causing significant social, environmental, and economic impacts. An example is sunflower (*Helianthus annuus* L.), with around 50 million tons produced globally in 2020 [1,2]. So, this study intended to value a large-scale biowastes from sunflower seed production, exploring the nutritional profile and chemical composition of different vegetative parts of the discarded plant: leaves and stems (FOG) and flowers (FLG) . discarded after seed harvesting to promote the sustainability of the sector through innovative reuse strategies that increase the circular economy, within the value chain (SDGs 9, 12, 13 and 15).

Methodology

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

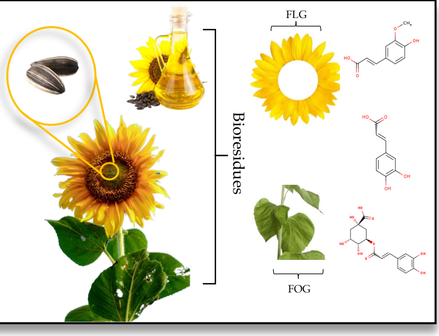
Separation (leaf/stem and flower) and freeze-drying of samples

Chemical Analysis

- Free sugars profile (HPLC-RI)
- Fatty acids profile (GC-FID)

Nutritional Analysis

- Proteins (AOAC 978.04)
- Fat (AOAC 920.85)
- Ash (AOAC 923.03)
- Carbohydrates
- Energy



Results

Table 1. Nutritional and chemical composition of sunflower bioresidues samples.

	FOG	FLG	*p-value*
Fat (g/100g)	1.00±0.03^{a}	15.42±0.47^{b}	<0.01
Protein (g/100g)	4.61±0.01^{a}	12.48±0.22^{b}	<0.01
Ash (g/100g)	0.01±0.00^{a}	0.01±0.00^{a}	-
Carbohydrates (g/100g)	94.38±0.02^{a}	72.09±0.17^{b}	<0.01
Energy (kcal)	405.0±0.1^{a}	477.1±2.3^{b}	<0.01
Energy (kJ)	1695.5±0.6^{a}	1997.4±9.8^{b}	<0.01

		FOG	FLG	*p-value*
Free sugars profile (g/100g dw)	Fructose	0.24±0.01^{a}	0.44±0.01	0.01
	Glucose	0.16±0.01^{a}	0.24±0.01^{a}	0.11
	Sucrose	0.67±0.11^{a}	0.86±0.05^{a}	0.22
	Total sugars	1.07±0.14^{a}	1.53±0.03^{b}	0.05
Fatty acids profile (relative %)	SFA	37.27±0.73^{a}	9.59±0.00^{b}	0.01
	MUFA	2.53±0.03^{a}	49.13±0.47^{b}	<0.01
	PUFA	60.20±0.76^{a}	41.28±0.66^{b}	<0.01

FOG: sunflower leaves and stems; FLG: sunflower flowers; SFA: saturated fatty acids; MUFA: monosaturated fatty acids; PUFA: polyunsaturated fatty acids; dw: dry weight

The samples of FOG and FLG exhibit significant differences in nutritional composition attributed to their distinct roles within the plant. FLG shows higher levels of fat (15.42±0.47 g/100g) and protein (12.48±0.22 g/100g) compared to FOG, which contains lower amounts of fat (1±0.03 g/100g) and protein (4.61±0.01 g/100g). FOG is rich in saturated and polyunsaturated fatty acids, crucial for plant structure and photosynthesis, whereas FLG predominantly features monounsaturated fatty acids. Regarding sugars, FLG exhibits higher levels of fructose, glucose, and sucrose than FOG, indicating a greater demand for these carbohydrates to support seed development.

Conclusion

This study showed that there are chemical and nutritional differences between FOG and FLG samples, however, these differences highlight the biochemical discrepancies of each tissue in relation to its specific function in the sunflower plant. Nevertheless, these results highlighted the potential of sunflower flowers and leaves/stems that are discarded by the industry, showing excellent nutritional values and suggesting their usefulness for different industrial applications, especially for the development of innovative foods.

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