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Processing of inulin-enriched apple juice using high-intensity ultrasound technology

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Abstract
The effects of high-intensity ultrasound (HIUS) processing on chemical composition of inulin-enriched apple juice were evaluated at different specific energy levels (0, 1, 4, 7 and 10 kJ/g). The functional beverage was characterized with respect to fructooligosaccharides (FOS) and total sugars content. In addition, the inulin chemical profile was evaluated. The analysis of sugars and fructo-oligosaccharides in the functional juice was performed by high-performance anion exchange chromatography coupled with pulsed amperometric detection (HPAEC-PAD).

Key words:
Emerging technology, fructooligosaccharides, functional beverage.

Introduction

The study of new processes for food stabilization along with the formulation of functional products have been a challenge for the food industry. Thermal technologies are still the standard processing technology for food and beverage conservation. However, thermal processing promotes the reduction of functionality in these products due to degradation of heat-sensitive compounds such as vitamins, antioxidants, proteins, lipids and others. The use of HIUS technology for the treatment of food products is an attractive alternative for application in the functional beverages industrialization, as it enables a non-thermal solution for the processing of this type of product. The HIUS is an efficient method for inactivating bacteria, viruses, yeasts and enzymatic inactivation[1].

In this sense, the aim of this work was to evaluate the effects of the HIUS operating at different specific energy levels (0, 1, 4, 7 and 10 kJ/g) on the chemical stability of a functional beverage, inulin-enriched apple juice. The samples were characterized with respect to fructooligosaccharides (FOS) and total sugars content. In addition, the inulin chemical profile was evaluated. The functional compound evaluated was chicory inulin Orafti® GR (DP ≥ 10) (BENEO-Orafti, São Paulo, Brazil).

Results and Discussion

Table 1 presents the effects of the HIUS treatment on the FOS and total sugars content. Analyzing the results, it was possible to observe that the HIUS processing of the functional beverage did not alter the FOS and total sugars content present in the beverage.

Table 1. FOS and total sugars content.

Specific Energy [kJ/g]	GF2 [mg/mL]	GF3 [mg/mL]	GF4 [mg/mL]	Total sugars [mg/mL]
0	1.95 ± 0.06	2.14 ± 0.04	2.66 ± 0.07	223 ± 4
1	1.81 ± 0.01	2.01 ± 0.02	2.53 ± 0.04	218 ± 5
4	1.88 ± 0.01	2.05 ± 0.01	2.57 ± 0.01	247 ± 15
7	1.89 ± 0.01	2.07 ± 0.01	2.61 ± 0.02	226 ± 7
10	1.9 ± 0.1	2.1 ± 0.1	2.6 ± 0.2	218 ± 10

The process intensification did not promote changes in the chromatographic profile of the samples as can be seen in Figure 1.

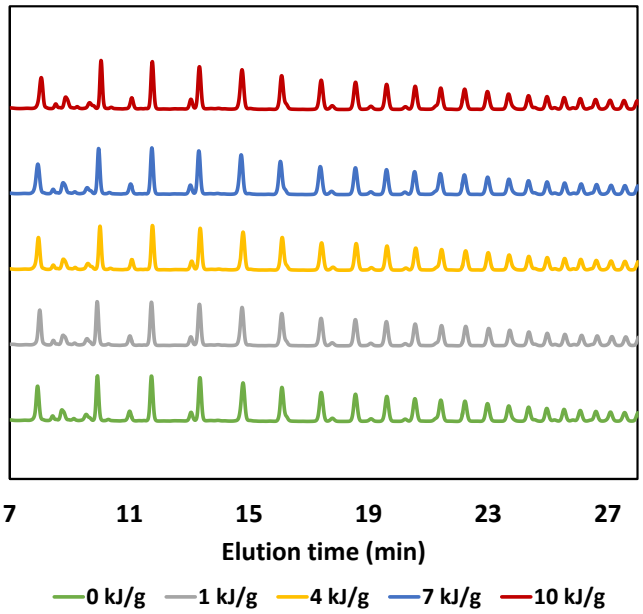

Figure 1. Influence of the HIUS treatment on the chemical inulin profile.

Conclusions

This work demonstrated that HIUS treatment is a promising technology for manufacturing functional beverages. HIUS was able to preserve the total sugars content. The emerging technology did not reduce the FOS content, thus maintaining their functionality. HIUS processing did not alter the chemical profile of the inulin added to the juice during the formulation step.

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[1] Guimarães, J. T.; Silva, E. K.; Alvarenga, V. O.; et al. Physicochemical changes and microbial inactivation after high-intensity ultrasound processing of prebiotic whey beverage applying different ultrasonic power levels. **Ultrasonics Sonochemistry**, v. 44, p. 251-260, 2018