

ABSTRACT

Agriculture and agri-food industry produce a large amount of residues in non-edible portions from cultivation and processing of crops. These wastes, considered by-products, give serious environment damage, if not properly disposed, also because of their seasonal production. Until a few years ago the only goal was the disposal of these by-products. Recently the researchers discovered the characteristics of these wastes and their possible exploitation as sources of interesting compounds and energy for pharmaceutical, cosmetics and nutraceutical sectors. Fruit and vegetable by-products, in fact, are rich in bioactive compounds, such as carotenoids, dietary fibers, minerals and phenolic compounds, with correlated beneficial health effects.

In this context the activity of the PhD project evaluated agricultural by-products as sources of bioactive compounds.

The aims of the present PhD project were the development of **innovative and selective analytical methodologies**, for determination of bioactive compounds, using liquid chromatography methods (UHPLC) coupled to UV-Vis spectroscopy and mass spectrometry (high resolution, HRMS and tandem mass, MS/MS), the improvement of **new extraction techniques**, which can optimize extraction yields, minimize costs and environmental impact, such as pressurized hot water extraction (PHWE), ultrasound assisted extraction (UAE) and supercritical antisolvent fractionation (SAF), and finally **the study of antioxidant activity** of obtained extracts, using chemical and biological assays (DPPH, ABTS, ORAC, CAA).

The analysis of bioactive compounds in plant extracts through advanced sample preparation techniques and modern separation tools allows a comprehensive study of the matrix. The project, very relevant, was to provide innovative methodologies, procedures and final products for different companies of healthcare area, in terms of innovation, costs and profits.

The project was divided into three major areas, corresponding to the three selected by-products. The determination of chemical profile and the development and optimization of innovative and green extraction procedure for recovery of bioactive compounds have been carried out for each matrix. Selected by-products were: the main **artichoke by-products**, bracts and leaves, derived from cultivation and industrial processing, **hazelnut by-products**, roasted skins, derived from kernel industrial processing, and **aromatic plants by-products**, distillation waste waters, derived from essential oils production.

All by-products studied have proved to be low cost sources of bioactive compounds with antioxidant activity. Furthermore, among innovative extraction techniques, PHWE procedures have allowed obtaining final extracts selectively rich in compounds of interest without formation of artefacts, and compared to existing extraction methods were simple, fast, environmentally friendly and fully automated. Moreover my PhD project provided new analytical methods to standardize vegetable extracts. The most relevant results showed that discarded raw materials are suitable ingredients for the production of formulated health products and nutraceuticals.