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Control of *Listeria monocytogenes* in the food industry

In this thesis contamination routes of *L. monocytogenes* were examined in a food establishment, the survival of *L. monocytogenes* strains was studied in dry-fermented sausages prepared using two different starter cultures, the acid and heat tolerance of *L. monocytogenes* strains were studied, and efficacy of ultrasonic cleaning was tested on conveyor belts contaminated with *L. monocytogenes*.

Contamination routes of *L. monocytogenes* were examined during an 8-year period in a chilled food-processing establishment that produced ready-to-eat meals using amplified fragment length polymorphism (AFLP) analysis. Compartment I of the establishment, producing cooked meals, was heavily contaminated with three persistent AFLP types, and compartment II, producing uncooked chilled foods, was contaminated with persistent and non-persistent AFLP types. *L. monocytogenes* was isolated only once from compartment III. The persistent contamination appears to be influenced by the cleaning routines, product types and lack of compartmentalisation in facilities producing cooked meals. The reconstruction of the production line in compartment II resulted in the elimination of two persistent AFLP types.

The survival of five *L. monocytogenes* strains was studied in dry-fermented sausages prepared using two different starter cultures with or without a bacteriocin-producing *Lactobacillus plantarum* DDEN 2205 strain. *L. monocytogenes* was detected throughout the ripening process in sausages containing no bacteriocin-producing strain. The use of both starters with bacteriocin-producing culture resulted in *L. monocytogenes*-negative sausages after ripening. Two of the *L. monocytogenes* strains survived in sausages with bacteriocin-producing cultures better than the other strains. Bacteriocin-producing strains provide an appealing hurdle in dry sausage processing, but differences in survival of *L. monocytogenes* strains require the use of other hurdles as well.

The acid and heat tolerance of persistent and non-persistent *L. monocytogenes* strains were studied. *L. monocytogenes* strains exhibited large variation in both acid and heat tolerance. The persistent strains exhibited higher tolerance to acidic conditions than the non-persistent strains, but significant differences in heat tolerance between persistent and non-persistent strains were not detected. Due to the great differences in acid and heat tolerances between *L. monocytogenes* strains, preventive measures should be designed to be effective against the most tolerant strains. Ultrasonic cleaning was tested on three conveyor belt materials contaminated with *L. monocytogenes* strains.

The ultrasonic cleaning was efficient for all materials, but the reduction of *L. monocytogenes* was significantly greater in stainless steel than in plastic materials. The ultrasonic cleaning was further studied by building a pilot-scale conveyor with an ultrasonic cleaning bath. The detachment of *L. monocytogenes* from the stainless steel conveyor belt caused by the ultrasonic treatment was significantly greater than without ultrasound. In both studies, lengthening of the treatment time did not significantly increase the detachment of *L. monocytogenes*. However, an increase in temperature improved the effect of the ultrasonic treatment, and 10 s at 50 °C reduced *L. monocytogenes* counts by more than 5 log units. These results indicate that the ultrasonic cleaning of conveyor belts is effective even with short treatment times.