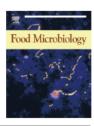


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Effect of storage temperature on the lag time of *Geobacillus* stearothermophilus individual spores



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ABSTRACT

The lag times (λ) of Geobacillus stearothermophilus single spores were studied at different storage temperatures ranging from 45 to 59 °C using the Bioscreen C method. A significant variability of λ was observed among individual spores at all temperatures tested. The storage temperature affected both the position and the spread of the λ distributions. The minimum mean value of λ (i.e. 10.87 h) was observed at 55 °C, while moving away from this temperature resulted in an increase for both the mean and standard deviation of λ . A Cardinal Model with Inflection (CMI) was fitted to the reverse mean λ , and the estimated values for the cardinal parameters T_{\min} , T_{\max} , T_{opt} and the optimum mean λ of G. stearothermophilus were found to be 38.1, 64.2, 53.6 °C and 10.3 h, respectively. To interpret the observations, a probabilistic growth model for G. stearothermophilus individual spores, taking into account λ variability, was developed. The model describes the growth of a population, initially consisting of N_0 spores, over time as the sum of cells in each of the N_0 imminent subpopulations originating from a single spore. Growth simulations for different initial contamination levels showed that for low N_0 the number of cells in the population at any time is highly variable. An increase in N_0 to levels exceeding 100 spores results in a significant decrease of the above variability and a shorter λ of the population. Considering that the number of G. stearothermophilus surviving spores in the final product is usually very low, the data provided in this work can be used to evaluate the probability distribution of the time-to-spoilage and enable decision-making based on the "acceptable level of risk".

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