



UCD Institute of Food & Health

Harnessing bioactives from plant food waste and underutilised resources

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Background

- In the EU, nearly 59 million tonnes of food waste (131 kg/inhabitant) are generated annually with an associated market value estimated at 130 billion euros
- 10% of food made available to EU consumers may be wasted.
- Around 19 % of the total food waste generated in the EU comes from to the processing sector¹
- ¹ Fusions. (2016). Estimates of European food waste levels. <http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf>



Why plant food processing waste?

Figure 2. Per capita food losses and waste, at consumption and pre-consumptions stages, in different regions

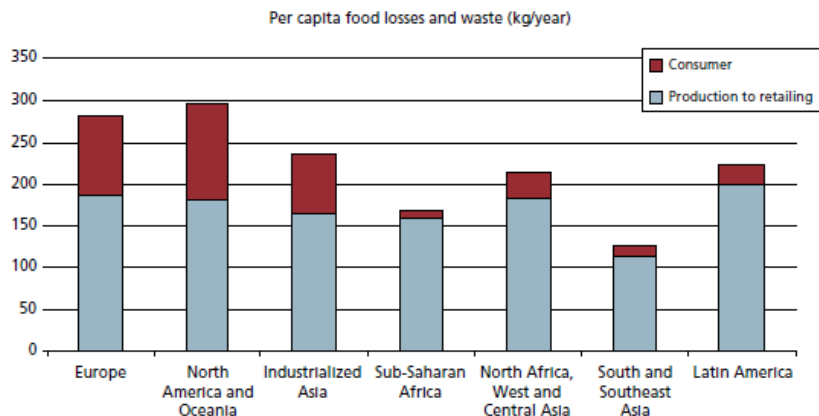


Figure 4. Part of the initial production lost or wasted at different stages of the FSC for root and tuber crops in different region

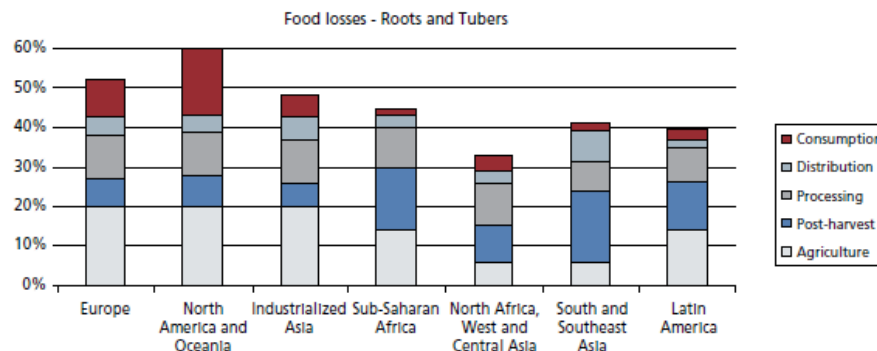
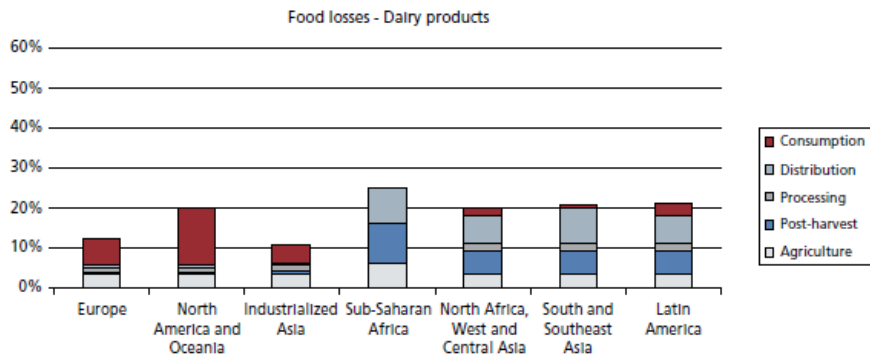


Figure 9. Part of the initial milk and dairy production lost or wasted for each region at different stages in the FSC



- Dairy Industry – Ireland is now the second-largest exporter of infant formula to China
- Ireland supplies up to 15 per cent of the total global market

Rest Raw Materials!!



Apple
Pomace



Potato
Peel



Mushroom
stalks



Brewers
Spent Grain



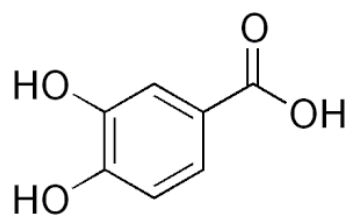
Underutilised
Plants



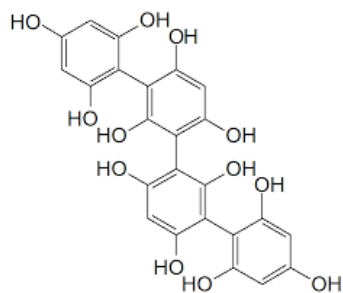
Underutilised
Seaweeds

Molecules

Polyphenols

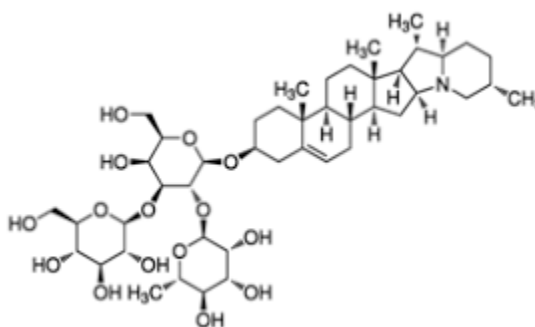


Caffeic Acid

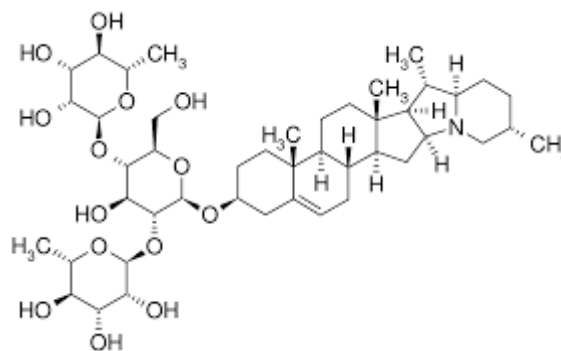


Phlorotannins

Glycoalkaloids

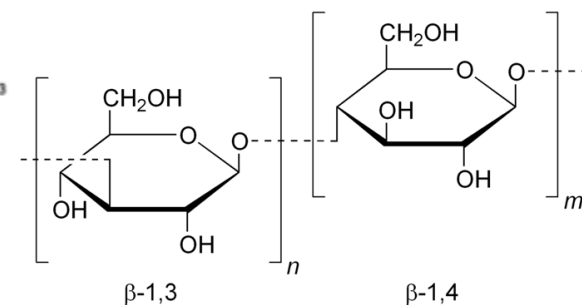


α -Solanine



α -Chaconine

β -glucan



Polyphenols from apple pomace - PLE

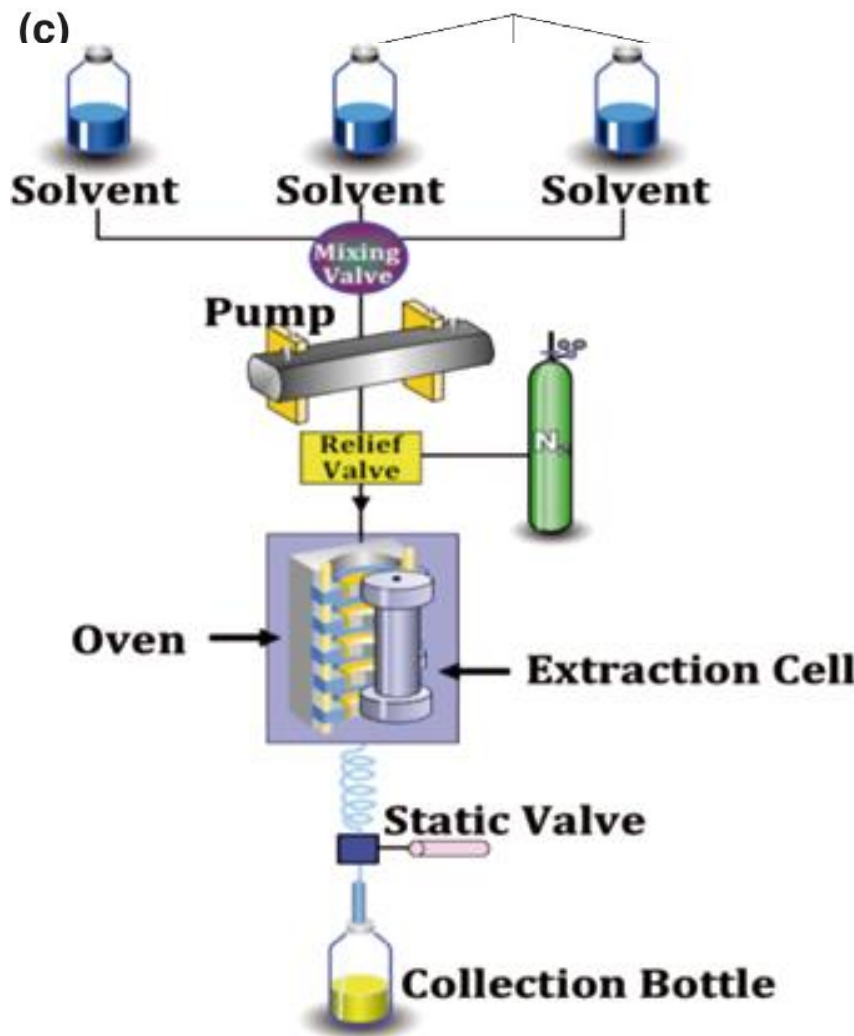


Table 5. Optimal Conditions for Extracts^a

	respor
	pred
60% ethanol, 102 °C	1011

Standard Deviations of Triplicate

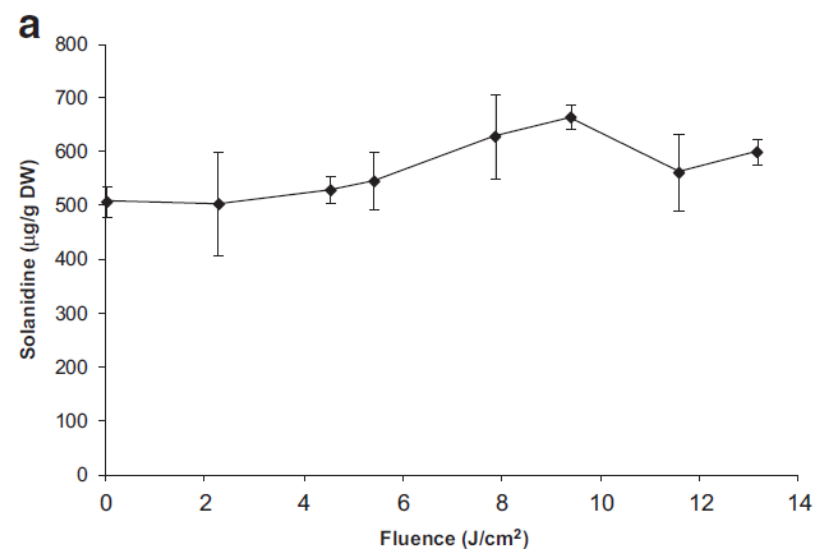
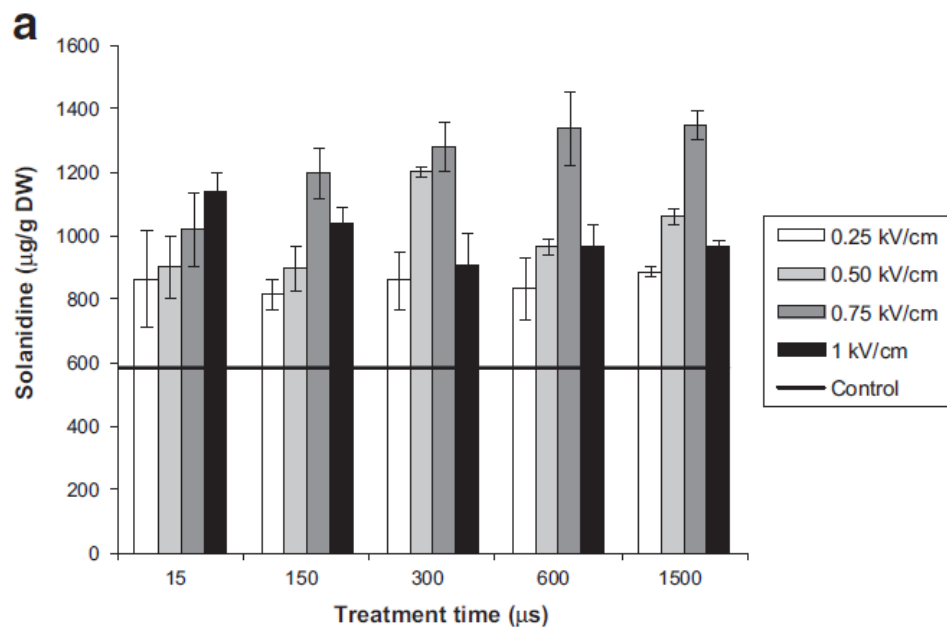
FLA	response 5, PHLOR	
ctual	pred	actual
2 ± 63	826	813 ± 18

75.00

101 %

rowing oxidant (b) the level of

Glycoalkaloids – Potato Peel



Hossain, Mohammad B., et al. "Effect of pulsed electric field and pulsed light pre-treatment on the extraction of steroidal alkaloids from potato peels." *Innovative food science & emerging technologies* 29 (2015): 9-14.

Glycoalkaloids – Potato Peel

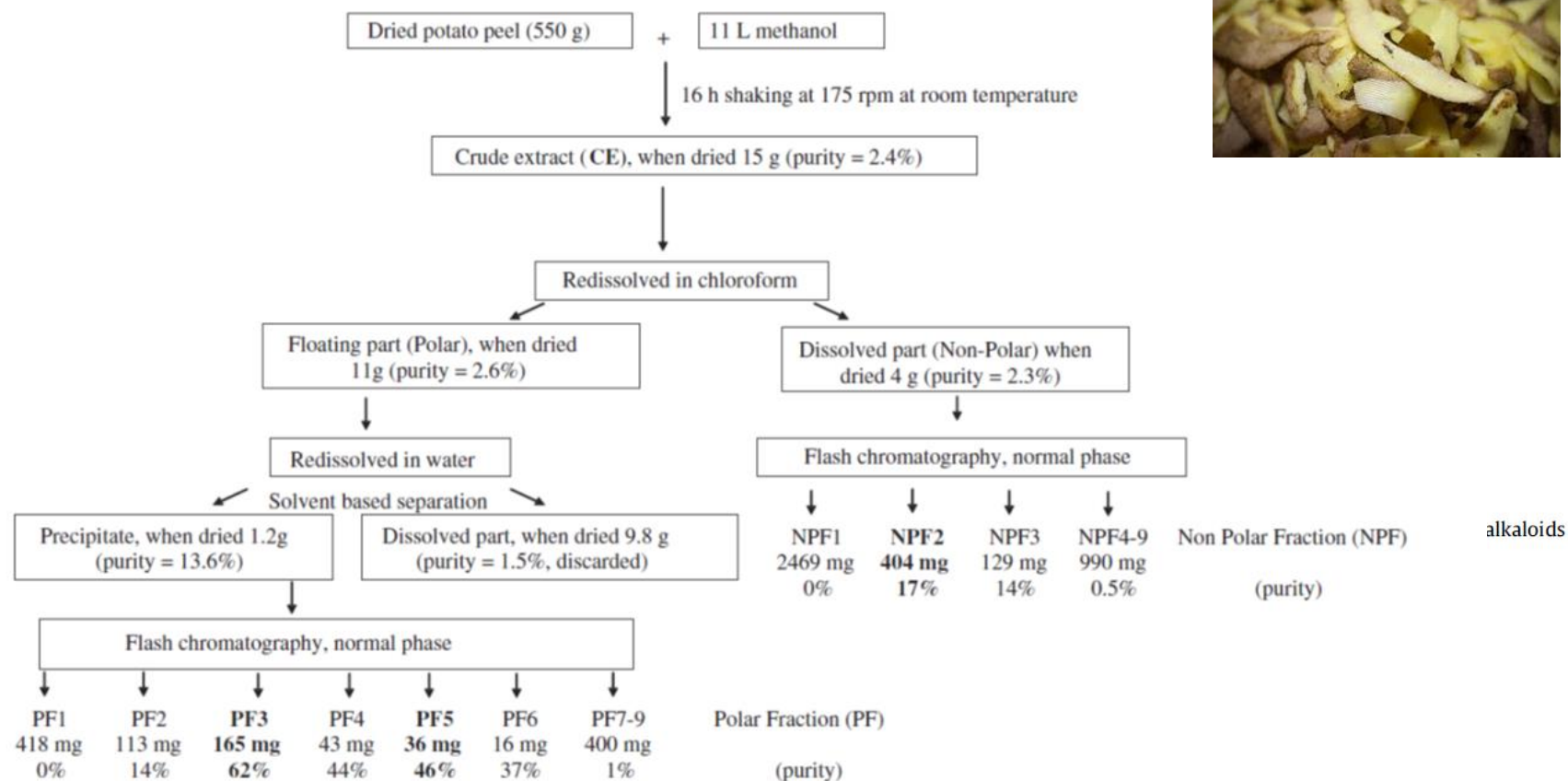
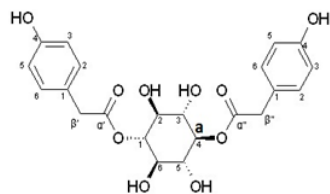


Fig. 2. Schematic diagram for the partial purification of glycoalkaloids from potato peel. Crude extract (CE) was generated from potato peel and subjected to solvent based separation producing semi-purified extracts (SPEs) containing polar fraction (PF) and non-polar fraction (NPF). Fractions selected for biological testing included CE, PF3, PF5 and NPF2 (highlighted in bold).

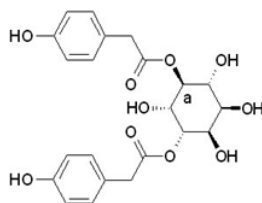
Characterisation of new compounds from underutilised plants



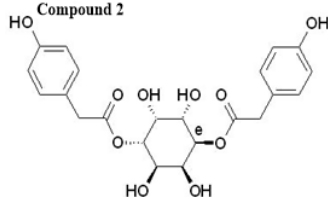
Compound 1



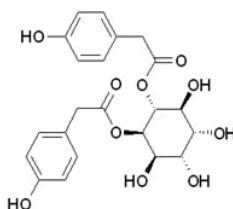
Compound 3



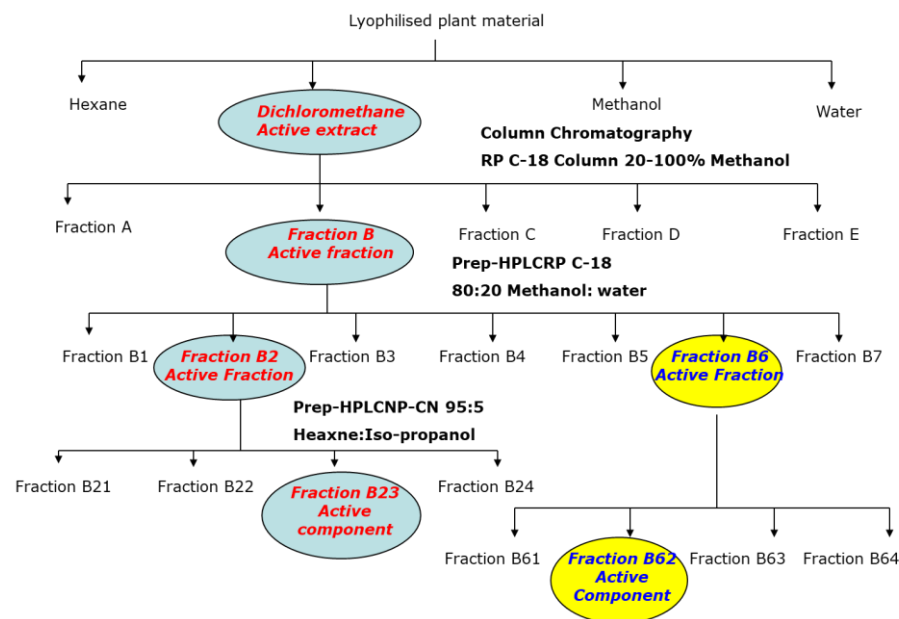
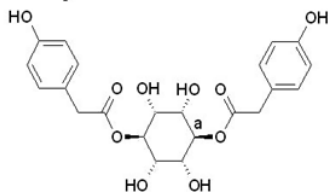
Compound 2



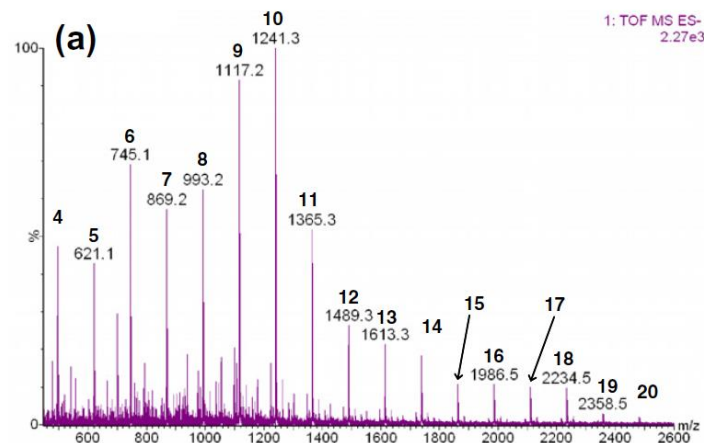
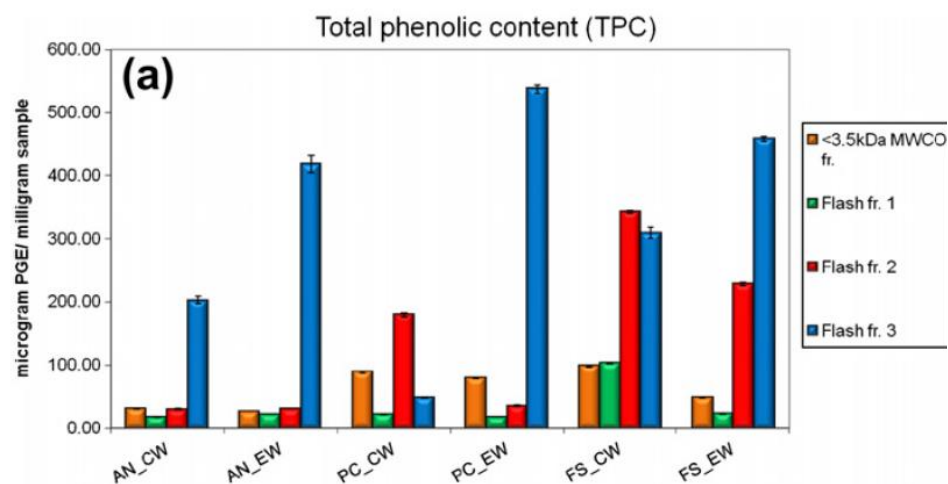
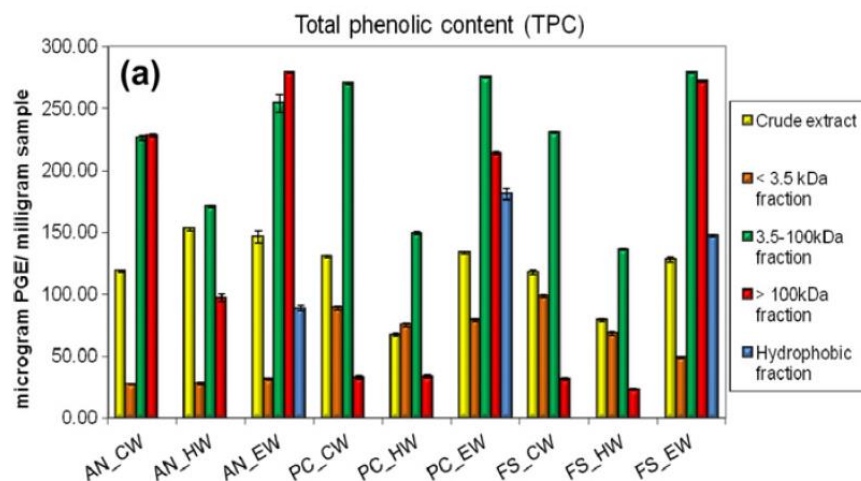
Compound 4



Compound 5



Seaweeds and Phlorotannins



Tierney, Michelle S., et al. "Enrichment of polyphenol contents and antioxidant activities of Irish brown macroalgae using food-friendly techniques based on polarity and molecular size." *Food chemistry* 139.1-4 (2013): 753-761.

Agrimax

48 Months

29 Partners

11 Countries (Austria, Belgium, Germany, Hungary, Ireland, Italy, the Netherlands, Norway, Slovenia, Spain, United Kingdom)

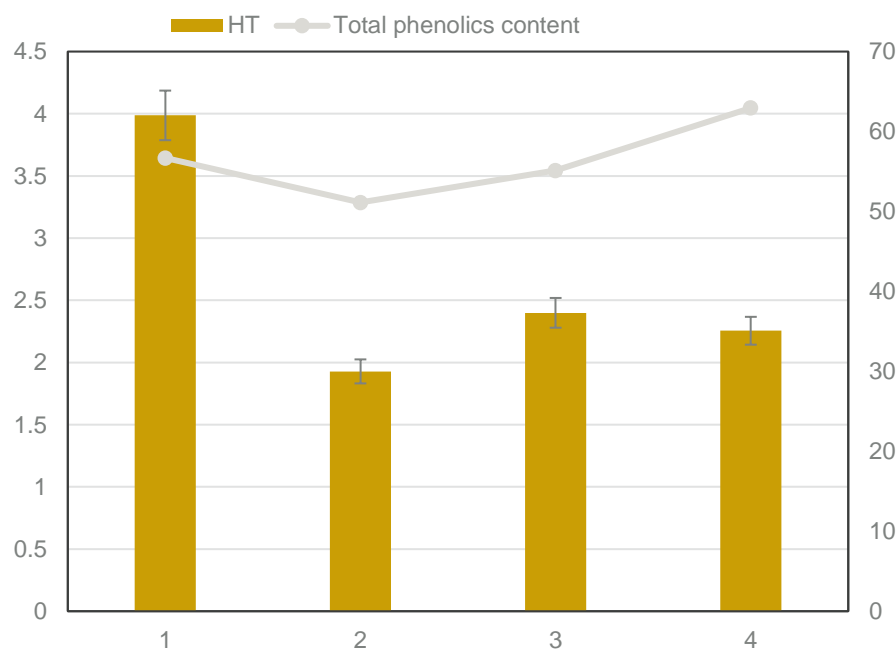
15 Million € (ca. 12 M€ EC contribution)

