INTEGRATED MODELLING OF FOOD PROCESS AND BACTERIAL BEHAVIOUR: APPLICATION FOR PREDICTING THE EVOLUTION OF *L. MONOCYTOGENES* CONTAMINATION DURING DELICATESSEN PROCESS

V. ZULIANI, P. GARRY, J.L. VENDEUVRE
Centre Technique de la Salaison, de la Charcuterie et des Conserves de Viandes, Maisons-Alfort, France.

J.C. AUGUSTIN
Unité Mixte de Recherches RISQUAL ENVA/INRA, Maisons-Alfort, France.

I. LEBERT, A. LEBERT
Unité de Recherches sur la Viande, INRA, Theix, France.

Microorganism, food and process are the three main components involved in the quality and safety of food products. Indeed food products may become microbiologically unsafe if the growth of pathogenic or spoilage bacteria occurred in particular when they are not properly processed and stored. Predictive microbiology is a powerful tool that can help professional to guarantee the microbiological quality of their products. Nevertheless, too many models have been built in static condition with broth medium. So, their ability to predict the behaviour of bacteria in food during its process (inducing dynamic environmental conditions) is not as satisfactory as it could.

In this study, we developed a global modeling approach similar to that of Wilson *et al.*[1]. Such approach consists in combining a food-processing model and predictive bacterial models. As raw pork meat is part of the most sensitive food concerning risk with *Listeria monocytogenes* contamination [2] there is a need to understand and model the behaviour of *L. monocytogenes* during delicatessen processes. We thus applied an integrated modeling approach to predict the behaviour (growth and decrease) of *L. monocytogenes* taking account of the raw meat product characteristics and the process effects (formulation, heat processing regime and storage temperature).
All experiments were carried out in raw minced pork meat artificially contaminated with *L. monocytogenes*. We studied the effect of pH (five levels), water activity-a_w- (five levels), heat processing regimes (four time/temperature combinations) and storage temperature (two levels) on the evolution of contamination of the bacteria.
Two bacterial models were used: a growth model and an inactivation model. A heat transfer model was also used to take the change of temperature into account. The parameters of the models were adjusted in order to take account of the influence of the product characteristics and the strain used. Predicted kinetics were compared with experimental data obtained in more than one hundred different environmental conditions. Models were first individually validated and the combined approach was also validated.

Such integrated approach, taking into account the characteristics of the medium, the bacteria and the process predict accurately the evolution of listerial contamination in raw pork. It will be useful for predicting food safety. It will also have many applications in HACCP or risk analysis.

References

[1] P.D. Wilson, T.F. Brocklehurst, S. Arino, D. Thuault, M. Jakobsen, M. Lange, J. Farkas, J.W. Wimpenny and J. F. Van Impe. International Journal of Food Microbiology **73** (2002), p. 275

[2] I. Giovannacci, C. Ragimbeau, S. Queguiner, G. Salvat, J.L. Vendeuvre, V. Carlier and G. Ermel. International Journal of Food Microbiology **53** (1999), p 127