Modeling and predicting the growth boundary of Listeria monocytogenes in lightly preserved seafood

The antimicrobial effect of diacetate and lactate against Listeria monocytogenes was evaluated in challenge tests with vacuum-packaged or modified atmosphere packaged (MAP) cold-smoked salmon, marinated salmon, cold-smoked Greenland halibut, marinated Greenland halibut, and gravad salmon. MAP cold-smoked salmon with the addition of 0.15% (wt/wt) diacetate prevented the growth of L. monocytogenes for more than 40 days at 8 degrees C, whereas the addition of 0.15% (wt/wt) diacetate reduced the growth rate of the pathogen in MAP cold-smoked Greenland halibut. This difference between the two types of products was explained by a higher content of naturally occurring lactate in cold-smoked salmon (0.77 to 0.98%, wt/ wt) than in cold-smoked Greenland halibut (0.10 to 0.15%, wt/wt). In fact, the addition of 0.15% (wt/wt) diacetate and 0.75% (wt/wt) lactate to MAP cold-smoked Greenland halibut prevented the growth of L. monocytogenes for more than 45 days at 8 degrees C. A mathematical model that included the effect of diacetate, lactate, CO2, smoke components, nitrite, pH, NaCl, temperature, and interactions between all these parameters was developed to predict the growth boundary of L. monocytogenes in lightly preserved seafood. The developed growth boundary model accurately predicted growth and no-growth responses in 68 of 71 examined experiments from the present study as well as from literature data. Growth was predicted for three batches of naturally contaminated cold-smoked salmon when a no-growth response was actually observed, indicating that the model is fail-safe. The developed model predicts both the growth boundary and growth rate of L. monocytogenes and seems useful for the risk management of lightly preserved seafood. Particularly, the model facilitates the identification of product characteristics required to prevent the growth of L. monocytogenes, thereby making it possible to identify critical control points, and is useful for compliance with the new European Union regulation on ready-to-eat foods (EC 2073/2005).

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