

Nondestructive Analysis of Phytochemicals Present in Typical Foods of the Mediterranean Diet by Photoacoustic Techniques

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Many epidemiological studies suggest that a diet rich in fruits and vegetables, like the Mediterranean diet, offers protection against some common diseases of the Western world, such as cardiovascular events, obesity, diabetes, cancer and other age-related degenerative diseases. Fruits and vegetables have long been regarded as having considerable beneficial effects on health, due in part, to the presence of bioactive compounds or phytochemicals. These compounds include tens of thousands of molecules belonging to various chemical classes and botanical families also very distant from each other such as carotenoids, tocopherols, glucosinolates and polyphenols. They are produced as secondary metabolites by plants and play a key role in complex biotic and abiotic interaction. In fact, the bioactive compounds are essential for plants survival, because they are produced, as signal molecules, in response to various stimuli including stress (UV, temperature, hydric stress). Their amount and composition in plant foods is strongly dependent on a number of factors as genotype, ripening, environmental conditions, climate, cultivation practices, harvesting modalities and storage methods. Moreover, many of them are responsible for the organoleptic characteristics of foods such as colour, aroma and taste. In the human organism, the phytochemicals, through different mechanisms, defend our cells and tissues from free radicals attack, helping to neutralize or reduce the oxidative processes. In particular, due to their chemical structure, the phenolic compounds may exert strong antioxidant activity, in addition these molecules are involved in several other cellular processes, for example, are able to interact and modulate multienzymatic systems, to inhibit platelet aggregation, to counteract the carcinogenesis, to reduce the formation of inflammatory molecules. The daily and continuous introduction of these substances is of particular importance for human health. All these properties confer to phytochemicals an important role as biomarkers of nutritional, healthy and commercial quality. Nowadays, both the food industry and the agricultural sector need of rapid screening tools that make it possible the quality control along the whole chain of production (from farm to finished product). In this respect is desirable a non-destructive analytical approach, which allows to correlate the information obtained from direct analysis of bioactive compounds content in plant foods with the stadium of ripeness, freshness, shelf life of products. In the recent years, the PA and PT techniques have been applied to the quantitative analysis of phytochemicals present in fruits and vegetables. In particular, these techniques have allowed the direct quantitative analysis of carotenoids (α - and β -carotene, lycopene) and flavonoids (mainly anthocyanins) in fresh produce products such as tomatoes, carrots, brassicaceae, oranges, cherries, apricots, grapes, wine, etc, with little or no manipulation of the sample. In particular we obtained preliminary data (figure 4) from PA signals measurements in peel of apple fruits belonging to two different varieties: Golden Delicious and Royal Gala. The results revealed that PA signals were in agreement with the presence of chlorophylls (a and b), carotenoids and anthocyanins in different side of apple according to the different colour of the portion of apple peel analysed.