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Non-thermal processing of inulin-enriched araticum juice using supercritical technology

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Abstract

The people are increasingly aware of the relation between diet and health and, therefore, there has been an increasing interest in more natural, healthier and safer products obtained from innovative processing technologies that ensure their safety and preserve their functionality. Thus, this work presents the non-thermal processing of a functional beverage, inulin-enriched araticum juice, using supercritical carbon dioxide. The effects of pressure (MPa) and temperature (°C) on the quality parameters of the product were investigated using a full factorial experimental design (3x2) with pressures and temperatures of 8, 15 and 21 MPa, and 35 and 55°C, respectively. The functional beverage was characterized with respect to pH, soluble solids content (SSC), particle size distribution, zeta potential (ZP), color analysis and fructooligosaccharides (FOS) content.

Key words: *emerging technology, prebiotic beverage, carbon dioxide.*

Introduction

Food processing industries are exploring novel non-thermal processing technologies to meet the demand of consumers by the physicochemical and nutritional quality, safety, and sensory attributes of the processed food products[1]. 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.

Non-thermal treatments aim to achieve both microbiological safety and minimum loss of nutritional, functional and sensory characteristics in food products. In this context, non-thermal and innovative processing technologies, such as supercritical carbon dioxide technology (SCDT), are promising treatments that can be employed in the production of functional products. SCDT utilizes pressure (8–40 MPa) in combination with supercritical carbon dioxide (few minutes to 40 min) to inactivate microorganisms without affecting the nutritional content and sensory attributes. Many studies have shown that processing with SCDT is an efficient treatment capable of non-thermally inactivating microorganisms and enzymes associated with technological problems in the industrialization of food products[2]. Although this technology is recognized as effective process for microbial and enzymatic inactivation, the effects of this process on other product characteristics such as particle size distribution, microstructure, physical stability, color, surface charge density and inulin chemical stability remain yet unknown.

Therefore, the aim of this work was to evaluate the effects of pressure (MPa) and temperature (°C) on the quality parameters of inulin-enriched araticum juice processed by SCDT using a full factorial experimental design (3x2) with pressures and temperatures of 8, 15 and 21 MPa, and 35 and 55°C, respectively. The functional material evaluated was chicory inulin Orafti® GR (DP ≥ 10) (BENEO-Orafti, São Paulo, Brazil).

Results and Discussion

Table 1 presents the results of physicochemical characterization of inulin-enriched araticum juice processed by SCDT. Analyzing the results, it was possible to observe that the non-thermal processing of the functional beverage by SCDT did not alter the pH values, SSC, ZP and color parameters even with the variation of pressure and temperature. On the other hand, the average particle size (D_{43}) was shown to be influenced when pressure, temperature and pressure/temperature were changed. Moreover, the treatments employed did not change the molecular chain of inulin. The FOS content was not altered by the SCDT.

Table 1. Effect of pressure and temperature and their interaction on physicochemical properties.

T(°C)	P(MPa)	D_{43}	ZP (mV)	L*	C*	h*
35	8	121 ± 3	-35 ± 1	56 ± 1	21 ± 1	81 ± 2
	15	148 ± 1	-32 ± 3	55 ± 1	21 ± 1	80 ± 1
	21	136 ± 1	-35 ± 2	56 ± 1	21 ± 1	81 ± 1
55	8	105 ± 3	-36 ± 1	55 ± 1	21 ± 1	80 ± 1
	15	114 ± 2	-34 ± 1	55 ± 1	21 ± 1	80 ± 1
	21	106 ± 1	-35 ± 1	54 ± 2	21 ± 1	80 ± 1

T: temperature and P: pressure.

Conclusions

This work demonstrated that the use of SCDT is promising technology for manufacture of inulin-enriched araticum juice, since the supercritical processing preserved the physical properties of functional beverage, such as juice coloration, pH, zeta potential and soluble solids. In addition, the chemical profile of inulin added to the prebiotic beverage during the formulation step was not changed.

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