



WORKSHOP

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BIOBASED MATERIALS RESEARCH:
ADVANCES FROM ECOFUNCO AND
BIONTOP EUROPEAN PROJECTS

ecofunco

biontop



Bio-based Industries
Consortium



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Recovery of added value molecules from agro-wastes to apply as coating for the food packaging

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Background

Development of extraction process from agro-wastes in EU projects achieving pilot and semi-industrial scale





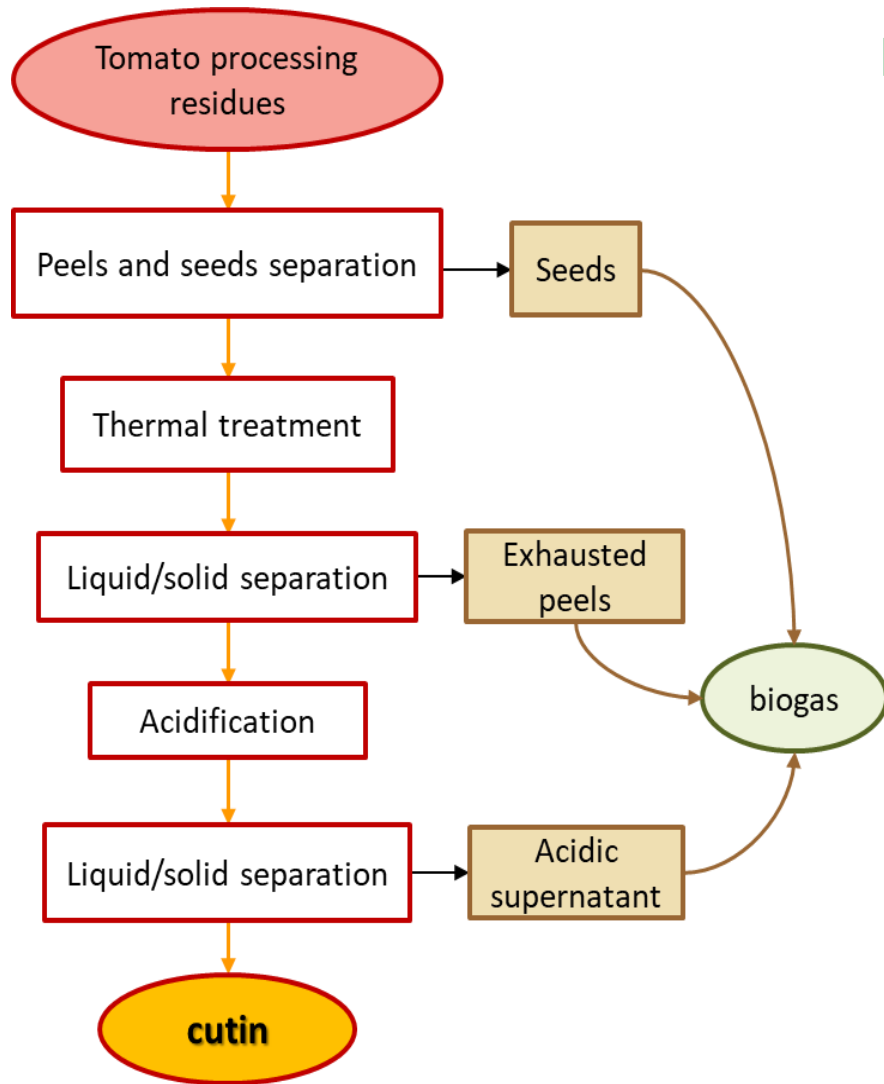
Target of the extraction

Extraction of the cutin, a substance composed of C16-C18 fatty acids.

Based on the cutin abundance, its fatty acids profile (literature data^{1,2,3}) and the availability of the vegetable source, three agro-wastes were selected for the extraction of this substance in the ECOFUNCO project:

- Tomato peels,
- Watermelon peels,
- Apple peels.





Extraction of the cutin from tomato by-products (peels)

Several tests performed to find the most suitable time and temperature conditions, considering a scale up perspective.



