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Formulation of Cold-Pressed Complementary Infant Foods for Food Safety Enhancement

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Abstract

Introduction: Bacillus spores are a challenge to infant foods that have undergone High-pressure processing (HPP) due to the ability of HPP to trigger spore germination and outgrowth in the food product. The objective of this study was to evaluate the combined effect of high-pressure processing (HPP), moderate heat, and low pH on these spores.

Methodology: B. amyloliquefaciens spore suspension in citric acidic (pH 5) was subjected to cooking only at moderate temperature for 25 min, HPP only at 600 MPa for 180 and 240 sec, and a sequential combination of cooking and HPP for 180 and 240 sec, as a simulation of different treatments used for commercial processing of complementary infant foods. Spore inactivation was investigated by analysing the morphological, structural, and physiological changes to the Bacillus spores using scanning electron microscopy, transmission electron microscopy, and flow cytometry analysis.

Results and Discussion: Each treatment applied, and the hurdle technology combined with all the treatments significantly affected the morphology, structure, and physiology of the spores. These observations were evident from the structural damage to the spores, which were obviously dented and crushed with loss of spore core materials under the combined treatment of low pH, heat, and HPP. During the presentation, the extent of damage to the internal membrane or spore cortex and the effect on the spore core materials will be discussed in detail. Acidity, on the other hand, reduces the resistance of bacteria spores to further treatment by exchanging the spore mineral content with charged proton, thereby demineralizing the spore. At the same time, wet heat inactivates the spores by disrupting the cortex and internal membrane, and HPP further damages the spore cortex, all leading to the release of spore core materials.

Conclusions: The findings of this study indicate that HPP technology combined with selected hurdles enhances inactivation of Bacillus spores, possibly resulting from synergistic effects on the morphology, structure, and disruption of physiological functions in the spores.