Farmhouse and
Artisan
Cheese & Dairy Producers
European Network

Wood and Traditional Materials in Dairy Processing

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Wooden equipment has been used in traditional cheesemaking for hundreds of years but the acceptance of wood and other traditional materials in dairy processing is open to different interpretations among member states. This paper reviews the safety of wood in relation to other food contact materials

European Regulation and Codex Alimentarius Guidelines

Regulation (EC) 852/2004, requires that:

> *"Surfaces (including surfaces of equipment) in areas where foods are handled and in particular those in contact with food are to be maintained in a sound condition and be easy to clean and, where necessary, to disinfect. This will require the use of smooth, washable, corrosion-resistant and non-toxic materials, unless food business operators can satisfy the competent authority that other materials used are appropriate."*

Regulation (EC) 852/2004 Annex II Chapter II

Regulation (EC) 2074/2005 permits specific derogations from Regulation (EC) 852/2004 for foods with traditional characteristics – such as those which are recognised historically, manufactured according to traditional production methods or protected by PDO, PGI or TSG status.

> *"Premises may in particular comprise walls, ceilings and doors that are not smooth, impervious, non-adsorbent or of corrosion-resistant material and natural geological walls, ceilings and floors*
>
> *The cleaning and disinfecting measures for the premises … and the frequency with which they are carried out shall be adapted to the activity in order to take account of their specific ambient flora.*
>
> *The instruments and equipment … shall be maintained at all times in a satisfactory state of hygiene and shall be regularly cleaned and disinfected.*"

Regulation (EC) 1935/2004 relates to food contact materials; it does not refer to wood specifically but specifies that food contact surfaces should not transfer their constituents in a way that endangers health or taints the flavour of the product.

The opinion of the Codex Alimentarius Commission of the United Nations & World Health Organisation is consistent with the requirements of EC legislation, namely that:

> *"Working surfaces that come into direct contact with food should be in sound condition, durable and easy to clean, maintain and disinfect. They should be*

> *made of smooth, non-absorbent materials, and inert to the food, to detergents and disinfectants under normal operating conditions."* [1]

Guidance specifically relating to unripened and ripened soft cheese states that:

> *"The use of material which cannot be adequately cleaned and disinfected, such as wood, should be avoided unless there are convincing technological justifications."* [2]

The Acceptability of Wood in several countries across Europe

Austria

The use of wood is permitted in two guidance documents for farmhouse cheese and dairy producers and for temporary alpine farming (Almwirtschaft).

• Leitlinie für eine gute Hygienepraxis und die Anwendung der Grundsätze des HACCP für bäuerliche Milchverarbeitungsbetriebe

https://www.verbrauchergesundheit.gv.at/lebensmittel/buch/hygieneleitlinien/LL_Milchverarbeitungsbetriebe_baeuerliche.pdf?6tdxj8

• Leitlinie für eine gute Hygienepraxis und die Anwendung der Grundsätze des HACCP bei der Milchverarbeitung auf Almen

https://www.verbrauchergesundheit.gv.at/lebensmittel/buch/hygieneleitlinien/LL_Milchverarbeitung_auf_Almen.pdf?6tdxj8

In farmhouse dairies ceilings, windows and doors made of wood can be accepted, while in temporary alpine dairies the floors and walls may also be made of wood. If wood is used the surfaces must be undamaged, smooth and clean; a self-monitoring plan should be established. The use of wood is permitted for equipment, working surfaces and transport containers if the food business operator can prove that the safety of the product is not impaired, or that safety is ensured by other measures.

Copper vats are suitable only for cheese making and not for storing or heating milk. The surface must be in good condition

France

In France, since 2012, there is a decree "*Arrêté du 7 November 2012 relatif aux règles sanitaires applicables aux produits laitiers présentant des caractéristiques traditionnelles*" obtained after many years of exchange between FNEC and the French sanitary administration.

