Eco-sustainable extraction of polyphenols from quince waste: Optimization and alternatives for determination of phenolic compounds.

Bustamante Brizuela, AB (1,2); Piccoli, MB (3,4); Ferreyra, NF (3,4); Baroni, MV (1,2)

(1) Institute of Food Science and Technology Córdoba (ICyTAC), CONICET, UNC, Córdoba, Argentina.
(2) Organic Chemistry Department, FCQ - UNC, Córdoba, Argentina.
(3) Department. Physical Chemistry, Faculty of Chemical Sciences, National University of Córdoba, Córdoba, Argentina.
(4) Physical Chemistry Research Institute of Córdoba (INFIQC), CONICET, UNC, Córdoba, Argentina.

alejandra.bustamante@mi.unc.edu.ar

Keywords: green chemistry, antioxidants, biosensor, Folin, UHPL-MS/MS

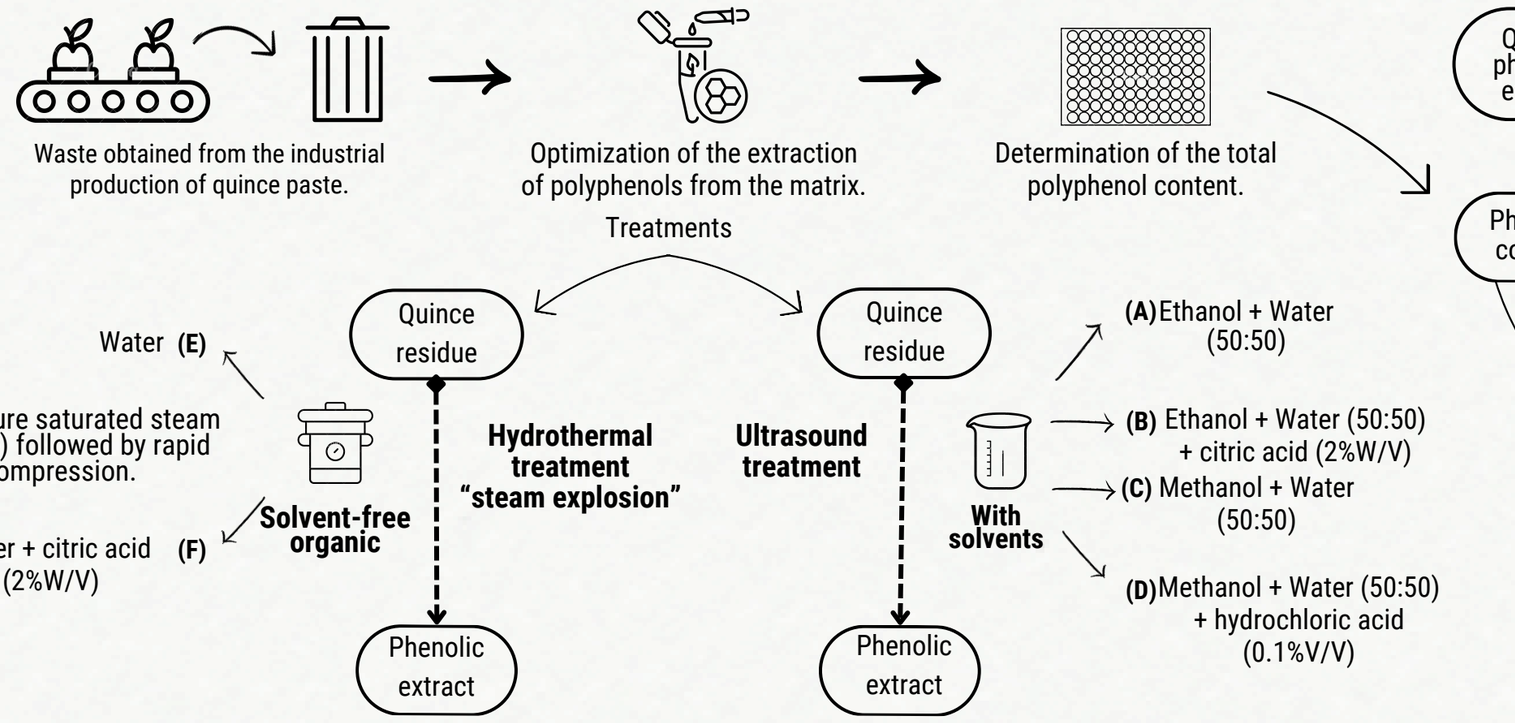
Introduction

During the production of quince paste, significant waste is generated including skin, peel and seeds. Quince is rich in bioactive compounds such as polyphenols, with antioxidant and antimicrobial properties. Extracting these compounds from agroindustrial waste is strategic. Alternative methods to conventional techniques are sought that are environmentally friendly and comply with the principles of green chemistry, avoiding or reducing the use of organic solvents. The determination of phenolic compounds is commonly performed using the Folin-Ciocalteu (FC) assay. Although it is convenient and simple, it has disadvantages such as the use of non-green reagents, long processing time, low specificity, and multiple interferences.

