Enhancing the safety and quality of blueberry juice by thermosonication

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According to consumers' newest preferences, the juice segment is expanding in the market, especially using novel high technologies for processing. Ultrasound is an up-and-coming technology increasingly being applied in the food field since it can minimize the undesirable effects of thermal processing.

This study aimed to evaluate the influence of thermosonication on the inactivation kinetics of *L. innocua* 2030c, a non-pathogenic surrogate of *L. monocytogenes*, in blueberry juice. Thermal treatments were conducted as controls, and both processes' impact was assessed on some physicochemical attributes of the juice. Blueberry fruit was chosen since it is recognized as a superfruit due to its high content of health-promoting compounds.

Juice samples were prepared by defrosting frozen blueberries and using a domestic centrifuge. Freshly prepared juices were inoculated with *L. innocua* subculture (~10^9 CFU/mL). Thermosonication at two amplitude levels (60 and 100%) with a pulse duration of 10 sec on and 5 sec off was applied using a sonicator probe (700 W, 20 kHz). Thermosonication and thermal treatments were performed at 45 and 55 °C until a 5-log reduction was achieved. Physicochemical parameters of the juice (pH, total soluble solids, water activity, and color) were analyzed in fresh and treated samples. All treatments/analyses were performed in triplicate.

The Weibull model was successfully applied to fit *L. innocua* inactivation kinetic by regression analysis.

The processing times needed to achieve a 5-log reduction were, in the case of thermosonicated samples, much shorter (1 and 25 min) than the heated ones (10 and 60 min), showing the effectiveness of the synergistic effect of ultrasound and mild heating compared to heat treatment alone. For thermosonication treatments, the first decimal reduction time (δ) obtained at 55 °C was 5.13 ± 0.83 and 4.26 ± 0.36 min, respectively, for 100 and 60% amplitudes. At 45 °C, those values were reduced to 1.15 ± 0.49 and 0.51 ± 0.17 min. When thermal treatments were used, δ decreased to 1.18 ± 0.33 (55 HT) and 0.08 ± 0.09 min (45 HT), showing the δ dependence on temperature and process.

Thermosonication processes were more effective in microbial inactivation and retaining quality parameters than thermal procedures, with thermosonication at 45 °C the best treatment for blueberry juice.

Keywords: Thermosonication, blueberry juice, thermal treatment, inactivation kinetics, *L. innocua*.

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