

Non-thermal technologies for *Alicyclobacillus acidoterrestris* inactivation in apple juice

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Introduction

A. acidoterrestris

- Thermo-acidophilic bacteria.
- Survives to pasteurization processes.
- Suggested as the target to be used in the design of adequate pasteurization processes.

Heat processing

- Adverse effects on sensory and nutritional characteristics of foods.

Non-thermal technologies

- Potential for inactivating spoilage and pathogenic microorganisms.
- Minimizing quality losses in terms of flavour, colour and nutritional compounds.

Ultraviolet radiation (UV-C)

- Microorganisms that are exposed to UV-C light are affected at DNA (deoxyribonucleic acid) level, which compromises their survival.

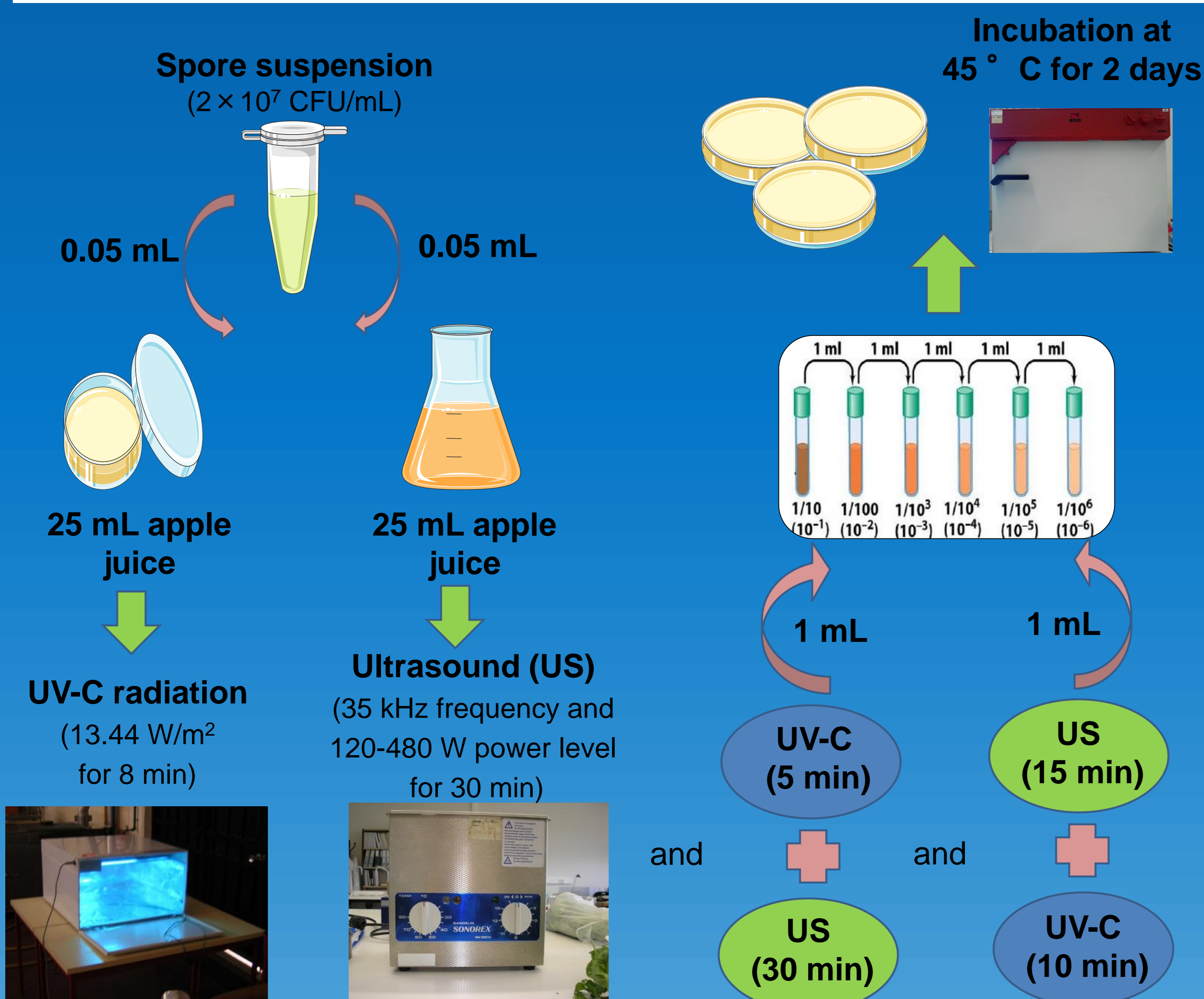
Ultrasound (US)

- Power ultrasound is capable of inducing cavitation to inactivate microorganisms in foods.

Objectives

The main objective of this work was to study the influence of UV-C radiation, ultrasounds, and combinations of both treatments on *A. acidoterrestris* inactivation in apple juices.

