

Characterization of *Citrus limon* peels for the valorization through the recovery of bioactive compounds



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Introduction

Citrus belongs to the family Rutaceae and are one of the most widely cultivated fruit crop and one of the main consumed products in the Mediterranean area. The annual production of different types of citrus fruits was approximately 143 thousand tonnes, where lemons, *Citrus limon* L.; and limes, *Citrus aurantifolia* L. accounts for ca. 20 thousand tonnes, in the year 2019 [1]. The processing and consumption of citrus fruit generates a significant amount of waste. This includes peel, pulp, seeds, and pomace, which represents about 50% of the fresh fruit [2]. *Citrus limon* (*C. limon*) peels contain significant amounts of bioactive compounds, such as minerals, carotenoids, vitamins, essential oils, phenolic compounds, and fibres (mainly pectin), which confer nutritional value and health benefits such as antimicrobial and antioxidant properties [3]. These by-products, which are typically discarded as waste in the environment, can be explored to produce new bioactive and functional ingredients, a desirable approach from a circular economy perspective.

Objectives

The main goal of this work was the development of an integrative and sustainable approach to obtain bioactive and functional ingredients from lemon by-products. The nutritional composition, phenolic compound profile and essential oil properties were characterised in order to understand the potential valorisation of the lemon by-products.

Methods

Nutritional Composition



Essential oils Profile



Phenolic Compounds Profile



Results and Main Conclusions

Nutritional Composition

Table 1. Lemon by-products nutritional characterization.

COMPONENT	RESULTS
MOISTURE (%W/W)	82.71 ± 0.19
EXPRESSED IN DRY BASIS (%W/W)	
ASH	4.38 ± 0.02
PROTEIN	5.35 ± 0.08
LIPIDS	1.04 ± 0.07
CARBOHYDRATES	89.23*
TOTAL DIETARY FIBER	41.16

Results are expressed in % dry matter basis (g/100g DM)
*Total carbohydrates content obtained by difference.

Table 2. Mineral composition of lemon by-products.

	CONCENTRATION (mg/100g DW)
Cadmium	0.01
Phosphorus	103.28
Manganese	0.63
Iron	1.24
Magnesium	148.07
Calcium	806.98
Copper	0.75
Aluminium	1.47
Sodium	26.82
Potassium	895.39

Table 3. Vitamin C composition of lemon by-products.

	CONCENTRATION
Vitamin C (mg/100 g FW)	0.10

Phenolic Compounds Profile

Table 3. Phenolic compounds composition of lemon by-products.

PARAMETER	CONCENTRATION
Free phenolics	
Eriocitrin (mg/g FW)	1.39 ± 0.02
Hesperidin (mg/g FW)	0.57 ± 0.02
Bound phenolics	
P-coumaric acid (mg/g FW)	0.15 ± 0.01
Protocatechuic acid (mg/g FW)	0.08 ± 0.01
Isoferulic acid (mg/g FW)	0.05 ± 0.01
Sinapic acid (mg/g FW)	0.02 ± 0.01

Volatile compounds profile of essential oil



Figure 1. Volatile compounds profile (%) of essential oil from lemon by-products.

Main Conclusions

According to these results, it can be concluded that lemon by-products, contain interesting bioactive compounds, mainly fiber, phenolic compounds and aromatic volatile compounds, justifying their valorisation in different food applications.

References

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