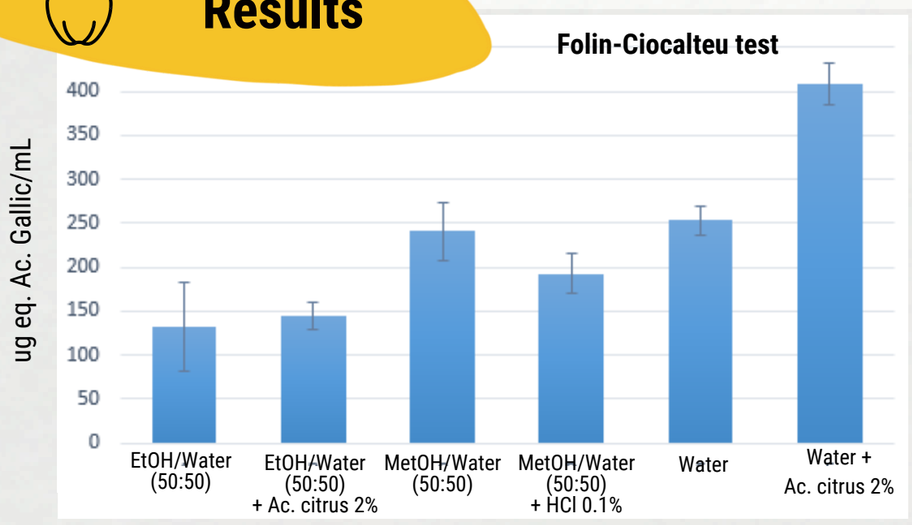
Objective

Optimize an alternative method of extraction of food grade polyphenols without the use of organic solvents, with a focus on the use and revaluation of waste from the industrialization of quince and propose an alternative to the classic determination of the total content of phenolic compounds.

Methodology



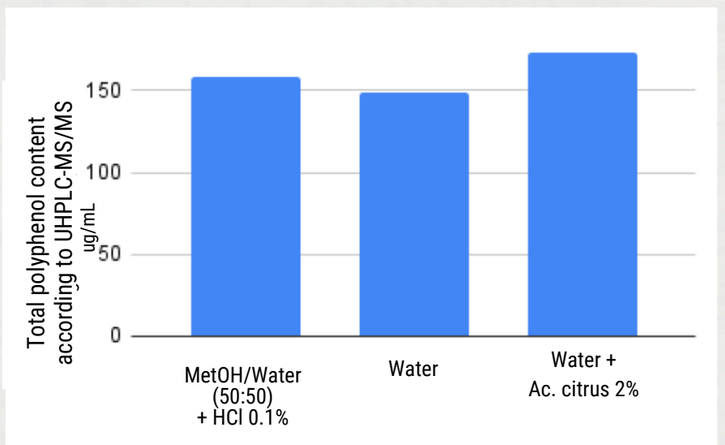
Results



It was observed that the polyphenol content of the hydrothermal extracts was the highest, being the Water + Ac extract. Citrus at 2% had the highest value, while the one with the lowest content was the Ethanol/Water extract (50:50).

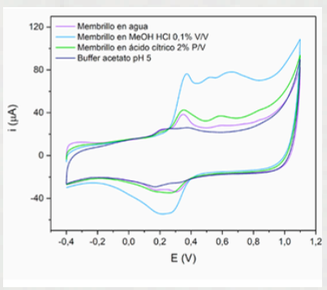
According to the biosensor results, **classical extraction methods would have similar yields to hydrothermal methods**. Based on this, the profile of compounds in extracts D, E and F was evaluated by UHPLC-MS/MS, observing similar areas for the majority compounds, coinciding with the results obtained by the biosensor.

