

Abstract

Ultrasonication and Thermal Treatment Impact on Quality Attributes of Lemon Functional Drink: A Comparative Study [†]

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Abstract: This study aimed to compare the effects of ultrasonication and thermal treatments on the quality attributes of a lemon-based functional beverage. The beverage samples were subjected to different treatments and analyzed for physicochemical parameters and microbial load over a four-week refrigeration period. The thermal treatment involved exposing the beverage to a temperature of 70 °C for 10 min, resulting in a notable 30% increase in shelf life compared to the untreated samples. However, this thermal treatment led to a significant reduction in bioactive compounds, including a 15% decrease in polyphenols, a 20% decrease in flavonoids, and a 25% decline in ascorbic acid content. In contrast, sonication, performed at a temperature of 20 °C and a frequency of 37 kHz, effectively reduced the microbial load from 6.16 CFU/mL to 3.82 CFU/mL. The application of sonication also demonstrated a superior preservation of the nutritional properties and antioxidant content of the functional beverage compared to the thermal treatment. A storage analysis revealed that sonication maximized antioxidant levels when compared to thermal heating at a temperature of 4 °C. The findings of this study have significant implications for the food industry. Sonication emerged as a cost-effective and efficient alternative to thermal treatment for producing high-quality fruit beverages. Its ability to reduce microbial load while preserving nutritional properties makes it an attractive option for large-scale production. The integration of sonication into existing production processes is also feasible, as it requires minimal equipment and can be applied at ambient or controlled temperatures. In conclusion, this study highlights the advantages of using sonication as a non-thermal technique for enhancing the quality and safety of lemon-based functional beverages. The findings support the adoption of sonication in the food industry to meet the growing demand for functional and healthy beverages while maintaining the desired quality standards.

Keywords: functional drinks; ultrasound; bioactive compounds; thermal degradation; sonication



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