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NEW VALUABLE RESOURCES FROM AGROINDUSTRIAL BY-PRODUCTS FOR A MULTITUDE OF APPLICATIONS IN PACKAGING AND BIOTECHNOLOGY FIELDS

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Recent directives of the European Community are implementing the ambitious Circular Economy plan, aimed at reducing waste and enhance recycling processes, with the main objective to “close the loop” of the productive cycle [1].

In this context, supporting the environmental sustainability, the use of by-products as new source represents an innovative trend, and is the object of many researches. In the agro-industrial field, high amounts of vegetables are discarded, sometimes just because they are not considered suitable for commercial use, for their dimension, shape or ripeness degree. Besides, in industrial preparation of canned and under-oil vegetables, such as onion or artichokes, large portions of the plant are eliminated, and farms also have to afford the costs for their disposal, with high environmental impact.

Those by-products are usually still rich of nutritional valuable substances; therefore, to introduce them again in the productive cycle as new resources can provide an additional economic value.

The aim of this study is the re-evaluation of by-products from onions, artichokes, asparagus, cardoons and grapes, proposed as source to prepare extracts with different solvents, and by different procedures, such as the use of microwave assisted extraction.

The presence of several valuable bioactive substances was identified in all considered materials using several analytical techniques. The amount of phenolic compounds was evaluated by spectrophotometric assay, following the Folin-Ciocalteu method. Reversed phase chromatography equipped with UV/DAD and mass spectrometry was used for the identification of the main compounds. A relevant antioxidant power was evaluated by Oxitest, a reactor able to measure the oxidative stability of vegetable oil enriched with the extracts. Steric exclusion chromatography was used to separate fractions according to their different molecular weight. Molecules with prebiotic activity, such as fructooligosaccharides and inulins were found in extracts from residues of cardoons, onions and artichokes by high performance anionic exchange chromatography coupled to pulsed amperometric detection (HPAEC-PAD).

The potential applications of the extracts obtained can cover a multitude of sectors, comprehending the nutraceutical, cosmetic, herbalist, food technology, and packaging fields. Functional foods can be obtained by adding extracts to food products; the peculiar technological features of inulins to form gel when mixed with water, can be exploited to

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obtain bulk effect that improves food texture of creamy products. Besides, an important synergic effect is reported by the co-presence of phenolic compounds with prebiotics, linked to the increase of bioavailability due to the glucosidases released by bacterial enzymes [2]. As for packaging, innovative material can be produced from these substrates, representing a solution for new technologies, as requested by the new European Directive that banned the single-use plastics by 2021. Active and compostable packaging based on biopolymers obtained from natural ingredients can be realized using only edible substances as reagents [3]. The materials can be enriched with natural and active molecules having antibacterial and antioxidant properties, thus exerting a protective effect on the packaged food. The application of the active film on products such as meat, fruits and vegetables showed its efficacy in prolonging their shelf-life. Finally, the solid residues of extraction, mainly constituted by cellulose and lignine, could be used as raw material for obtaining paper to be adopted as secondary packaging.

References

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