Cuantificación e identificacion por UHPLC-MS/MS



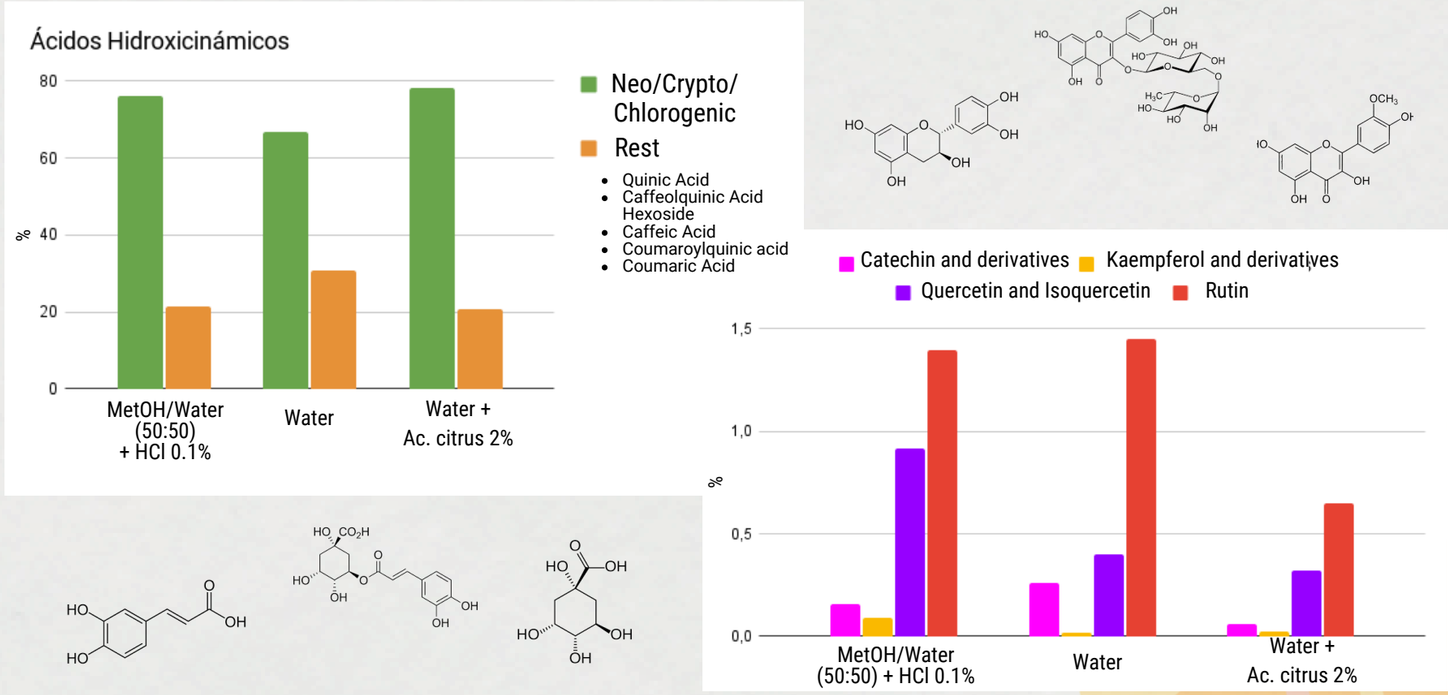
Identification (20 Polyphenols)	
Chlorogenic Acid	Quercetin
Neochlorogenic Acid	Isoquercetin
Cryptochlorogenic Acid	Quercetin Feruloyl Hexoside
Quinic Acid	Catechin
Caffeoylquinic Acid Hexoside	Epicatechin
Coumaric Acid	procyanidin dimer
Caffeic Acid	Procyanidin trimer
Coumaroylquinic acid	kaempferol
isorhamnetin rutinoside	kaempferol rutinoside
Rutin	kaempferol hexoside

The total polyphenol content for extracts D, E and F was compared with that determined by amperometry using a Laccase-based biosensor.



Treatment	Concentration µg Eq. Gallic Acid/mL	
	Folin-Ciocalteu	Biosensor
Methanol/Water (50:50) + HCl (0.1%V/V)	(193±23)	(238±34)
Water	(253±17)	(258±1)
Water + Citric Acid (2% P/V)	(408±24) [a]	(255±51) [b]

For extracts D and E, there was a high correlation between quantification by FC and the biosensor, but not for F, which showed a significant difference between the two quantification methods.



Conclusión

In conclusion, an eco-sustainable extraction of polyphenols was achieved from the waste of the quince industry. It was determined that the CF technique presents interferences, so it would be convenient to use another method, such as the Lacasa biosensor, a technique that was corroborated with a validated method such as UHPLC-MS/MS.