In 2005, the decree ("*Arrêté du 30 décembre 1993 relatif aux conditions d'installation, d'équipement et de fonctionnement des centres de collecte ou de standardisation du lait et des établissements de traitement et de transformation du lait et des produits à base de lait*") was repealed in order to implement the Hygiene Package. The consequence of this abrogation was that the previous derogation was suppressed.

In 2005-2006, a survey of technicians from small scale dairies was conducted by FNEC and the Livestock Institute. Following this survey, several drafts of a proposed decree were sent to the French food agency for opinion in 2007. The opinion, published in 2008, stated that that the proposition of decree was too general. A second, more detailed document was sent in 2010 but the response of the French food agency was again negative.

In parallel, some member states granted a derogation for traditional materials such as that of the German administration in 2007. A third request was made to the national authorities by FNEC and other organisations in the dairy sector, giving examples of derogations in other European counties, including Germany, Italy, Spain and Poland. After considerable work, the decree was published in 2012. This authorises the use of traditional materials, as listed in an annex to the decree, for the fabrication or ripening of dairy products under quality labels, or farmhouse cheeses, and for materials, equipment, packaging and premises.

Germany

The use of natural-stone caves and stone-built cellars, wooden equipment, copper vats and fabrics made of natural fibres or plant materials are permitted for the manufacture, storage or packaging of traditional milk products in Annex 3 of the ordinance: Verordnung über Anforderungen an die Hygiene beim Herstellen, Behandeln und Inverkehrbringen von Lebensmitteln.

Ireland

The use of hardwood is permissible on a case by case basis for cheese shelving in ripening rooms.

Italy

There is not a specific legal basis for using wood in food production, but the use of wooden equipment is foreseen in:

- National legislation
  - INTESA STATO REGIONI CSR 4 - 25/01/2007
  - For producers of traditional foods, PDO or PGI or TSG (Reg. 1151/2012)
  - For producers of traditional food under national legislation (DM 350 -08/09/1999) for the Prodotti Agrozootecnici Tradizionali (PAT)
- Regional legislation
  - For those processing milk in Alpine regions during the summer season.
  - Six sets of regional legislation: Piemonte, Valle d'Aosta, Lombardia, Veneto, Friuli Venezia Giulia and Trentino Alto Adige.
  - The authorities are working on a document to harmonize these requirements at national level.

The use of wood is not forbidden and, it may be considered that if wood is used and cleaned in the correct way there is no need for a derogation. Cleaning procedures, and a scientific documentation of their efficacy, are not defined.

In South Tyrol, wood is often used as a cheese ripening surfaces in the cellars, both in alpine dairies and farmhouse cheese premises, as well as larger operations. This is currently permitted by the authorities, especially for ripened cheeses and traditional products.

Traditional materials are permitted in the processing of traditional products, such as “Almkäse” or “Almbutter” (Cheese and butter from the mountain dairies). The materials used include wooden work surfaces, cheese forms, butter moulds, or churns, and stones as weights for cheese pressing. The materials must be in hygienic condition and a good state of repair.

Norway

There is no special legislation about wood in food production equipment in Norway. The national guide describes the use of wooden shelves for cheese as well as churns, butter equipment and cheese moulds. In mountain summer farms registered for local sales, the use of wooden butter-making equipment and cheese moulds is widespread because of its traditional use.

In the past, some producers had issues satisfying the inspecting authority about the use of wooden shelving, however the practice is widely accepted now. This is also the case for approved businesses, as long as the producer refers to methods and routines specified in the national guide.

Guidelines for the food authorities have been published and may be translated into English as: *"Several businesses in Norway use wooden shelves in maturing rooms. In that case it is important that the microbiological flora in the environment is consistent with the flora of the cheese. The manufacturer must have a conscious relationship with choice of materials."*

Poland

For producers of traditional food, the Regulation of the Minister of Agriculture and Rural Development apply. All relevant EU legal acts were listed in the Regulation.

