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Determination of bacterial spore inactivation kinetic parameters during ohmic heating by nonisothermal methods

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Bacterial spore inactivation is the major goal in safety assurance of low-acid canned food. Inactivation kinetics is typically done by steady-state determination at constant temperature. However, when the product is heated by ohmic (Joule effect) heating, the electric field strength has significant nonthermal effects on bacterial inactivation. Since the product will necessarily heat as a consequence of application of the electric field, maintenance of isothermal conditions is difficult and even impossible if product conductivity is high; thus nonisothermal methods are necessitated.

We approached the problem using D- and Z-value kinetics, for *Bacillus subtilis* inactivation under conditions of continuously (linearly) increasing temperature, which results in an analytical solution from which the Z-value (temperature dependence) may be determined once the D-value (proportional to reciprocal of reaction rate constant) is known. However, the Z-values thereby obtained (over the entire range of temperature from room temperature to sterilization conditions) resulted in great overprediction of inactivation at the highest temperatures, and underprediction at the lower temperatures. This suggested that the range of applicability of the D- and Z-value models be restricted to temperatures roughly in the range of 95°C and above. While better prediction is possible under these conditions, both kinetic parameters diverge greatly from the steady-state values.