

Ph.D Workshop - 4 Dicembre 2020

Development of extraction techniques and phytochemical investigations for the production of high-profile nutraceutical food supplements



Mohamed Aymen Chaouch (XXXIV Cycle, 2nd year, mohamedaymen.chaouch@unimore.it)

Tutor: Prof. Stefania Benvenuti

State of the art

2000

576.7 million metric tons

World fruit
production



2018

868.1 million metric tons



Fruits



Juice



Dried fruits



Jams

Fruit
by-products

Fruit
processing
industry

Carbohydrates

Proteins

Lipids

Polyphenols

Bioactive
compounds



10–75%
of wastes

- Pomace
- Seeds
- Peels

State of the art



Prunus domestica
L. var d'Ente

MONTERÉ

“COOPERATIVA MODENESE
ESSICCAZIONE FRUTTA”



Prune by-product

- ✓ Estimation of the chemical composition (polyphenols, sugars, minerals ...)
- ✓ Reduction of sugar content by fermentation
- ✓ Formulation of a nutritional supplement in order to develop a product useful for intestinal function

Chemical composition

Prune by product



Agitation (Ethanol 80%) / 30 min / room T°

Centrifugation / Filtration

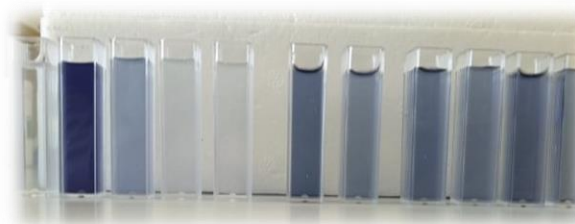
Evaporation



Ethanolic extract

Phenolic and flavonoid content

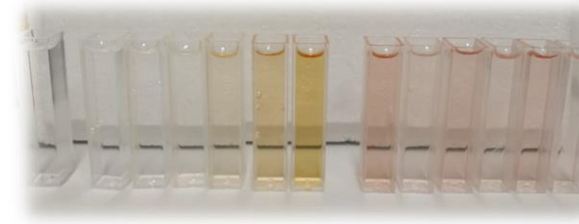
Folin-Ciocalteu assay



Total phenolic content
(**TPC**)

2.35 - 4.07 mg GAE/g FW

Aluminum chlorate assay

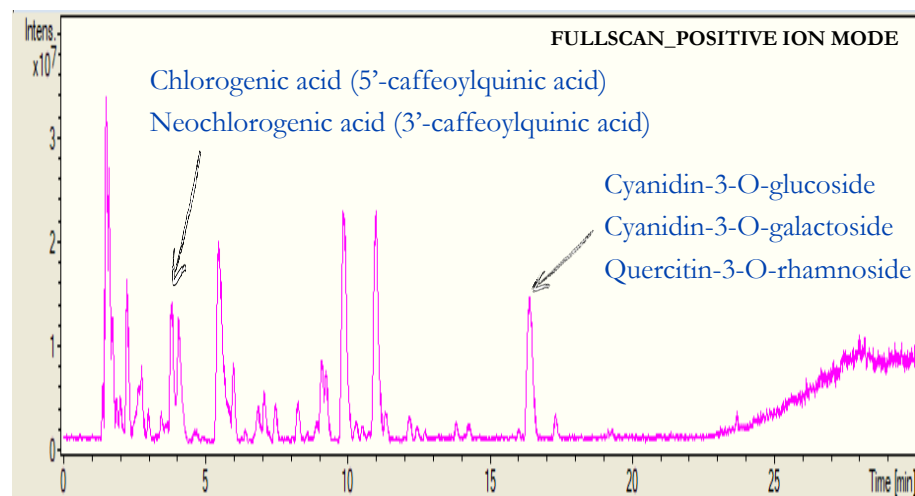
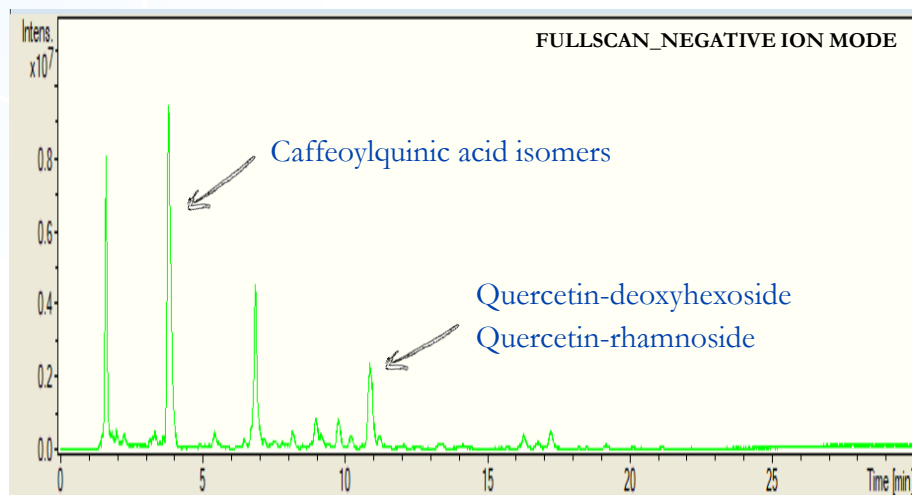


Total flavonoid content
(**TFC**)

0.023 - 0.125 mg QE/g FW

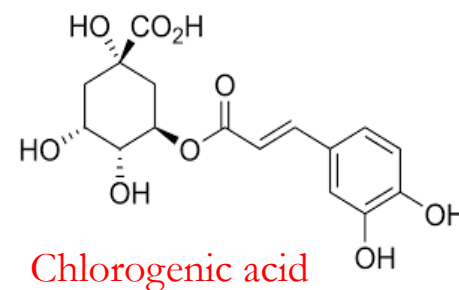
Chemical composition

Ion Trap LC-MS



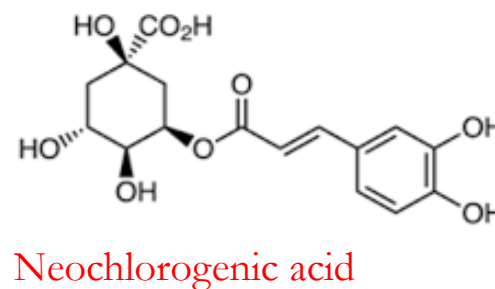
Phenolic and flavonoid content

HPLC/DAD



Chlorogenic acid

0.408 - 0.724 mg/g FW



Chemical composition

DPPH assay



Total antioxidant Activity (TAC)

Ethanollic extract

121.67 ± 33.63 to 294.09 ± 65.85
(mg AAE/100 g FW)

AAE: Ascobic acid equivalent



Antioxidant



Free radical



Healthy cell

Antioxidant activity

Cosmulescu et al. (2012)



Plum fruit

Fruit	$22.17 - 92.65$	mg AAE/100 g FW
Skin	$163.62 - 972.74$	mg AAE/100 g FW
Pulp	$10.38 - 38.17$	mg AAE/100 g FW

Chemical composition

Prune by product

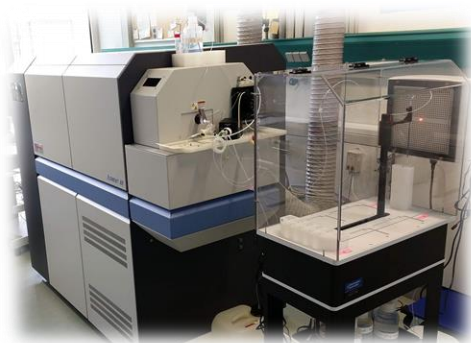


+ HNO₃ (69%)

+ H₂O₂

Microwave (20 min)

ICP-MS



11 Na Sodium 22.989770 [Ne]3s 5.1391	12 Mg Magnesium 24.3050 [Ne]3s ² 7.6462	3 IIIB
19 K	20 Ca	21 Sc Scandium

Metals

Metals (mg/100g FW)

Na	9.29 - 65.02
Mg	21.42 – 28.58
K	397.86 - 536.86
Ca	35.69 - 72.06
Zn	4.11 - 34.80
Fe	0.74 – 3.24
B	0.39 – 3.95

Chemical composition

Prune by product



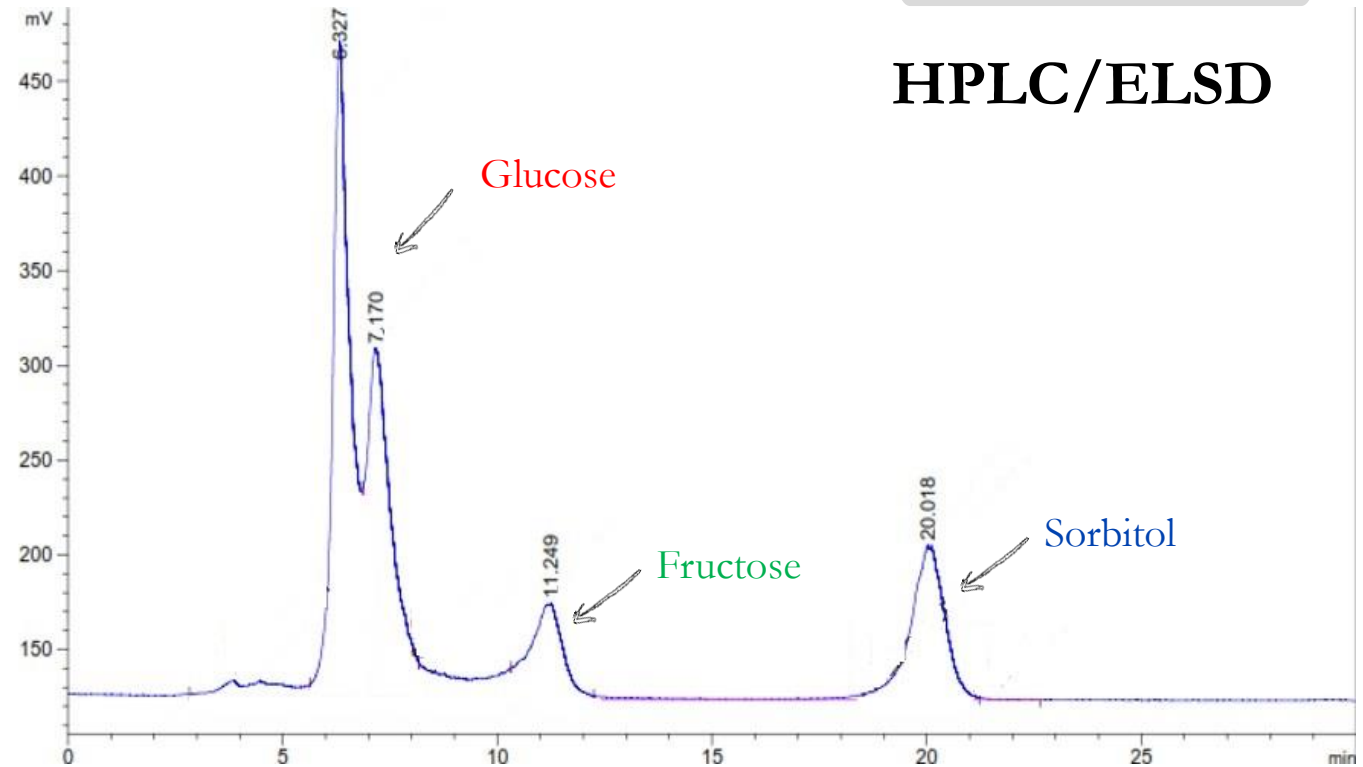
Agitation (water)/ 30 min / room T°

Centrifugation / Filtration

Water extract

Sugars

HPLC/ELSD



Sorbitol

30.55 - 45.22 mg/g FW

Fructose

79.83 - 155.04 mg/g FW

Reduction of sugar content

Prune by product



+ H₂O

Fermentation (24h/room T°)