ROZPORZĄDZENIE MINISTRA ROLNICTWA I ROZWOJU WSI z dnia 27 lipca 2007 r. w sprawie ogólnych odstępstw od wymagań higienicznych w zakładach produkujących „żywność tradycyjną pochodzenia zwierzęcego”

If a producer cannot prove the traditional character of the product, the use of wood depends on the ability to prove that hygiene standards can be maintained, and on the interpretation of the relevant authority. Some businesses can receive permission while others cannot.

Spain

Two years ago, the Regional Governments granted specific derogations and reported them to the Spanish Food Safety Agency. As a result of work done by QueRed, there was an increase in the number of new petitions to each regional government, which made the situation complicated. The Spanish Food Safety Agency decided to review procedures to

better address these demands. QueRed has participated in the discussion to implement a new procedure and it is expected that the new one will be approved and operational shortly. The new procedure will focus on the question of whether the foodstuff is a traditional one, or not.

Switzerland

The use of wooden equipment is permitted in Switzerland.

The Hygiene Ordinance of the Federal Department of the Interior (**HyV,** December 16th, 2016) merely states in this regard:

Art. 13 Equipment
1 For equipment, such as vessels, instruments, utensils, as well as other objects and installations that come into contact with food, the following regulations apply:
a. Thorough and regular cleaning is mandatory as well as disinfection when necessary. This does not apply to disposable containers and packaging.
b. The construction, design and maintenance of the equipment must be executed in such a manner that the risk of contamination is minimized.
c. The installation of the equipment must allow for adequate cleaning of the equipment as well as its immediate environment.
d. Where necessary, the instruments used must possess appropriate testing devices.

Fromarte, the umbrella organization of Swiss cheese specialists**,** accounting for 1/3 of the total Swiss production of dairy products, dedicates an entire chapter of its Quality Management document to the use of wooden objects. Aspects of the suitability of wood for the preparation of food and the requirements for the use of wooden objects are considered:

- Handling wood in hygiene zones 1 and 2
- Hygiene Management
- Cleaning
- Disinfection
- Drying
- Luminescence from the sun
- Storage
- Earmarking
- Visual inspection of condition
- Actions to be taken in case of nonconformity
- Wood inventory

In the artisan milk processing industry, Swiss cheese ripens almost exclusively on wooden shelves. Fromarte writes: *"The storage of various types of hard and semi-hard cheeses still takes place on wooden constructions, since only wood can provide the moisture balance necessary for the formation of a healthy cheese rind. Ripening on or combined with wood is part of the product recipe according to the requirements of different AOP cheeses."*

Mountain dairies (transhumance, seasonal summer dairies)

The use of many different wooden objects was customary until 2001 at seasonal cheese dairies located on mountain pasture. Wooden containers for milk storage, cream ladles, strainers, beechwood moulds, cheese presses as well as butter barrels, butter churns and of course the cheese shelves.

In the last 20 years, wood has slowly but surely disappeared from the processing, partly due to a dwindling product selection offered by suppliers of cheese production materials and partly due to misleading advice from consultants. Many farmers and cheesemakers are under the false impression that the use of wooden material is prohibited during the processing.

The Directive of the Federal Department of the Interior on hygiene in handling food (Hygienic Ordinance EDI, HyV) of December 16, 2016 states in this respect:

Chapter 6: Special regulations on hygienic milk processing in summer dairies
Art. 60 Special demands on production spaces in summer dairy farms
The use of wooden material is permitted as long as it is in an immaculate condition.
Firewood may be stocked in the production room when timber is used for fuel
Art. 62 Equipment in summer dairy farms.
Wooden equipment is permitted as long as it is in an immaculate condition. After each use, it must be cleaned thoroughly using hot water of 85° C or more.

