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INFLUENCE OF ENCAPSULATION ON THE TECHNOLOGICAL FUNCTIONALITY AND STABILITY OF ORGANIC NATURAL PLANT EXTRACTS.

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Abstract: In this study new organic ingredients consisting of encapsulated organic nettle (*Urtica dioica* L.) and tomato “Pera d’Abruzzo” extracts to be used for the production of organic foods with high added value were developed. Extracts encapsulation was performed by freeze-drying using enzymatically hydrolyzed maltodextrins. Encapsulated extracts were evaluated for the chemical, physical and thermal properties, and antioxidant activity. Quality parameters and stability during storage at room temperature were also assessed. Freeze-dried extracts were used as reference samples.

This study shows that encapsulation in maltodextrins affects the technological functionality and the antioxidant activity of tomato and nettle extracts during freeze-drying, and also their stability during storage. These ingredients can be applied in organic productions for the production of innovative and fortified products.

Introduction: In organic food productions, the use of organic plant extracts represents a useful strategy to replace the use of additives or ingredients with technological functionalities not accepted by the organic regulations, and to satisfy the demand of the organic stakeholders and consumers for innovative, high quality, healthy, clean labels and sustainable food products. However, the production and use of plant extracts can be very challenging due to the complexity of their composition and possible interactions among constituents which can lead to the loss of coloring, flavoring and antioxidant properties during manufacturing processes and storage. In this contest, the encapsulation of natural organic plant extracts in glassy matrices represents the main strategy to protect the functionality of these ingredients and to enhance their physical and chemical stability during storage at room temperature. Encapsulation, in fact, enables protection of natural coloring, flavoring and bioactive compounds naturally present in plant extracts from environmental stresses such as exposure to high temperatures, oxygen, water, and light during processing, storage, and transport, thus, preserving their nutritional value, bioavailability, solubility, and functionality (Vinceković et al., 2017).

This study aimed to investigate the effect of encapsulation on the physical and functional properties, of micro-encapsulated organic plant extracts and the products stability during storage at room temperature. In order to comply with the general production rules and with the principles for organic production, encapsulation was performed by using enzymatically hydrolyzed maltodextrins as wall material, and by freeze-drying. This physical drying process has the advantage of being easy to apply, preserves heat sensitive compounds, and allows to obtain dried products with low final moisture content (Fang, 2012).

Material and methods: Organic tomato "Pera D'Abruzzo" (cv. SAAB-CRA) and nettle (Urtica dioica L.) were purchased by local farmers. Juice extraction from nettle leaves and tomato fruits was performed by using a vertical extractor (Hurom, H-AI-SBE20, Italy) with 2 mm mesh filter. Before extraction, nettle leaves were washed, dabbed and subjected to water blanching at 90 °C x 1' while tomato fruits were washed, dabbed, cut in pieces and thermal treated at 90 °C for 12 min; these thermal conditions were preoptimizes in order to assured the inactivation of peroxidase (POD) and polyphenoloxidase (PPO) in nettles, and of POD and pectinmethylesterase (PME) in tomato fruits. After blanching, extracts were added with 10% (w/w) of enzymatically hydrolyzed maltodextrins (DE 7.5) and encapsulated by freeze-drying. Freeze-dried extracts and blanched extracts were used as reference samples.

Blanched extracts (BE), freeze-dried blanched extracts (FDBE) and encapsulated blanched extracts (EBE) were evaluated just after preparation and during storage at room temperature for the water content, water activity (aw), soluble solids content, color and coloring power, water solubility index (WSI), thermal properties (T'g, Tg), total polyphenol content (TPC) and antioxidant activity (FRAP, ABTS). On tomato samples, the lycopene content was also assessed. Data were reported as means and standard deviations calculated on 3 replicate treatments and significant differences between means were calculated by the least significant difference test.

Results: The addition of maltodextrin to tomato BE samples allowed to hinder structural collapse during freeze-drying by the increase the T'g, and to obtain an amorphous system through the shift of the Tg of the freeze-dried extracts above room temperature. As concerns nettle, freeze-dried extract and encapsulated extract showed a glass transition respectively at 30 and 35 °C. Encapsulation with maltodextrins affected the water solubility of both the plant extracts and influenced their coloring properties, content in bioactive compounds and antioxidant capacity both during freeze drying and storage at room temperature.

Discussion: Encapsulation of plant extracts with maltodextrins influenced their solubility and this result was observed also by other authors (Laine et al., 2008; Vidović et al., 2014).

The addition of high molecular weight to plant extracts allowed to produce glassy state systems in which low reaction rates and thus a higher products quality and stability could be achieved through the increase of the product Tg. Oxidation reactions were strictly dependent on the physical state of the matrices, which affects oxygen access to the matrix.

Further investigation will be focused on the effect of encapsulation on the stability of plant extracts towards physical stress process-induced.

References:

Fang, Z., & Bhandari, B. (2012). Spray drying, freeze drying and related processes for food ingredient and nutraceutical encapsulation. In Encapsulation technologies and delivery systems for food ingredients and nutraceuticals (pp. 73-109). Woodhead Publishing.

Laine, P., Kylli, P., Heinonen, M., & Jouppila, K. (2008). Storage stability of microencapsulated cloudberry (Rubus chamaemorus) phenolics. Journal of Agricultural and Food Chemistry, 56(23), 11251-11261.

Vidović, S. S., Vladić, J. Z., Vaštag, Ž. G., Zeković, Z. P., & Popović, L. M. (2014). Maltodextrin as a carrier of health benefit compounds in Satureja montana dry powder extract obtained by spray drying technique. Powder technology, 258, 209-215.

Vinceković, M., Viskić, M., Jurić, S., Giacometti, J., Kovačević, D. B., Putnik, P., Donsì, F., Barba, F.J., & Jambrak, A. R. (2017). Innovative technologies for encapsulation of Mediterranean plants extracts. Trends in food science & technology, 69, 1-12.

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