Modeling and optimization of the E-beam treatment of chicken steaks and hamburgers, considering food safety, shelf-life, and sensory quality

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Abstract

The present work was carried out to model the effect of E-beam treatment on the safety, shelf-life and sensory attributes of two poultry products, steaks and hamburgers, and to optimize the radiation treatment. The inactivation of Salmonella spp. by means of different irradiation doses was modeled using a first order kinetics. The shelf-life was studied by periodically counting the bacterial number in samples. For the modeling of experimental data, only the exponential phase of growth was taken into account. The effect of the irradiation dose on the sensory attributes (appearance, odor and flavor) and instrumental color (L*, a* and b* parameters) was modeled using the Gompertz function and the Activation–Inactivation or linear models. The optimization of the irradiation dose was carried out by maximizing the sensory scores of samples and minimizing the instrumental color changes. The safety and the shelf-life of samples were ensured by introducing constraints into the optimization problem. In the case of hamburgers, the optimum calculated dose was 2.04 kGy, which guarantees the safety of the product and provides the best combination of sensory and instrumental attributes. As regards the steaks, the optimum assessed dose was 1.11 kGy, significantly lower than for hamburgers.