FOOD SAFETY SUPPORT

Alberta Agriculture and RURAL DEVELOPMENT has a team of food safety specialists available to assist you to assess and improve your food safety programs.

www.agriculture.alberta.ca/aha

Contact 780-427-4054
or toll free 310-0000.

Improving food safety programs is a good business decision as doing so can:

- enhance food safety, quality and consumer confidence;
- reduce waste and recalls; and
- open doors to additional markets.

Alberta

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- Temperature Control

Rapid chilling of meat helps prevent spoilage. It is important to completely chill the carcass before curing because warm meat may start to spoil before nitrite and salt penetrates to the centre of the cut. The temperature of the meat during curing and the temperature of the brine should also be closely monitored and kept between 0° and 4°C. Do not mix cure with warm / hot water, this will lead to nitric oxide formation that will be quickly released to air.

- Time

It is important to allow adequate time for the curing solution to thoroughly penetrate the meat. The amount of time required will depend upon the curing mix and methods you are using.

- Cure Handling

- Since small quantities are difficult to weigh out on most available scales, it is strongly recommended that a commercial premixed cure be used. Nitrite is diluted with salt so that the small quantities, which must be added, can more easily be weighed. This reduces the possibility of serious error in handling pure nitrate or nitrite.
- If you use a spice premix, it is recommended that the spice supplier design the premix to match your standard batch.
- If the standard batch is halved or quartered, depending on the plant's requirement, weigh the spice premix and the cure separately. Do not mix the cure with the premix before using them, as the nitrite in the cure can react with sodium erythorbate and become less effective.

- Brine formulation

- To get an accurate formulation measure water by weight and use a regularly calibrated scale to measure the cure.
- Phosphates are known to have low water solubility. Whenever possible, fully dissolve the phosphate before adding the cure. If properly dissolved, the brine should be clear before adding the salt.
- Immersion brines should not be reused.
- Prepare fresh brine daily, do not keep it overnight. The cure will start immediately working in the water; therefore less nitrite will be available and it will have a less desirable effect in the meat.

- Brine Injection

Stitch or inject the brine into meat product using a weigh scale until percentage weight is gained. For example, if a meat item weighs 1 kg and your target percentage gain is 15%, the injected item should weigh no more than 1.15 kg.

- Tumbling

The most recent development in curing is "tumbling" or massaging in rotating drums. This process has a big role in evenly distributing the cure in the meat product and draws out from meat the salt soluble proteins to the meat surface and increases the overall water holding capacity.

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FOOD SAFETY SENTINEL

March 2008

IN THIS ISSUE

CURE ME!

What is "Curing"?

Curing is the treatment of meat with nitrite in combination with salt and other curing aids. Curing is done to improve color, texture and flavour and to prevent or delay microbial growth.

The origin of the word "cured" is unknown. We do know that, hundreds of years ago, meat products were treated with salt to preserve them. This process was usually combined with drying and/or smoking. Salt addition and drying inhibited spoilage by reducing the amount of water available for bacteria to grow. Smoking inhibited spoilage by creating anti–bacterial substances on the surface of meat.

Early sausage makers discovered that using certain salts produced a distinct color and flavour. These salts contained an impurity called potassium nitrate, also known as saltpeter. In the late 1800s, scientists began to understand the function of saltpeter in meat curing. It was determined that the nitrate in saltpeter changed to nitrite and that the reddish-pink color of cured meat was due to nitrite and not nitrate. These and other discoveries led to the use of nitrite as a meat-curing ingredient.

Curing Ingredients: Facts and Issues

The two main ingredients that must be used to cure meat are salt and nitrite. Other substances can be added to speed up the curing process, stabilize the colour, modify the flavour and reduce shrinkage during processing. There are five main factors that the meat industry is concerned with when it comes to cured meat: preservation, flavour, colour, tenderness and yield. The substances used in curing affect each of these factors.