UK

In its guidance for Small and Low-Throughput establishments, the Food Standards Agency permits the use of wooden shelving for certain cheeses:

> *"Wood is generally not acceptable as a food contact surface as it is difficult to clean and disinfect and may shed splinters, but it may be acceptable for the storage and maturation of hard cheeses only on this surface, as long as the surface is well maintained …*
>
> *…Wood is generally not acceptable as a food contact surface as it is difficult to clean and disinfect and may shed splinters.*
> - *May be acceptable for cutting blocks and the maturation of traditional cheese as long as the surface is well maintained."* [3]

Wood Vs Plastic and Steel

Counts of inoculated bacteria have been shown to decrease more rapidly on cutting boards made of wood than of plastic[10]. Plastic has in some circumstances been used as an alternative to wood for cheese shelving. In humid environments, reduction in bacterial numbers during cleaning has been shown to take longer on plastics while scrubbing may abrade the surface, making it progressively harder to clean.[11, 34] The use of plastic shelving can also lead to rind defects in some instances due to moisture retention.

Pooling condensation allows the growth of spoilage bacteria, including *Pseudomonas* which grows in the condensate and readily forms biofilms that may support the survival of pathogens.[17] [15]. *Listeria monocytogenes* has been demonstrated on glass and stainless-steel surfaces while *Escherichia coli* and *Bacillus cereus* have been shown to grow on glass but not on dry, wooden crates.[28, 31]

The positive benefits of microbial biofilms have been described in several studies; however, the effect may be hard to quantify and dependent on many variables.

Listeria monocytogenes deposited on spruce shelves with a viable biofilm has been shown to remain stable or decline, whereas growth of 4 log cfu/cm^2 (i.e. a 10,000-fold increase, from 10^3 to 10^7 cfu/cm^2) was observed on shelves where the biofilm had been inactivated by heat-treatment. Shelves were brushed three times with cold water then air dried.[26]

Challenge testing of the washed-rind cheese Taleggio with *Listeria innocua* has shown that timing of contamination is significant in determining the outcome of contamination. Contamination of a single cheese at 2 weeks off age resulted in growth on the rind, with significant cross-contamination of other cheeses and of the wooden boxes used for ripening the cheeses, while a 4-week old cheese with higher counts of rind microflora showed less cross-contamination of other cheeses and equipment.[14] The growth of *Listeria* has been shown to be limited when introduced to a biofilm that has entered its stationary growth phase.[18] These papers highlight the risk of product contamination that may occur early in the ripening process and indicate the protective effects of a diverse microflora on the rind or shelf.

Alternative materials cannot be considered to have superior hygienic properties to wood and there may be a technological argument for the use of the latter material.

Wooden Shelves used in Cheese Ripening

Several papers deal directly with the issue of wooden shelving used in the production of traditional cheeses.

The water activity of wood has been reported to be in the region of 0.94 to 0.97 for spruce shelves used in the maturation of Reblochon.[25] Cleaning was shown to reduce water activity of the shelves to around 0.886, too low to allow the growth of *Listeria* but high enough to allow the growth of yeasts and moulds which often dominate the ripening microflora.[17, 20, 25 30]

Several authors have reported anti-microbial properties in wood with different species showing different properties. Pine and oak were shown to be inhibitory to *E. coli* and *Enterococcus faecium* while larch and pine have inhibited growth of *Staphylococcus aureus*.[21, 27] The anti-microbial properties of larch are reported to be strongly dependent on

the chosen piece of wood. Milling *et al.* showed that aqueous wood extracts inhibited *E. coli* and proposed that tannins may be responsible for the effect while Schönwälder *et al.* showed that anti-microbial properties of wood in relation to *E. coli* and *Enterococcus faecium* decreased in the following order: Pine, Larch, Spruce, Beech and Poplar. Decreases in bacterial numbers were greatest at high bacterial loads >10^6 cfu/cm^2, with wood and plastic behaving in a similar manner at lower inoculation rates. Anti-microbial characteristics of the wood may depend on the liquid absorption of the wood.[33]

Zangerl *et al.* reported that UV-sterilised spruce boards showed no anti-microbial properties when inoculated with ~4.4 x 10^5 cfu/cm^2 *L. monocytogenes*[34] however this would represent an exceptionally high level of product or environmental contamination and the authors identified a seven-log reduction during their experiment.

