Microwave pretreatment for the extraction of active compounds from olive pomace. Extraction optimization and dielectric properties measurement.

Olive pomace is a waste of the olive industry, with little use as a by-product. However, its high content in active compounds, like oleocanthal, hydroxytyrosol or oleuropein, makes this material a source of valuable bioactive extracts in food and health industry. Some of these compounds are highly bounded to the biomass structure, what entails the use of severe hydrothermal conditions (for instance, 180ºC for 90 minutes) or non-edible solvents (such as benzene and hexane). Accordingly, conventional solid-liquid extraction of polyphenols from olive pomace presents yet severe drawbacks to overcome. A short and intense microwave pretreatment is presented in this work as a greener effective resolution to enhance yield, final product quality and throughput capacity.

Two pretreatments have been tested: an atmospheric-microwave one, which provided enough energy to reach the solvent boiling point, and a pressurized-microwave pretreatment, where a pressure of 3 bars was reached. Both pretreatments were followed by a conventional solid-liquid extraction that was also used by itself as a reference to assess the efficiency changes associated to the pretreatments.

Although extraction yield ($mg_{GAE}/g_{Dry\ pomace}$) is not highly enhanced with the addition of the pretreatments, extraction richness is. Extraction richness ($mg_{GAE}/g_{Dry\ Extract}$) is understood as the proportion of active compounds in the possible commercial final product. This is usually a solid product, since de solvent must be removed from the extract to obtain a stable dry product. A 47% and a 39% richer extracts are obtained with the pressurized and atmpspheric microwave pretreatments, respectively. It is also noteworthy the high proportion of hydroxytyrosol obtained when pretreatments are used. The implementation of the pretreatment provides an improvement in the extraction of this compound, since a 3-fold richer extract in this compound is attained. This enhancement is also found in the antioxidant capacity of the extract, which is around 30% higher in the pretreated process than in the standalone conventional solid-liquid extraction.

Such enhancements support the scale-up of the process. To achieve this goal, the dielectric properties of the complex mixture water-ethanol-pomace have been measured under microwave heating as a function of temperature. Data has also been correlated to a model able to predict multiphase mixture permittivity. The resulting model is able to estimate the dielectric constant with an accuracy of 12%, and the loss factor with a deviation of 36%. These preliminary results will be used in the near future to adapt and operate a continuous microwave extraction oven to explore the possibilities of its utilization in a real processing plant.