Nitrites and nitrates

Nitrite is one of the most widely used food additive and has multifunctional properties:

- Gives the meat the characteristic pink or red color;
- Imparts the characteristic flavour of cured meat products;
- Prevents bacterial growth;
- Prevents the development of rancidity, which leads to an extended shelf life.

Sodium nitrite is most commonly used for curing. Another nitrite salt used in curing is potassium nitrite.

Sodium nitrate is mostly used in products that require long ageing periods, such as country ham. We now know that only nitrite is responsible for the red meat color and, furthermore, that nitrate is reduced to nitrite by microorganisms.

Historically, nitrite was used in toxic amounts, prompting governments to establish legal limits for use. In the European Union, for example, the use of nitrite is permitted only in non-heated products at a maximum level of 150 ppm (parts per million), equal to 15 g nitrite per 100 kg of raw meat product.

The legal limits for nitrite use in Canada are: 200 ppm in most cured products (e.g ham, sausages) and 120 ppm in bacon, calculated in raw formulated products.

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WHAT ARE THE MAIN HAZARDS ASSOCIATED WITH MEAT CURING?

Pathogenic bacteria growth due to insufficient nitrite

Meat products such as sausages, salamis and pepperoni have the potential to harbour an anaerobic (no air) environment, especially if the product is very thick. If nitrate/nitrite salts are not added in the correct level and mixed evenly throughout the product, *Clostridium* spp*. bacteria can grow. The toxins from these bacteria pose a serious food safety hazard and nitrite is the substance that will prevent their growth. Even though there is no regulatory minimum nitrite level for cured products, it has been proven that meat product requires at least 100 ppm nitrite to control *Clostridium botulinum*. (*species)

Excess nitrite leading to toxic compounds formation

Adding too much nitrite will cause nitrosamines to form when the product is heated. This is a significant concern, as large amounts of nitrosamines are known to be cancer-causing agents. Too much cure will also result in a very salty and bad-tasting product. It is important to follow recipes carefully, ensuring that exact amounts are used and that the curing blend is thoroughly mixed. Premixed curing formulations can help prevent problems that can occur when the wrong amount of nitrate or nitrite is added to the mix.

Hard particles in the product

Broken injection needles, chips from silent cutter blades or particles in dry cure ingredients can pose a hazard. This can be prevented by good maintenance of equipment, visual inspection of injection needles and dry ingredients before use and filter injection of brines. During curing, meat should be held in a non-corrosive vat.

Nitrosamines

Under certain conditions, the natural breakdown products of proteins known as amines can combine with nitrites to form compounds known as nitrosamines. There are many different types of nitrosamines, most of which are known to be carcinogens.

Not all cured meat products contain nitrosamines. It has been shown that bacon, when cooked by frying, contained considerable amounts of nitrosamines. The high levels of heat that occur during cooking in a frying pan allow a greater amount of nitrosamine formation. Nitrosamines may be found in other cured foods such as grilled or fried cured sausage and pizza toppings, but they usually occur in very small amounts.

Many factors influence nitrosamine levels:

- amount of nitrite added during processing,
- concentrations of amines in meat,
- type and amounts of other ingredients used in processing,
- storage time and temperatures,
- method of cooking, and
- degree of doneness.

To minimize the risk of nitrosamine formation in fried bacon, the amount of nitrite that was initially used to cure bacon has been reduced. In Canada, bacon is limited to 120 ppm nitrite. In the United States, it is required to add ascorbic acid (vitamin C) or erythorbic acid to bacon cure; as doing so, the formation of nitrosamines is reduced.

Salt

In the curing process, salt creates flavour, has a preservative effect and acts as a protein extractor. Salt helps to increase the binding ability due to its water-retaining properties. In Canada, there are no restrictions on salt use.

Sweeteners

There are a variety of sweeteners that a processor may use: white sugar (cane, beet or table sugars), brown sugar, dextrose, corn syrup, corn syrup solids, fructose and honey. Care must be taken if using honey. Ensure that only pasteurized honey is used (as non–pasteurized honey can cause microbial problems).