Guidance issued by the Nordic Council in 2010 advocates the use of hot water, with or without disinfectant, followed by 0.1% acetic acid spray and stresses the importance of drying the equipment after washing.[29]

Wooden Vats and Other Equipment

Wooden vats remain in use in several member states. Research into the use of wooden equipment used in the production, rather than ripening, of cheese has been carried out in respect of the beneficial biofilms formed on the wood and the absence of major pathogens.

The 'tina', a wooden vat made of Douglas fir and used in the production of Ragusano and Caciocavallo Palmeritano cheese, has been shown to be dominated by *Streptococcus thermophilus* with or without *Enterococcus faecalis* or *Lactobacillus delbrueckii*.[22, 32] Several studies were unable to isolate *Listeria*, *E. coli* O157 and *Salmonella* from the vat biofilm.[22, 23, 24, 32]

In studies using micro-filtered milk, the tina has been shown to shed sufficient lactic acid bacteria to acidify the milk to pH 4.5 within 8 hours at 37°C compared to no acidification in a control sample held at the same temperature for 18 hours.[23] Studies with unfiltered, raw milk showed that the tina has only a partial contribution to starter inoculation. The greatest increase in acidification rate was seen in milk samples with the lowest total bacterial counts (TBC), i.e. less than 10^4 cfu/ml.[22, 32]

The 'gerle' is a chestnut-vat used in the production of Salers cheese and is specified in the PDO rules. Use of the gerle is subject to producers passing a series of product-safety tests before authorisation. The preparation of the gerle involves filling with warm water to leach out tannins.[13, 16] Gerles are then sterilised with hot water and primed with whey from Salers production. After use, gerles are washed with sour whey or water only at up to 40°C. Cleaning chemicals are not used. Inoculation of pasteurised milk with LAB present in the gerle biofilm has been demonstrated, though after 7 days of using pasteurised milk without starter, Gram-negative bacteria started to grow, and it was concluded that raw milk may be important in maintaining control of the microbiological balance.[16]

Didienne *et al*. took 248 gerle surface samples from ten farms over a two-year period. *Salmonella* was not detected in any sample. *Listeria monocytogenes* was detected in one sample from farm G9, which also showed the highest levels of coagulase-positive staphylococci and some of the highest levels of coliforms. Practices on individual farms made significant contributions to the microflora. Samples were clustered according to the

range of microflora detected. High levels of *Lactococcus* and thermophilic bacteria and low levels of other bacteria, yeasts and moulds, was seen on all samples from a single farm which used a mesophilic starter culture each day and washed the gerle in water at 65^{o}C. The results at this farm showed the greatest consistency over a two-year period. High levels of *Lactobacillus*, *Lactococcus*, *Leuconostoc* and yeast but low levels of Gram-negative bacteria such as coliforms and *Pseudomonas* were seen on farms which washed the gerle with sour whey and sterilised it at the start of the season with 75^{o}C water. The highest levels of Gram-negative bacteria, yeast, moulds and *Lactococcus* were seen from farms which washed the gerle in 30^{o}C water and did not sterilise at the start of the season but did use commercial starter culture each day.

Other Traditional Materials

Authorisation Procedures

The characteristics of food premises and the equipment requirements are specifically described in Regulation (EC) No 852/2004, annex II, chapters I to V. In general, the use of impervious, non-absorbent, washable and non-toxic materials, as well as smooth surfaces, are required.

