

# Dairy Pipeline

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## Future Uses of Wooden Boards for Aging Cheeses

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Wooden boards have been used for many years in most traditional cheesemaking countries as a shelving mechanism for aging cheese. In France, more than 300,000 tons of cheese are ripened on wooden boards each year (Meyer, 2005). Most artisan cheesemakers feel that wooden shelves favor cheese rind development and improve the organoleptic qualities of aged cheeses thanks to the formation of a biofilm on the wood surface. Is this biofilm safe? Might it favor the development of spoilage and potential pathogenic bacteria? The purpose of this review is to look at the benefits of wooden boards as well as the potential concerns and how to avoid them.

## Experiences with Wooden Shelving for Aging Cheeses

In a French study on the biofilm ecology of shelves used in ripening raw milk smear cheese (Mariani et al., 2007),



French researchers did a microbial characterization and found that most of the microflora was composed of micrococci-corynebacteria (7.2 to 7.3 log<sub>10</sub> cfu/cm<sup>2</sup>) and yeasts/molds (6.0 to 6.1 log<sub>10</sub> cfu/cm<sup>2</sup>). Based on these findings, they concluded traditional methods of cleaning wooden cheese ripening boards by soaking them in cold water and brushing them minimized the risk of contamination by pathogenic microorganisms, thus allowing useful microflora to be preserved. When large-scale pathogen contamination occurred, however, pathogenic microorganisms could not be satisfactorily eliminated; even with the use of disinfectants. In case of heavy contamination the wooden boards had to be destroyed.

In another French study (Lemoine, 2002), newly sawn wooden boards were surveyed for potential pathogens. The study found no evidence of pathogens on the board surface or within the wood. Processes for cleaning wooden boards used for aging cheeses were also evaluated. It was determined that the most effective cleaning process, in terms of pathogen removal, was to involve a washing at 179.6°F for 30 minutes.

The effect of cleaning and heat disinfection processes on the survival of *Listeria monocytogenes* on wooden shelves used for cheese ripening was also examined (Zangerl et al., 2010). *Listeria monocytogenes* is a gram-positive rod-shaped bacterium that can be found in fresh cheeses and unpasteurized milk. The cut boards were inoculated with a suspension containing 5.5X10<sup>7</sup> colony forming units (CFU)/ml of *L. monocytogenes*. Survival of *L. monocytogenes* was investigated in the wood shavings. During the 24-hour incubation period in a humidity chamber, *Listeria* counts increased by 0.8 log units on average (n = 9), compared to results one hour after incubation, indicating the absence of antimicrobial properties of the wood in use. Additionally, after incubation for 24 hours at room temperature, the boards were cleaned by soaking them for 15 minutes in a solution of hot alkaline detergent followed by brushing and rinsing with warm water. Some of the cleaned boards were subsequently heat treated at 176°F for 5 minutes and at 149°F for 15 minutes, respectively. The cleaning procedure alone was not sufficient to render *L. monocytogenes* from the upper 2 mm wood layer inactive. In the case of both temperature-time combinations for heat disinfection, however, *L. monocytogenes* was not detectable. The present study shows that the use of wooden shelves does not affect the hygienic safety of cheeses if such



shelves are in good repair and are thoroughly cleaned and sanitized by heat treatment.

Results from a two-year French research study called ACTIA (Association de Coordination Technique pour l'Industrie Agro-alimentaire) (2004-2006) involving professionals, technical centers and research agencies including INRA (Institute National de la Recherche Agronomique) may have a significant impact on acceptance of wooden boards for aging cheeses. This study involved two types of soft smear cheeses: Reblochon and Muenster. The risk of contamination by pathogenic bacteria was studied by analyzing the growth of *Listeria monocytogenes*. The researchers have shown the presence of a living biofilm on wooden shelves that presents anti-*Listeria* properties. This inhibiting effect appeared to be active against two strains of *L. monocytogenes* that were chosen for their different surface properties and their presence in certain cheesemaking environment. The anti-*Listeria* effect was not affected by the level of *Listeria* inoculation nor the origin of the cheeses ripened on the shelves.

Scientists from the INRA/AgroParis Tech center developed an experimental system reproducing the anti-*Listeria* effect to understand the inhibiting properties. The idea was to analyze the metabolites produced by the biofilm and the two *Listeria* strains inoculated. The study showed that competition occurred when the microbial biofilm entered a stationary phase and stopped the growth of *Listeria*. At this stage, it did not appear that the metabolites produced contain any inhibiting molecules. Further collaborative research should provide a better understanding of the inhibiting effect of biofilms against pathogenic microorganisms.

Wooden boards seem to be more sanitary than plastic boards when using extraction procedures for assessing number of bacteria retained on the surface of boards. The bacterial contaminants were bound tightly enough in the wooden boards to keep them from being extracted and they actually formed biofilms. Several researchers (Cools et al., 2005; Mariani et al., 2007) have investigated the potential for pathogens to be retained in the biofilm. Cools et al. (2005) stated that there is a higher risk for cross-contamination from *Campylobacter jejuni* surviving and persisting at the surface of a polypropylene cutting board than from *C. jejuni* being present in the deep interior of the wood, as the latter has less direct contact with food. The pathogen is more easily removed from the upper non-porous surface of the plastic board than from the interior of the deep crevices and pores in the wood.

The wood used to make the shelves is usually carefully selected. The caves of Joseph Paccard in Haute-Savoie, France that make Reblochon use spruce wood that is cut in December when the sap goes back down from the top of the



tree into the ground. This is really important for the quality of the wood. In order to be able to age cheese on wood, the shelves have to be cut close to the heart of the tree without including the heart otherwise the wood tends to split and the shelves cannot be used. Finally, the shelves have to be dried naturally for at least 18 months. In summary, wooden boards, especially spruce, fir, pine and larch, seem to be more effective than plastic boards in trapping bacteria in pores and controlling them with possible antimicrobial properties.

### Future for Wooden Shelving for Aging Cheeses

Wooden boards have been traditionally used for cheese ripening shelves because of their moisture retaining properties and porosity that aids in the retention of potential bacterial contaminants. The future use of wooden boards for aging cheeses will depend on the cleaning and sanitation of those boards. A.K. et al. (1994b) reports that cleaning with hot water and detergent generally removes most of the residual bacteria, regardless of bacterial species, wood species, and age of the wood. Zangerl et al. (2010) reported that the cleaning procedure alone was not sufficient to eliminate *Listeria monocytogenes* from the upper 2 mm wood layer of wooden shelves used for cheese ripening. They recommended heating the cleaned boards to 176°F for 5 minutes or 149°F for 15 minutes to eliminate the potential for pathogens. Yang et al. (2009) reported that quaternary ammonium compound (QAC) – based sanitizers and sodium hypochlorite sanitizers were effective against *L. monocytogenes* on cutting boards.

In general, with the use of softwood boards, e.g., pine or spruce, along with a hot wash using hot water and detergent, most boards should be fairly clean. The freshly cleaned boards should then be sanitized by heating the boards to 176°F for 5 minutes or sanitized with either a chlorine-based or QAC-based sanitizer to ensure freedom from any potential pathogens.

Finally, considering the beneficial effects of wood boards on cheese ripening and rind formation, the use of wood boards does not seem to present any danger of contamination by pathogenic bacteria as long as a thorough cleaning procedure is followed.