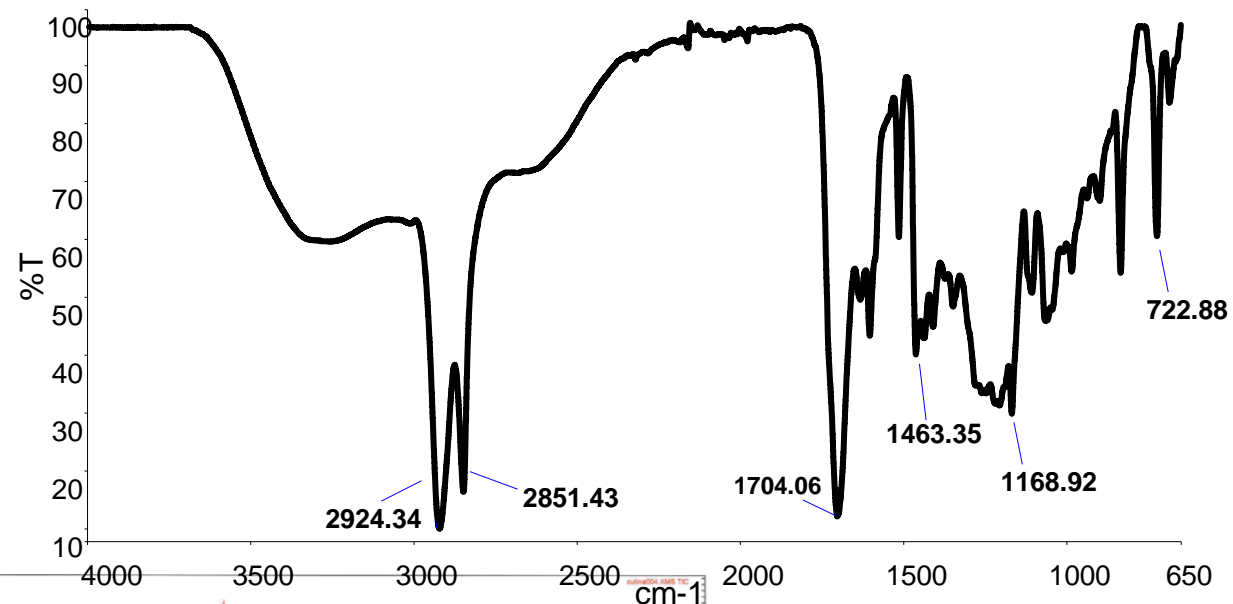
Yield of the extraction process achieved 40% wt/wt



FT-IR monitoring of the extraction results and GC-MS characterization

FT-IR spectrum:

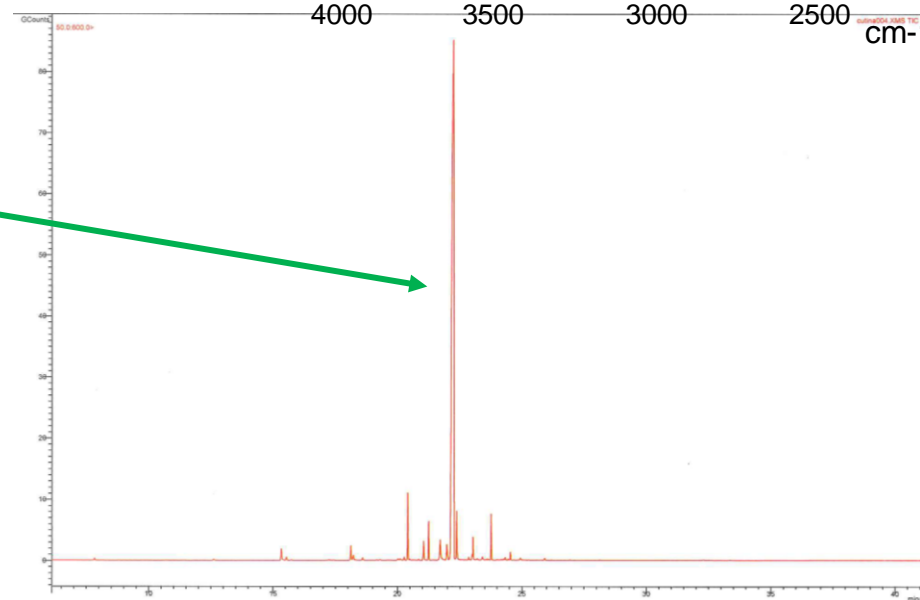
identification of the characteristic peak of the cutin (stretching C=O)

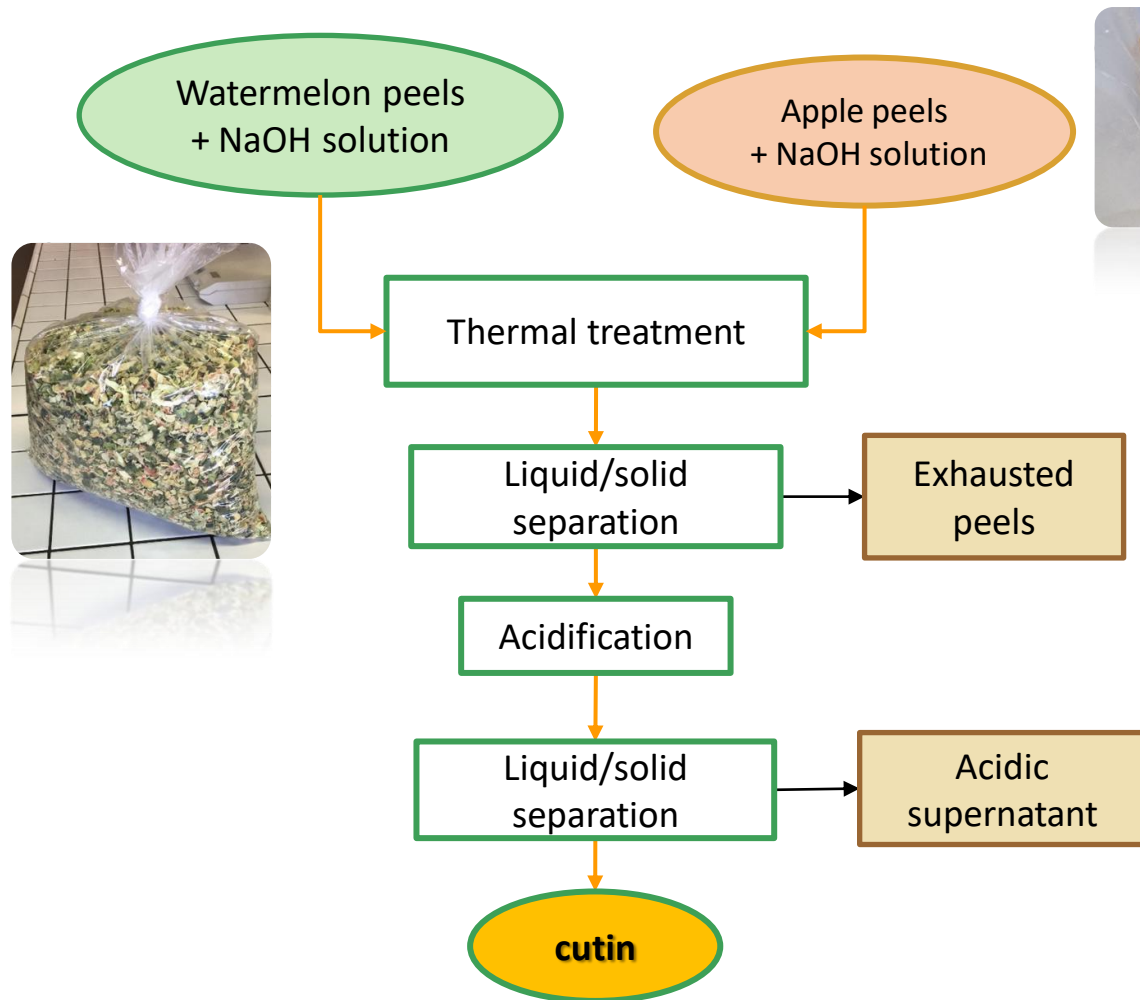


GC-MS chromatogram:

10,16-dihydroxyhexadecanoic acid

main component (> 60%)





Extraction of the cutin from apple and watermelon by-products (peels)

Several tests performed to find the most suitable time, temperature conditions and NaOH concentration. The sustainability of the process was considered in terms of time and reagents consumption.

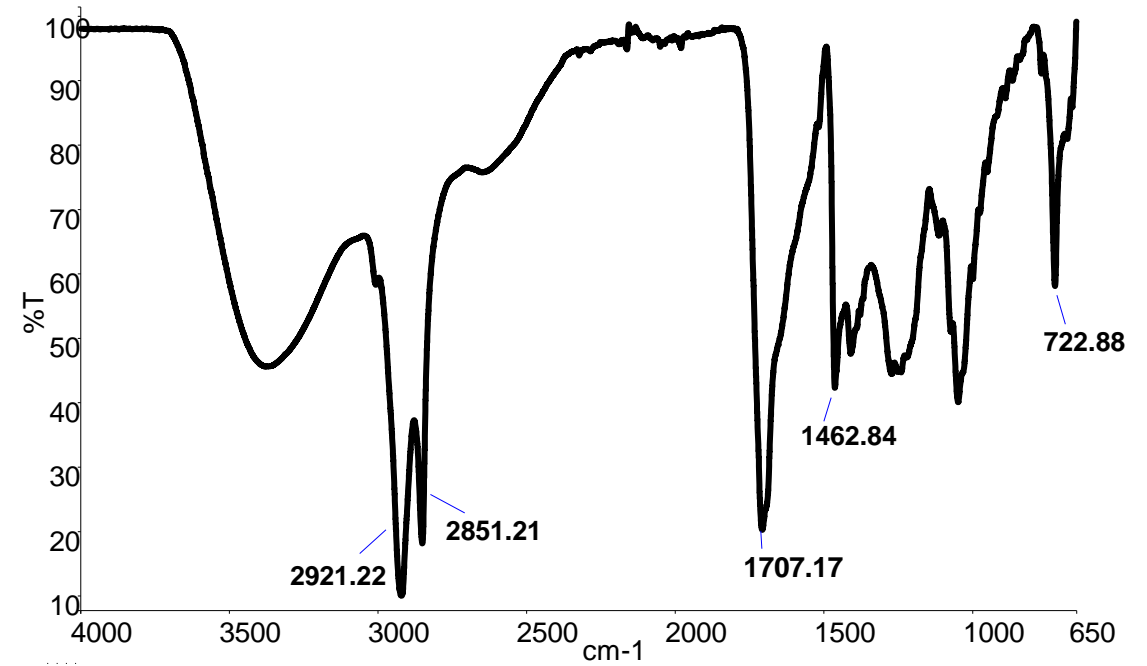
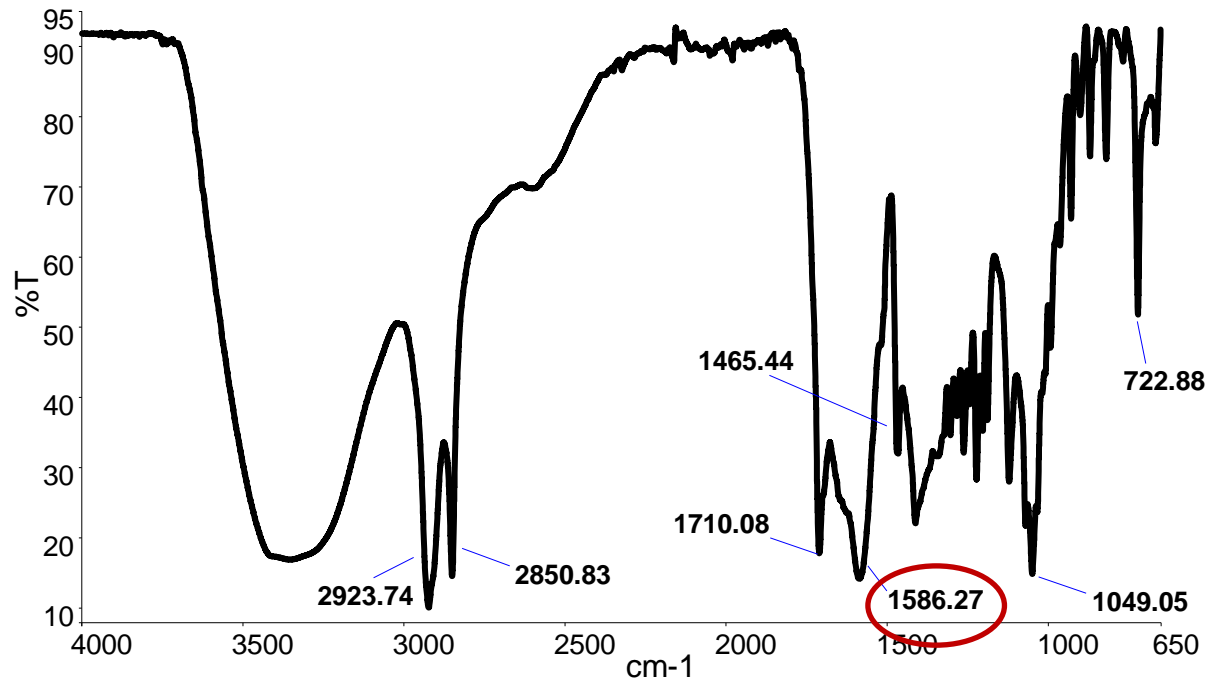
Yield of the extraction process achieved:

- Apple peels: 20% wt/wt
- Watermelon peels: 2% wt/wt



FT-IR monitoring of the extraction results

FT-IR spectrum: identification of the characteristic peak of the cutin (stretching C=O)



Apple cutin

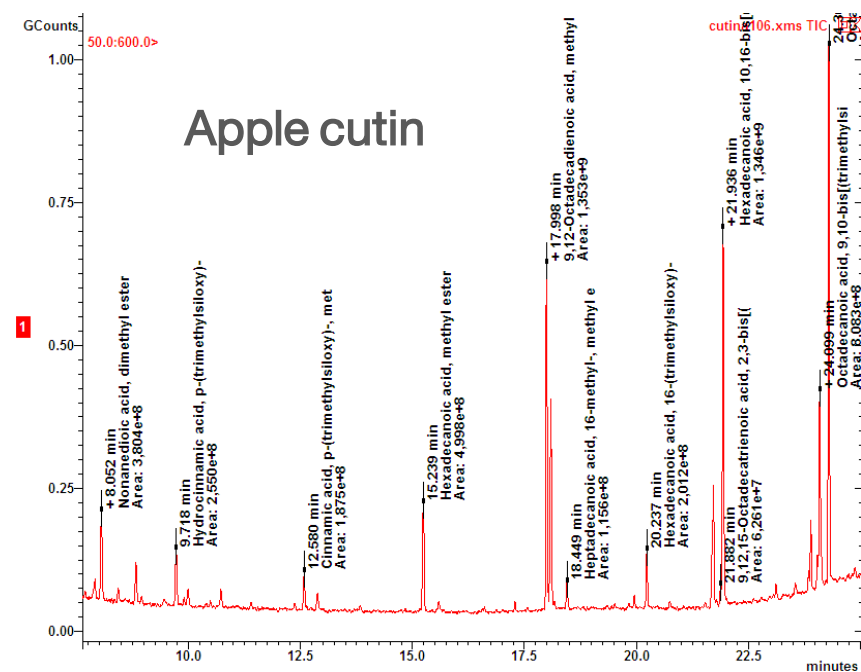
Watermelon cutin: presence of impurities
the extraction method requires further research



GC-MS chromatogram: fatty acids composition of the apple and watermelon cutin revealed some differences compared to those in the literature; the proportion among the fatty acids is different.

The fatty acid profile of apple and watermelon cutin is more complex than the tomato cutin.

	Composition	Abundance
Watermelon cutin	9,10-dihydroxy-octadecanoic acid	38-50%
	Hexadecanoic acid	13-16%
	9-octadecenoic acid	7-11%
	9,12,15-octadecatrienoic acid	5%
Apple cutin	11,14-octadecadienoate acid	20%
	Hexadecanoic acid	19%
	10,16-dihydroxyhexadecanoic acid	8%



Remark

the extraction protocols described in the literature are solvent based and long time duration



Applications under evaluation

Cutin has **hydrophobic properties** itself

ECOFUNCO aims to transfer this water repellence property to substrates as bioplastic and cellulose

HOW?

Combine the cutin with other components to formulate a wet coating to be applied as thin layer on the substrates





Conclusions

- Cutin was successfully extracted from tomato peels both at laboratory scale and pilot scale avoiding the use of organic solvent
- Apple and watermelon cutins were extracted applying a similar protocol to the tomato cutin
Some differences compared to the literature were found in the GC-MS profile
The extraction protocol requires further evaluation
- The cutin is naturally hydrophobic, for this reason this substance is under study for the formulation of a wet coating to confer water repellence property to bioplastic and cellulosic substrates.



Thank you!



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