In the production of artisanal dairy products, materials and surfaces that don't meet these characteristics are often found; wood and cloth among others. It is possible the use of these traditional materials, within the scope of the hygiene package, specifically in compliance with Regulation (EC) No. 852/2004. However, these materials are widely used without being authorized as it should be, by the competent authority.

It is necessary to know the procedures to get these materials authorized, in order to use them in compliance with the hygiene regulations.

There are two different procedures to modify the content of Regulation (EC) No 852/2004, annex II, chapters I to V, to grant the use of traditional materials: by means of **adaptations** and by means of **derogations for foods with traditional characteristics**.

1. Adaptations

According to Regulation (EC) No 852/2004, article 13.3., Member States may, without compromising achievement of the objectives of this Regulation, adopt national measures adapting the requirements laid down in Annex II, with the aim of:

a) Enabling the continued use of traditional methods, at any of the stages of production, processing or distribution of food; or
b) Accommodating the needs of food businesses situated in regions that are subject to special geographical constraints.

In any other case, these national measures shall apply only to the construction, layout and equipment of establishments.

When traditional methods of production are applied, it is possible to ask for adaptations of Annex II in order to go on using traditional materials.

Following the principle of transparency, Member States wishing to adopt national measures shall notify the Commission and the other Member States, describing the requirements to be adapted, the foodstuffs and the establishments concerned, and the reason for the adaptation. The Commission and the other Member States have a three months period to send comments. National measures may be adopted by Member States only if consensus is reached.

This is a long, complicated procedure, generally by means of a national law, when it's necessary to apply some measures at the national level for a specific food sector or food commodity.

2. Derogations for foods with traditional characteristics

According to Regulation (EC) No 2074/2005, article 7.2.b., when producing food with traditional characteristics, the type of materials of which the instruments and the equipment for the preparation, packaging and wrapping of these products are made, don't have to be smooth, impervious, washable and/or corrosion-resistant. In any case, this equipment shall be maintained at all times in a satisfactory state of hygiene and regularly cleaned and disinfected.

Bear in mind that for the purpose of this Regulation (see article 7.1), foods with traditional characteristics means foods that, in the Member State in which they are traditionally manufactured, are:

a) Recognised historically as traditional products, or
b) Manufactured according to codified or registered technical references to the traditional process, or according to traditional production methods, or
c) Protected as traditional food products by a Community, National, Regional or Local law (PDO, PGI, TSG)

A simplified notification procedure (simple information) is laid down for foods with traditional characteristics. In this case Member States must no later than 12 months after granting individual or general derogations, notify the Commission and the other Member States any derogation granted, with a description of the requirements adapted and the foodstuffs and establishments concerned. Neither a standstill period nor comments from other Member States and the Commission are applicable.

This simplified procedure is faster and easier to ask for and to grant. Any traditional material intended to be used in the elaboration of dairy products with traditional characteristics, shall be authorized by the competent authority and notified to the Commission and the other Member States, within 12 months after being granted.

No national law is needed and the authorisation can include a specific food sector or food commodity, a traditional material to be used in some establishments, or even a specific establishment.

Having in mind that farmhouse and artisan cheeses and dairy products are made according to traditional production methods (article 7.1.b, see above), and that traditional materials are widely used in almost every cheese dairy, it's highly recommended to apply for collective

derogations (for all the national farmhouse and artisan) and to include all the traditional materials generally found in farmhouse and artisan cheese dairies.

Conclusion

This literature survey has shown that the use of plastic or metal surfaces as an alternative to wood should not be considered as unquestionably superior. If properly cleaned and maintained, wooden shelving and other equipment is no worse from a hygienic perspective than other materials such as plastic. Indeed, in some circumstances they may offer superior hygienic and technological properties.

Wood is often selected as a material for ripening cheese as it can help to buffer changes in atmospheric humidity, preventing excessive rind moisture, but also helping to avoid the drying and cracking of the rind. This serves both an aesthetic function but has implications for food safety as a wet or cracked rind can make the cheese more vulnerable to contamination.

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