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FERMENTATION AS A VALUABLE TOOL FOR FACILE ACCESS TO BIOACTIVES FROM AGRO-FOOD WASTES

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PURPOSE OF THE ABSTRACT

Research on agro-industrial by-products is nowadays a cutting-edge topic within circular economy systems. Recycling at any step of the agro-food chain should be regarded as a further value-added of the original crops that otherwise would be destroyed or directed to bioenergy production. In this context, the recovery of bioactive compounds particularly phenolics from agro-food by-products has attracted increasing attention in the past years due to their antioxidant power, and industries have been finding high value and sustainable alternatives to their residues. Among others, fermentation represents an environmentally clean process for production of such bioactives, providing high activity extracts, which can be incorporated in foods. [1,2]

We report herein the results of studies carried out on various wastes from food and/or beverages industrial production in which fermentation processes have been used to ease access to bioactives or to favor their release from polymeric matrices.

Pomegranate is currently one of the most extensively investigated source of health beneficial phenolics, including ellagitannins, flavonoids, other polyphenols, and anthocyanins. These compounds are present in all part of the fruit including peels, arils, juice and are responsible for a variety of biological activities. [3]

Wastes deriving from production of wines by yeast fermentation of Punica granatum (Fermented Pomegranate Wastes, FPW), showed a marked antioxidant activity in a series of chemical tests. HPLC/MS analysis of the methanol extract showed the presence of ellagic acid (EA) as the main phenolic component (Figure 1) at levels up to 4% on a w/w basis with respect to the dried FPW [4]. Notably EA was not present in the extracts of the fresh fruit. The FPW extract proved able to reduce the LPS-induced expression of pro-inflammatory genes IL-1beta, TNF-alpha and iNOS in murine macrophages.

To allow for a larger scale extraction of FPW, Extractor Naviglio®, an innovative solid?liquid extractor based on a suction effect, generated by a compression of the extracting solvent on solids at 8?9 bar pressure over a few minutes, followed by an immediate decompression at the atmospheric pressure, was also used.[5] (Figure 1) Using a food grade solvent like ethanol at 25°C the EA extraction yield from FPW was still satisfactory around 1%, almost 2-fold that obtained with ethanol at solid to solvent ratio of 0.1 g/mL under conventional extraction conditions.

Experiments carried out under simulated gastrointestinal conditions showed a slow release of EA from FPW up to 80% of the overall content over 2 h incubation at the slightly alkaline pHs simulating the small intestine environment, suggesting a potential of the material in nutraceuticals.

Release of EA and other bioactives from pomegranate wastes under different fermentation conditions has then been explored. Solid state fermentation with various strains of Aspergillus Niger was primarily investigated in view of high ellagitannase activity of this fungus capable of releasing EA from hydrolysable ellagitannins of

pomegranate. [6]

The formation and release of small molecules with potential antioxidant and other bioactivities from residues of spontaneously fermented fruit mashes further to distillation for fruit spirits production was also investigated. An increase of the antioxidant power was observed for mashes of peaches, quinces and figs following the fermentation process. The HPLC profiles (UV detection at 254 nm) revealed the presence of predominant components in the fermented pomaces most of which not present in the fresh fruits. The extraction yields of these components have been evaluated using different methodologies including supercritical fluids and the Extractor Naviglio®,

These and other results that will be presented indicate the potential of fermentation for straightforward access to bioactives from agro-food wastes via sustainable and low-cost extraction methodologies.

FIGURES

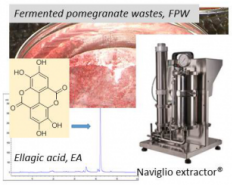

FIGURE 1

Figure 1

Fermented pomegranate wastes, analysis and extraction

FIGURE 2

KEYWORDS

agri food wastes | fermentation | extraction | bioactives

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