Development of innovative green procedure for the recovery of active compounds from food and agricultural by-products

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My PhD project is part of the CHRONOS project, which aims to study the mechanisms underlying chronic multifactorial diseases (tumors and neurodegenerative diseases) and the aging process. In this framework, my research aims to obtain a sustainable source of nutraceuticals, for the prevention of these diseases, from food and agricultural by-products using green extraction procedure.

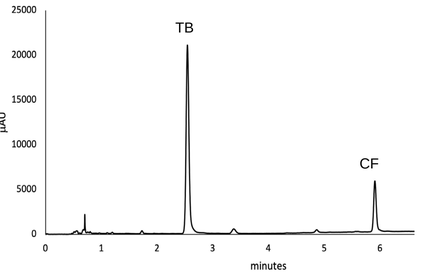
Cocoa shell

***1g of Theobroma cacao* L. by-product**

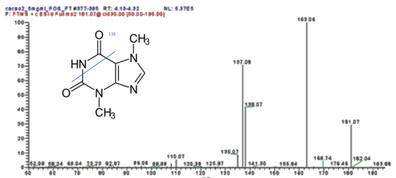
Pressurized Liquid Extraction (PLE)
EtOH 15%, temperature 90 °C, 5 cycles and static time 6 minutes

UHPLC-UV/HRMS Analysis

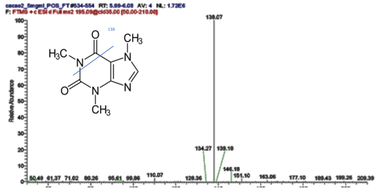
Quali-quantitative analysis



UHPLC-UV profile of Cocoa by-product PLE extract (283 nm)



MS/MS Spectrum – Theobromine



MS/MS Spectrum - Caffeine

2 Methilxantine Cafeine (11.30 mg/gEXT) and theobromine (56.18 mg/gEXT) have been indentified and quantified in the extract.

In vitro activity

Finally, the extract was tested in vitro in collaboration with Dr. Sacco's group. The results showed that the extract significantly enhance, in a dose dependent manner, the cytotoxic effect of cetuximab in SW48 cell line expressing KRasG13D . Manuscript have been written and submitted to LWT Food Science and Technology.

FINISHED

Camelina sativa seeds

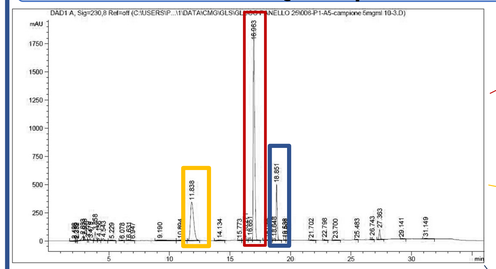
***1g of Camelina sativa* L. seeds by-product**

Defatting and then **Extraction** by USAE

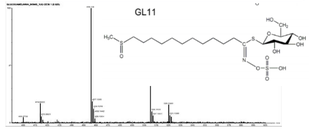
Purification by Solid-Phase Extraction (SPE)

Isolated glucosinolates by **HPLC preparative.** Extract and pure compounds have been analyzed with **HRMS analysis**

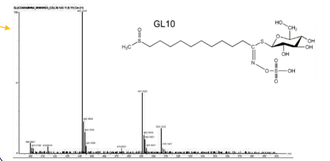
Quali-quantitative analysis



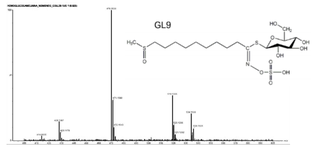
UHPLC-UV profile of USA extract (283 nm)



MS/MS Spectrum – Glucocamelinin



MS/MS Spectrum – Glucoarabinin



MS/MS Spectrum – Homoglucocamelinin

3 glucosinolates have been purified and indentified:

Glucoarabinin (215,21mg/gEXT)

Glucocamelinin (552,81mg/gEXT)

Homoglucocamelinin (80,93mg/gEXT)

Glucosinolates are 85% of the extract

In vitro activity

The extract and purified compunds have been tested in collaboration with teams of Prof. Vai and Prof Fusi. Preliminary results shown promising anti-ageing and antioxidant properties.

Future Goals

- To optimize the extraction by means of green procedures such as PLE and supercritical fluid extraction (SFE) to improve the extraction yield, avoiding use of organic solvent.
- To test pressurized extract to evaluate their health effect for developing nutraceuticals

Artichoke and Orange by-product

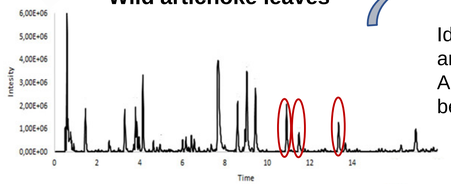
1g of Cynara cardunculus* L. *leave or Citrus sinensis* L. *by-product

Extraction by ultrasonic assisted solid liquid extraction (USAE)

UHPLC-UV/HRMS Analysis

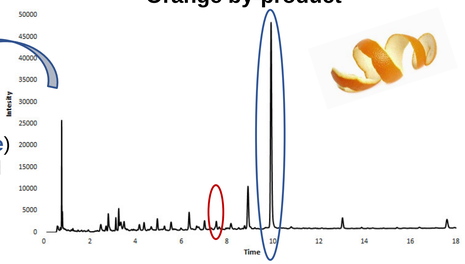
Preliminary qualitative analysis

Wild artichoke leaves



Identified mainly **caffeolquinic acids** and **luteolin and apigenin glycosides**. An **aglyconic component** has also been identified (highlighted in **red**).

Orange by-product



11 compounds belonging to the class of **polyphenols** and **terpenoids** were identified. In particular, **Hexperidin** (**blue**) is the main component of the extract and **Limonin** (**red**) is an important terpenoid.

Future Goals

- To optimize the extraction process by means of green procedures such as pressurized liquid extraction (PLE) and supercritical fluid extraction (SFE) to improve the extraction yield reducing time and solvent consuming
- To quantify the content of the main bioactive molecules in the final extracts
- To test the extract in vitro to evaluate their health effect for developing nutraceuticals and functional foods.