Sweeteners add flavour and counteract the harshness of salt. In some cases, they can also affect the surface colour of the cured meat, (for example, caramelized sugar used on ham.)

Cure Accelerators

Sodium ascorbate (the salt out of Vitamin C) and sodium erythrobate are mainly used for color retention in fresh and cured products. They are highly recommended to use to speed up curing process and block nitrosamine formation.

Phosphates

Phosphates increase the water-holding capacity of cured products. Increasing the water-holding capacity also increases the yield of the product and improves retention of the brine. They also provide an antioxidant effect.

In Canada, all phosphates are allowed at the maximum of 5000 ppm in the raw formulated product.

Binders and Fillers

Binders are substances that not only pick up the water, but also function, by physically binding a portion of that water, to stabilize the emulsion and improve cook yields. Fillers are added primarily for water pick up and "fill" space in the formula.

Types of binders and fillers:

- Wheat flour, modified wheat flour, toasted wheat crumbs, cracker meal
- Modified milk ingredients such as whey powder, sodium caseinate or milk proteins
- Soy proteins in various forms such as soy flour, soy protein concentrate or isolated soy proteins
- Hydrolyzed plant protein and hydrolyzed vegetable protein
- Gelatin acts as a binder for certain meat food products

Some of these binders (wheat, milk and soy products) are known allergens. To avoid cross contamination, measures should be taken when making products containing allergenic ingredients:

- separate production of allergen-containing products through proper scheduling (produce allegen-containing products last to avoid a full-cleaning between product runs);
- full cleaning should be performed between products using different allergens;
- rework that contains allergens should only be used in products containing the same allergens;

Flavour Enhancers

Monosodium glutamate (MSG), hydrolyzed proteins, yeast extracts, spices and other flavour enhancers may also be added to improve the flavour of the finished product.

Water

Water is a carrier for other ingredients and can be used to improve the juiciness and yield of the finished product.

Curing Methods

Whole Muscle Curing

- Dry Curing

Dry curing is the oldest method of cure application and involves rubbing curing ingredients onto the surface of meat. It is frequently used in the production of salt pork and jerky. A key advantage of this processing method is that it can be done under wider temperature variances and will have less spoilage problems under unfavourable curing conditions than other methods.

- Liquid Curing

Liquid curing involves a curing solution called brine or pickle. There are four methods that can be used in the liquid curing of whole muscle meat products:

- Osmosis is the most basic method of liquid curing. The meat is immersed in brine solution. The definition of osmosis is the diffusion of a fluid (in this case brine) through a membrane, in this case the wall of a living cell. Immersion curing is slow, it happens at a rate of two and a half centimetres (one inch) per day at cooler temperature, but it has the advantage of resulting in less shrinkage.
- Stitching is the injection of brine into the meat with a use of a multiple or single orifice needles. The curing process is accelerated in a more efficient manner and controls the amount of brine a product should absorb.
- Artery Pump is the most efficient method that distributes brine uniformly. It can only be used in a bone-in ham. The arterial system, through which the blood was carried, is used as a pipeline for the brine. Brine travels through the arteries to the remote capillaries and no part of the product is missed.
- Machine Pump is when a multiple needle, spring-loaded piece of equipment is used to pump brine into meat items. It allows for injecting precise quantity of brine.

Meat Emulsion Curing

Meat emulsion is a finely chopped batter composed of lean meat and water in which small particles of fat are held in suspension by a protein matrix. The most common type of emulsion type meat product is sausage. The cure is directly added to the batter. The primary cured sausage types are cooked and fermented sausages.

Best Practices

Successful curing relies on many factors. Accurate recipes, proper meat handling, good sanitation and high-quality ingredients will ensure that the finished product is safe. The suggestions on the back page are some ways to ensure that the product that you make is the highest quality possible: