THERMAL DEGRADATION AND SYNTHESIS IN APPLE WASTE DURING PRESSURIZED HOT WATER EXTRACTION

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Aim
To develop an efficient extraction method based on a sustainable technology like pressurized hot water extraction (PHWE) for the recovery of antioxidants from apple waste coming from cidery industry.

Background
Apples are one of the most widely consumed fruits, due in part to their wide-ranging positive health effects. In addition, they have been identified as one of the main dietary sources of antioxidants, mainly phenolic compounds, such as flavonoids and phenolic acids.

Tons of waste and by-products are produced from cidery industry and these contain high-value compounds. We want to develop a sustainable extraction method to extract these compounds.

Extraction and Characterization
In this work, an experimental design (response surface method (RSM) design) was used to study the influence of two independent variables, temperature (25-200 °C) and time (3-17 min) in the extraction of antioxidant compounds by PHWE from industrial apple waste.

Analysis of polyphenols
Different flavonoids were found in the apple waste extracts. The best extraction conditions to extract flavonoids were 10 min at 112 °C. The presence of flavonoids can not explain the high antioxidant capacity found at high temperatures.

Analysis of sugars
The increase of antioxidant capacity observed at high temperature from apple waste by PHWE could be related with development of new compounds from Maillard and caramelization reactions. For this reason, the sugars present in the extracts were analyzed. The sugars were degraded at high temperature (temperatures > 175 °C).

Final Maillard Reaction Products
New compounds were formed from Maillard and caramelization reactions like melanoisins. These compounds could be responsible for the high antioxidant capacity found.

Conclusions
The results from this work have shown that PHWE based at very high temperatures may induce the formation of bioactive compounds derived from Maillard and caramelization reactions. The presence of quercetin derivatives may be responsible for the antioxidant capacity found in the apple waste extracts obtained from 25 to 112°C.

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