Materials & Methods



Results & Discussion

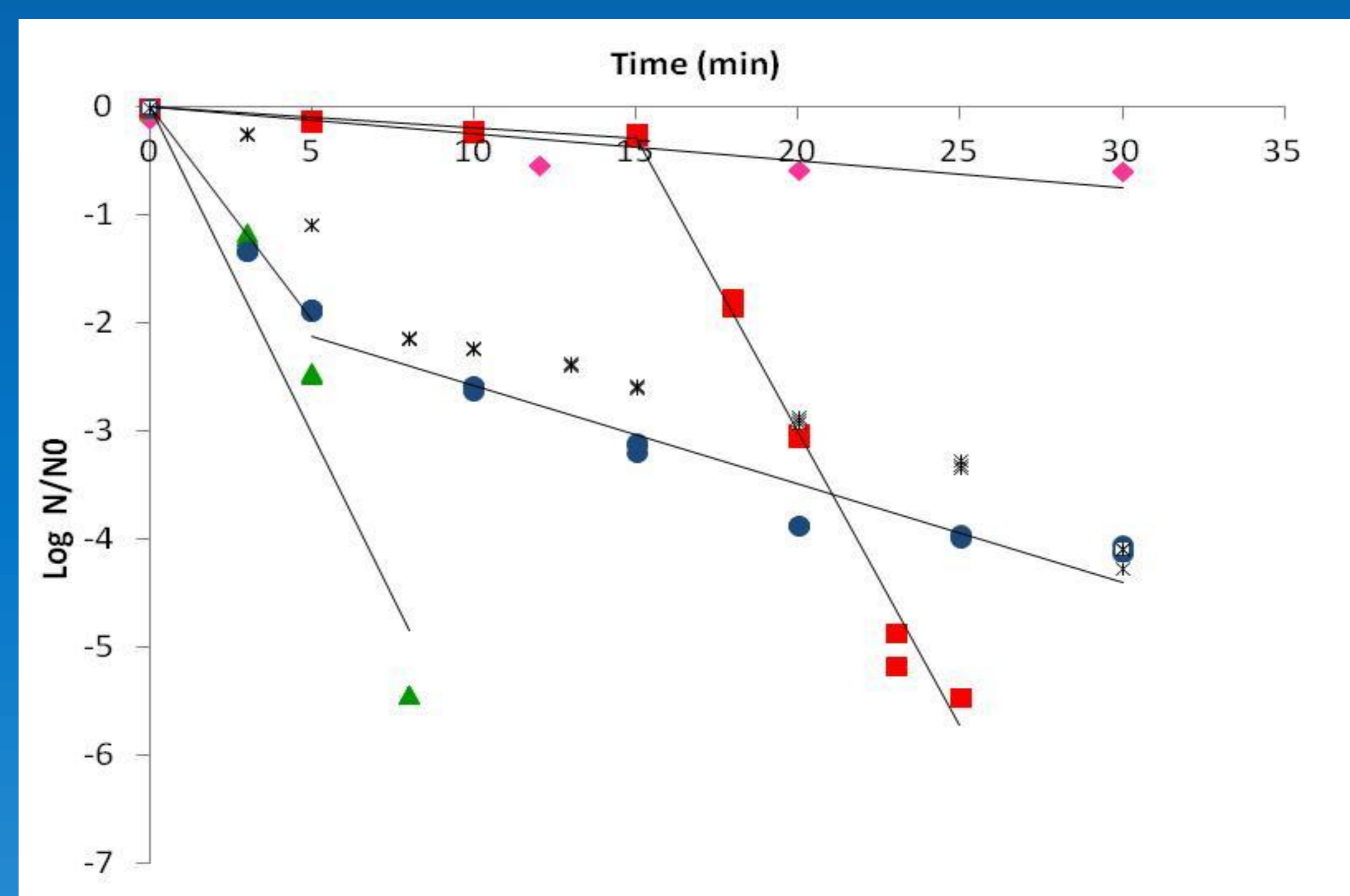


Figure 1. *A. acidoterrestris* inactivation in apple juice applying different treatments: (▲) UV-C, (◆) US, (■) US+UV, (●) UV+US and (×) 95 ° C. Lines represent model fits for each treatment individually (eq. 1).

Table 1. Inactivation rates of *A. acidoterrestris* spores in apple juices obtained for each non-thermal treatment; confidence intervals at 95% (CI_{95%}) and correlation coefficients (R) are included.

Treatment	First treatment		Second treatment	
	k(min ⁻¹) ± CI _{95%} /2	R	k(min ⁻¹) ± CI _{95%} /2	R
UV-C	0.606±0.069	0.97	-	-
US	0.025±0.005	0.76	-	-
UV+US	0.393±0.025	0.99	0.091±0.014	0.96
US+UV	0.019±0.002	0.96	0.546±0.035	0.99

Data analysis

$$\log\left(\frac{N}{N_0}\right) = -kt \quad (1)$$

N_0 is the initial microbial load of the juice (CFU/mL), N the microbial load (CFU/mL) at a given treatment time t (min), and k the inactivation rate (min⁻¹).

Conclusions

- ✓ Ultrasounds had a minor effect on *A. acidoterrestris* inactivation, reducing only 0.6-log after 30 minutes of treatment.
- ✓ UV-C radiation decreased drastically the number of spores (around 5-log reduction, which attains FDA requirements) after 8 min of treatment.
- ✓ The combined treatment US followed by UV-C resulted in higher inactivation (around 6-log reduction) after 25 min of exposure.
- ✓ Inverting the order of treatments, *i.e.*, UV-C followed by US, a decrease of approximately 4-log of initial microbial load occurred after 30 minutes of treatment. These results are similar to the ones obtained with a thermal treatment at 95 ° C.
- ✓ It can be concluded that UV-C radiation and combined treatments of UV-C followed by US are promising treatments, with a drastic impact on the loads of *A. acidoterrestris* in apple juices.

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