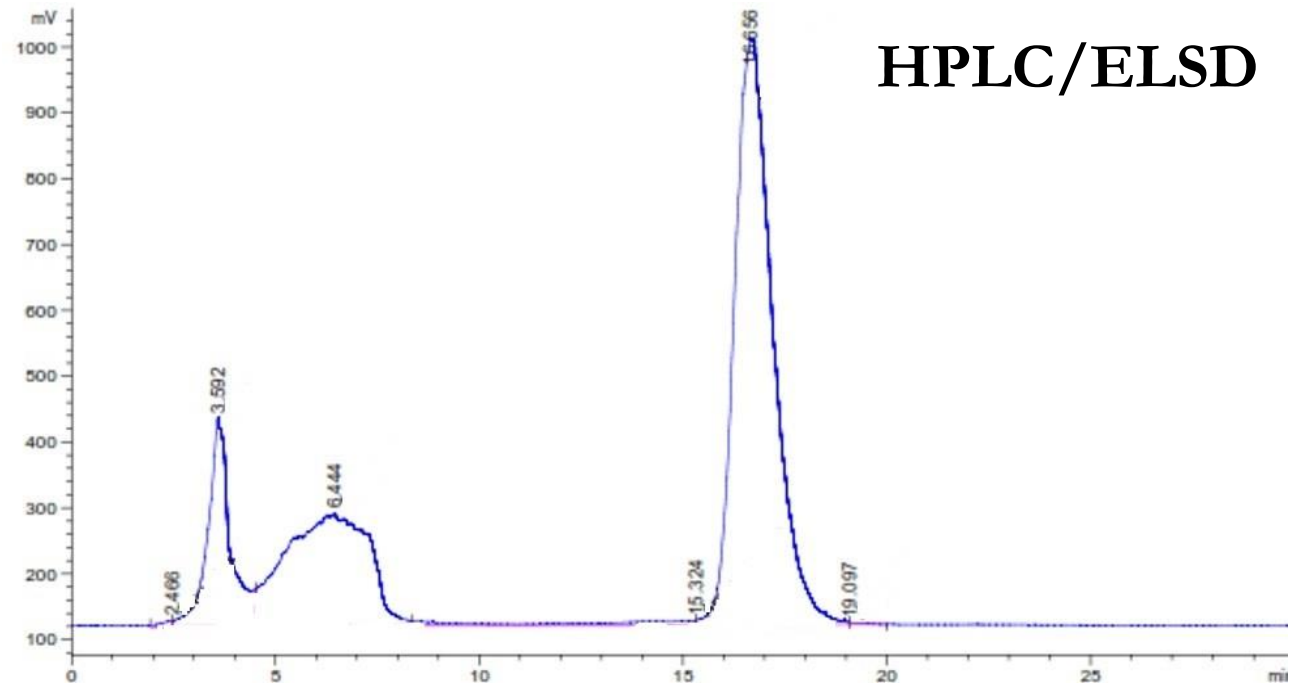
Yeast (*Saccharomyces cerevisiae*)

Centrifugation
Filtration

HPLC/ELSD

Fermentation

HPLC/ELSD



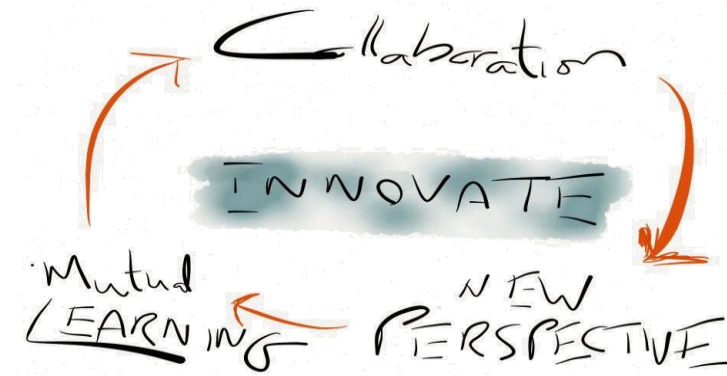
Sorbitol

40.68 - 90.63 mg/g FW

Fructose

0.66 - 14.53 mg/g FW

Perspectives



✓ Application of prune by-product into new formulations in order to obtain beneficial nutraceutical derivatives

✓ Effects on intestinal health



NUTRACEUTICALS

“Let Food be Your Medicine”



The background is a solid blue color. On the left side, there is a pattern of light blue hexagons. On the right side, there is a diagonal gradient from dark blue to light blue, with a pattern of small white dots. The text "THANK YOU" is centered in the middle of the image, with a white underline under the word "THANK".

THANK **YOU**