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Valorization of waste and by-products from globe artichoke and recovery of inulin, a prebiotic with endless benefits

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pharmaceuticals



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Graphical Abstract

The graphical abstract is a 2x3 grid of images illustrating the research process. The top row includes 'Artichoke cultivation' (a field of artichokes), 'Inulin recovery' (chemical structure and a test tube), and 'Chemical analysis' (laboratory equipment). The bottom row includes 'Artichoke waste' (artichoke by-products), 'Inulin recovery' (repeated), and 'Potential applications' (artichokes and inulin powder).

Artichoke cultivation

Artichoke waste

Inulin recovery

Chemical analysis

Potential applications



Abstract:

Globe artichoke (*Cynara scolymus* L.) is a well-known medicinal plant belonging to Asteraceae family, widely cultivated also as food in the Mediterranean region. The immature inflorescence (head) is the edible part of the plant. Every year, the globe artichoke processing industry generates around 60-80% of waste and by-products (WBPs) that are still rich in metabolites. The recovery of value-added biomass creates an opportunity for recycling resources to the circular economy. The aim of this study is to valorize WBP from *C. scolymus* cv “Romanesco” harvested in the central regions of Italy. In particular, we focused our attention on inulin, a fructo-oligosaccharide that works as a prebiotic, due to the regulation of intestinal microbiota *via* stimulating the growth of beneficial bacteria. Moreover, inulin has other useful effects on human health. Indeed, it improves lipid metabolism, promotes weight loss, lowers blood sugar, and so on. WBPs were extracted by using green extraction technologies obtaining a rich-inulin solid analyzed by Fourier-transform infrared spectroscopy (FTIR), thin-layer chromatography (TLC) and nuclear magnetic resonance (NMR).

Keywords: *Cynara scolymus* L./globe artichoke/inulin/fructo oligosaccharide/prebiotic/circular economy



Introduction:

The artichoke is a biennial, rhizomatous herbaceous plant. The flowers are blue-violet, tubular, grouped in head-like inflorescences. The commonly called 'heart', as well as the foodstuff, consists precisely of the fleshy receptacle and the innermost bracts.





Artichoke's uses:

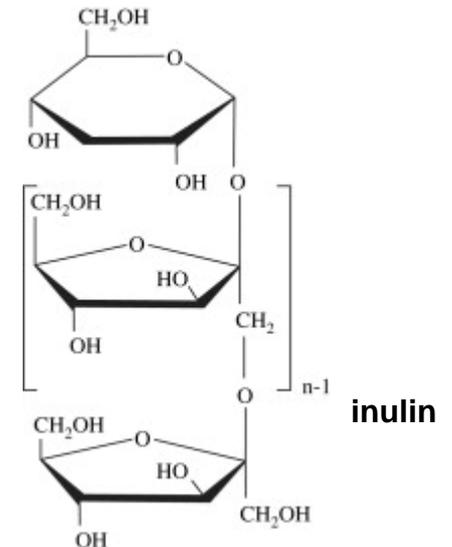
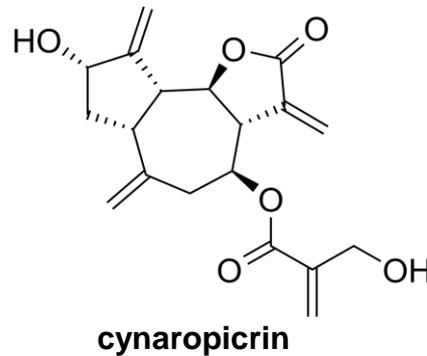
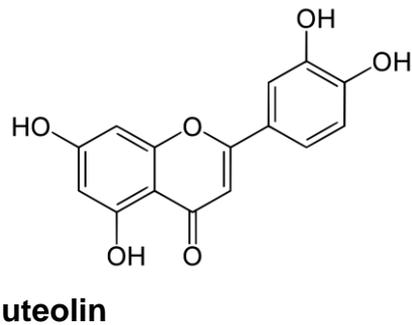
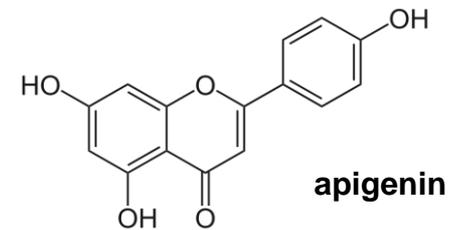
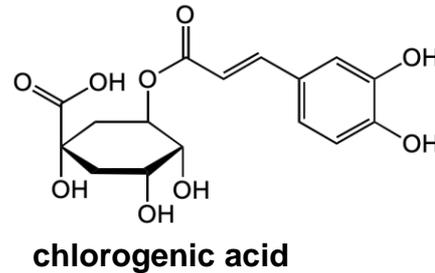
The artichoke's first processing consists of sorting and sizing the artichokes; at this stage the **stem, outer bracts, leaves** are discarded. The actual heart product consumed is processed for packaging in oil, salt, vinegar.





