Influence and comparison of thermal, ultrasonic and thermosonic treatments on physicochemical quality of orange juice

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Orange juice is the most popular and consumed juice worldwide, associated with healthy eating habits. Thermal pasteurization treatments are used to preserve industrially produced juice. Unfortunately, this process removes many nutritious compounds. Therefore, other milder treatments are being studied to minimize the impact on the product's final quality.

The main goal of this study was to evaluate the effect of thermosonication (TS) treatment on the quality of orange juice in comparison with heat (HT) and ultrasound (UT) treatments alone. Commercial pasteurized orange juice was treated by UT, HT or TS in a sonoreactor (20 kHz and 80% amplitude) at different temperatures 20, 30, 40, 50 and 60 °C for 90, 60, 60, 30 and 30 min, respectively. These treatment times were chosen to guarantee the *Staphylococcus aureus* inactivation. Physicochemical characteristics, such as pH, colour and Brix, and microbial cell counts, were evaluated before and after treatments. Principal components analysis (PCA) was carried out to detect simple patterns and differences.

All treatments could reduce the *S. aureus* presence in at least 3 log cycles, except the HT at 20, 30 and 40 °C, where an increase in microbial counts was attained. The majority of quality characteristics were not significantly affected by the applied treatments, except a* value for US 20, 30 40 and 50°C, Brix for TS 60°C and pH for US 30 and 40 °C, TS 50°C and HT 20 and 50 °C. PCA revealed two components with eigenvalues greater than one, which explained 56.1% and 28.4% of the total variance, respectively. The first component was mostly influenced by a*, pH, L*, b* and Chroma, while the second by Hue and microbial inactivation. The second component allowed a clear distinction between types of treatment, while the first component allowed separation among the processing conditions of temperature/time.

Keywords: thermosonication, ultrasound, *Staphylococcus aureus*, PCA

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