國立臺灣海洋大學食品科學系碩士班
專題討論書面報告

零售與收穫後食品中微生物風險量化評估與模型建立

Quantitative Microbiological Risk Assessment and Model Development in Retail and Post-Harvest Foods

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Outline

Ⅰ. Introduction

II. Development of a quantitative microbiological spoilage risk assessment (QMSRA) model for cooked ham sliced at retail

III. Quantitative microbiological spoilage risk assessment (QMSRA) of fresh poultry fillets during storage at retail

IV. Modeling naturally-occurring *Vibrio parahaemolyticus* in post-harvest raw shrimps

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Abstract

The study integrated the development and application of quantitative microbiological risk and spoilage assessment models to characterize microbial behavior in retail and post-harvest foods. For retail-sliced cooked ham, a Quantitative Microbiological Spoilage Risk Assessment (QMSRA) model was developed based on the stochastic growth of lactic acid bacteria (LAB), identified as the specific spoilage organisms (SSO), and a spoilage-response relationship describing consumer perception variability. Simulation results predicted zero spoilage events within 4.5 days of storage, with spoilage risk increasing significantly after 5–6 days. Sensitivity analysis indicated that domestic storage temperature and contamination level during slicing were the most influential factors.

For fresh poultry fillets stored aerobically at retail, a QMSRA model based on the growth and metabolic activity of *Pseudomonas spp.* was established. Microbiological and sensory data were combined to define the relationship between bacterial concentration and sensory rejection using a beta-Poisson model. A second-order Monte Carlo simulation was used to separate uncertainty from variability. The model predicted an increasing number of spoiled units after 6–10 days of storage, while a 1 log reduction in contamination or a 1°C temperature decrease could reduce spoilage risk by up to 90–99%.

In post-harvest raw shrimps, the fate of naturally-occurring *Vibrio parahaemolyticus* was investigated using PMA-qPCR and fitted with the Baranyi growth model. The bacteria showed slow inactivation at 4°C and 7°C but rapid, temperature-dependent growth between 15°C and 30°C. Comparative analysis revealed that predictive models based on artificially inoculated cooked shrimps may underestimate the actual risk. Seasonal variation was also observed, with higher initial

and maximum bacterial concentrations in summer-harvested samples.

The integrated predictive microbiology and QMSRA models provide a robust scientific foundation for food quality management, shelf-life determination, and microbial risk assessment in both retail and post-harvest food systems.

Reference

Tsaloumi, S., Stathas, L., & Koutsoumanis, K. (2023). Quantitative microbiological spoilage risk assessment (QMSRA) of fresh poultry fillets during storage at retail. *Food Research International*, 170, 113018.

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