Metabolites:

The metabolites of greatest interest in food and medicinal purposes present in the artichoke, especially in the waste vegetative organs are:





Inulin: beneficial effects and applications

Inulin is a fructo-oligosaccharide (FOS). Its benefits as a prebiotic and its low caloric value are well known. Depending on the degree of polymerisation, inulin can be a versatile compound for some technological improvements in the food industry: short-chain molecules are used to optimise taste and sweetness, while long-chain inulin is less soluble and more viscous, so it can be used in food products as an aid to texture.





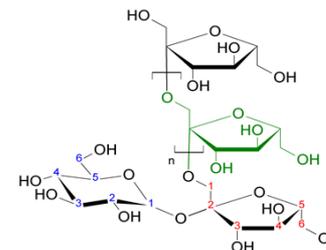
Materials and Methods:

The waste materials chosen for the study were bracts and stems. Both were dried either in an oven or in a freeze-dryer and then extracted in water. Then, the aqueous extract was precipitated with different volumes of ethanol.

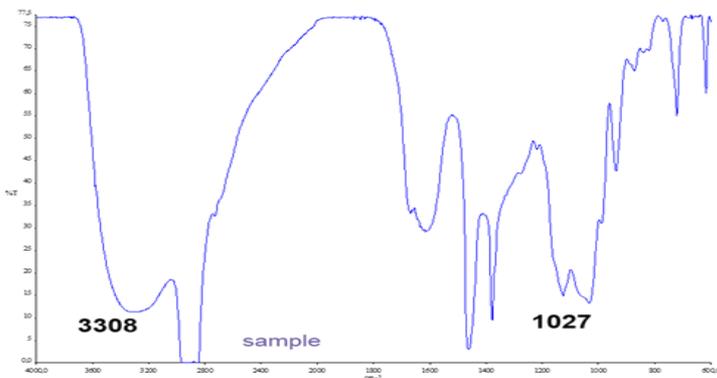
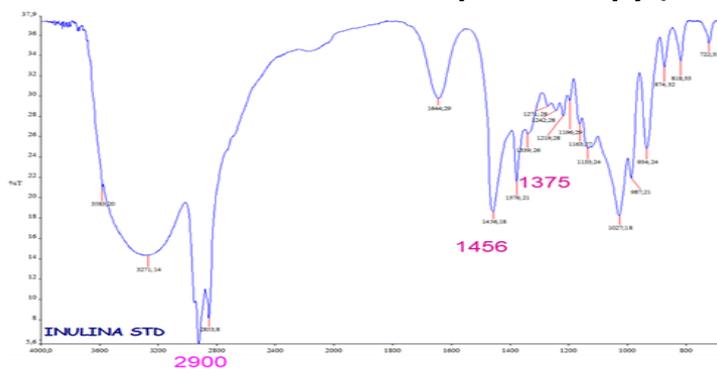




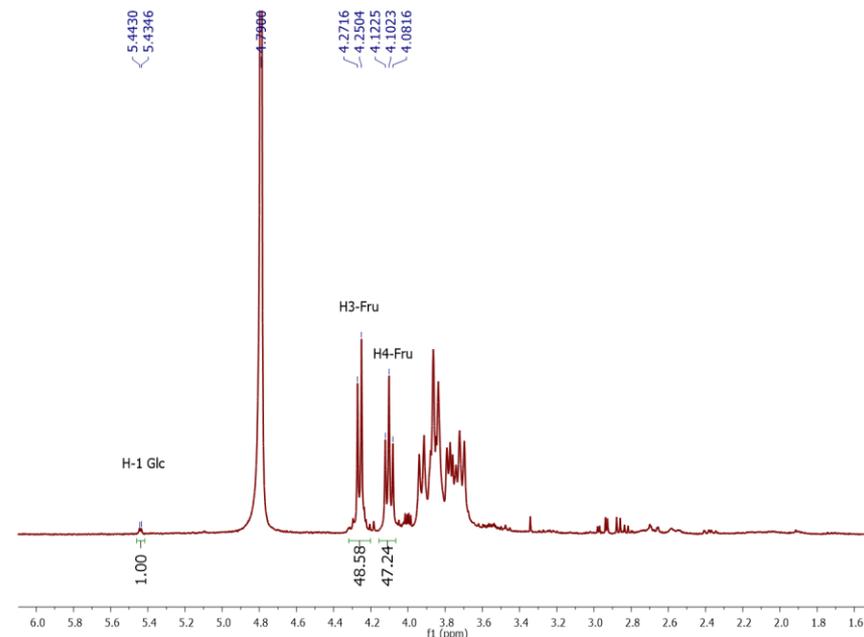
Results and discussion



Fourier transform infrared spectroscopy (FTIR)



Nuclear Magnetic Resonance (NMR) Spectroscopy





Conclusions:

- Artichoke waste is rich in inulin
- For the first time waste of *Cynara scolymus* cv Romanesco was used for the extraction of inulin
- Inulin is an important prebiotic, its recovery gives a value to artichoke waste
- Nutraceuticals





Acknowledgments



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