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Effect of High Isostatic Pressure (HIP) and High Pressure Homogeneization (HPH) on technological properties of Brazil nut-based beverage

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Abstract
Brazil nut is a natural product that has been highlighted for its nutritional quality besides offering plenty of technological applications. One of the major applications is its water-soluble extract, named as Brazil nut-based beverage, that can be implemented on alternative diets as lactose intolerants. Thus the present study intended to evaluate the effect of HPH and HIP on the technological properties of Brazil nut-based beverage.

Key words:
High isostatic pressure, high pressure homogeneization, Brazil nut

Introduction

Brazil nut (*Bertholletia excelsa* Bonpl.), previously known as Pará nut, introduces high nutritional quality and is an important protein; selenium, and vitamin E source. The kernel nut still is prevalently consumed *in natura*, but in the last few years it has been used on alternative diets, mainly on vegan or lactose intolerant diets, and this trend demonstrated a necessity to use new technologies that may lead to efficient Brazil nuts processing. The objective of the present study was to evaluate the impact of HPH and HIP in comparison to heat treatment on the stability and physical properties of Brazil nut-based beverage in order to characterize processing conditions that provide product quality.

Results and Discussion

Characterization of physicochemical (acidity, pH and ° Brix) and optical properties, dynamic rheology, physical stability, Dynamic Light Scattering (DLS) and zeta-potential were measured to understand process impact. The adopt conditions were HIP (20; 50; 150; 300 and 600 MPa); or HPH (15 or 150 MPa) modifying the extraction temperatures (25 or 50 °C). All treatments were compared with a raw beverage as control. Concerning HPH processing, the results showed that this treatment led to a reduction of oil droplet size, which might counteract creaming. Also, none physical characterization results denoted to considerable product degradation as rose the extraction temperature did not exhibit a great effect on measured properties. Respecting optical properties, there was a propensity to increase Lightness (L*) due to a reduction of fat particles, which suggested a whiter beverage whereas rheological analysis demonstrated a Newtonian behavior. When applied thermal treatment (65 °C/20 min.), there was a significative ($p < 0.05$) increase of viscosity, probably due to protein entanglement. This is according to the temperature sweep test, which indicated that temperatures above 60 °C promoted an increase of complex modulus (G*) as a result of storage modulus (G') increase (image 1).

On the other hand, DLS analysis revealed a different trend for HIP, which expressed a reduction of particle size with 20, 50 and 150 MPa but when applied 300 and 600 MPa it occurred a raise of particle size, probably due to globular protein denaturation and clusters formation by fat globules induced by HIP (image 2).

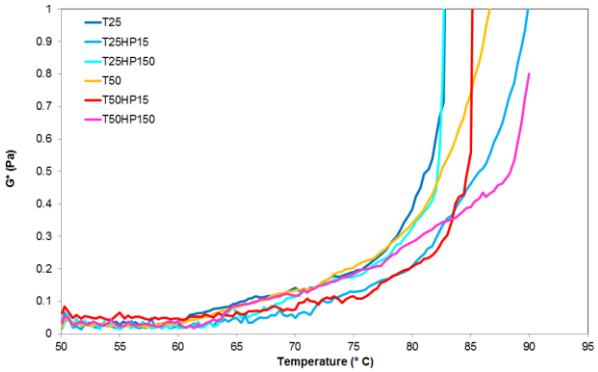

Image 1. Rheological sweep for denaturation temperature of Brazil nut-based beverage treated by HPH.

Studies about soy protein indicated that 7S fraction was denaturated at 300 MPa, while denaturation of 11S fraction occurred at 400 MPa. Another study with bovine milk concluded that the employment of pressures above 250 MPa could increase oil droplet size.

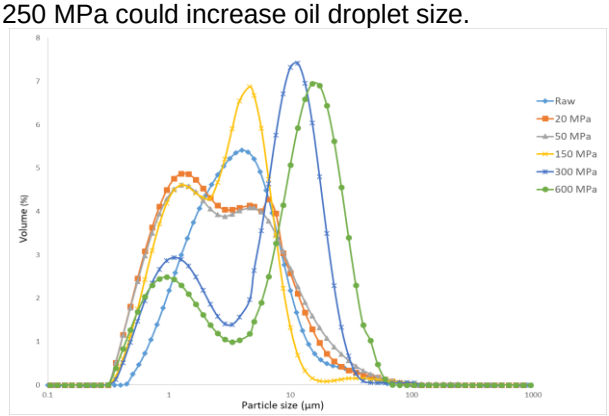

Image 2. Particle size distribution of HIP treated Brazil nut-based beverage samples.

Conclusions

HPH might improve beverage stability since there was a reduction of particle size, however, when applied 150 MPa, occurred an increase of solid sedimentation. HIP processing suggested several modifications on fat and globular protein, mainly when applied 300 and 600 MPa.

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