TRL >7 Demonstration Action

BBI VC3.D5 - 2015 Valorisation of agricultural residues and side streams from the agro-food industry



Hydroxytyrosol and Phenolic content of Olive Pomace extracted using US assisted Method



Sample	Time, min	Amp (μm)	L:S
1	8.2	45	2:1
2	24.5	45	2:1
3	8.2	45	2:1
4	8.2	66	2:1

Potato Peel - Glycoalkaloids

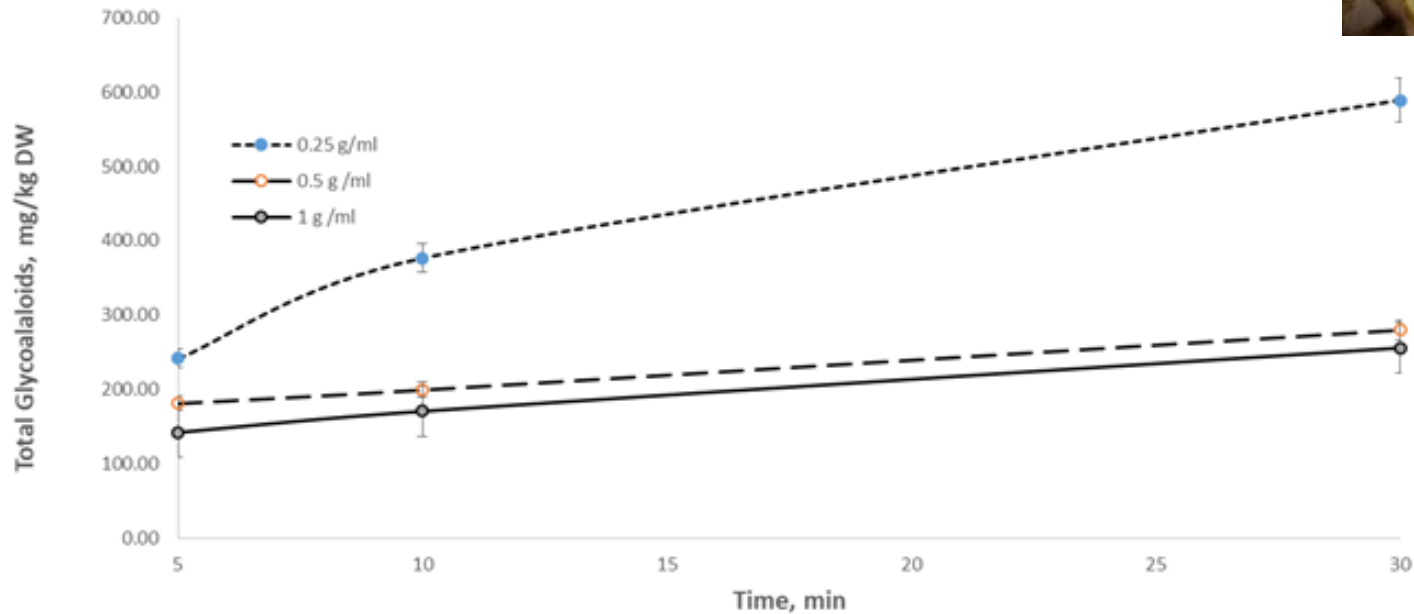
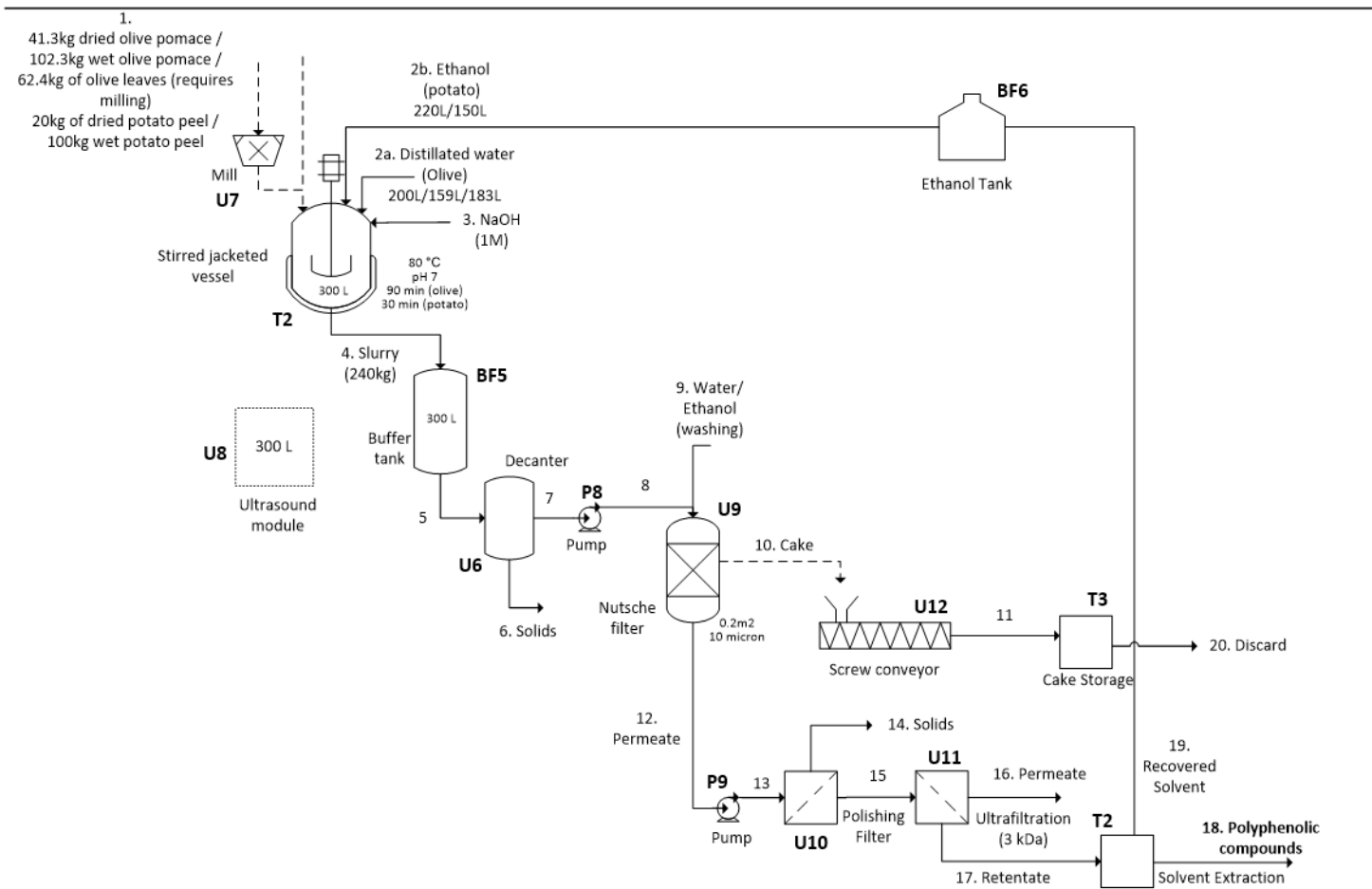


Figure 1. The effect of time on the removal of glycoalkaloids from potato at concentration from 0.25 to 1 mg/ml and a temperature of 20°C

Polyphenol Extraction

Polyphenol Extraction



Pilot Pant Design



Obstacles to valorising plant food waste

- Homogeneity of raw material
- Logistics of carrying out valorisation process at appropriate scale for a viable business
- Food Friendly processes do not always give the highest yield
- Co-extracted toxicants
- Valorisation process creates more waste/by products – cascade approach required
- Sustainability of valorisation process
- Technology Readiness of primary producers / processors



If we can Valorise Plant Food waste we could.....

- Develop new value chains for higher added value products, open new markets, connect organisations and sectors
- Improve the environmental performance and cost efficiency
- Validate new products with higher value than the current applications of the raw material, contributing to rural development and employment
- Increase sustainability and meet a clear market demand



Thank You

