STEP 2 – PROPER INCUBATION (CONVERSION OF NITRATE TO NITRITE)

- Incubation step at the beginning of the traditional cooking cycle is required for the starter culture to convert the nitrate in the vegetable juice source to the active nitrite.
- The time-temperature relationship is crucial - We want to be able to convert as much of the nitrate to nitrite as possible.
  - Starter cultures are temperature dependant and should be held at the optimum temperature for their activity.
  - The time factor depends on the product diameter - Smaller diameter products such as frankfurters require more incubation time (2 hours) than larger diameter products like ham (1 hour or less).

STEP 3 – COOKING REQUIREMENTS

- Only difference from traditional cooking cycles is the addition of the incubation step at the beginning of the cycle.
- We want to keep the temperature during the incubation step in the range where the starter culture likes to grow (typically 90-100°F; There are some combination cultures that can be activated at lower temperatures)

Direct addition of a pre-converted vegetable juice powders and/or juices

The commercially available pre-converted vegetable juices and powders are standardized up to 10,000 ppm nitrite. This curing system is typically easier for processor as it does not require the addition of a lactic acid starter culture as the naturally occurring nitrate from the vegetable source already been converted to the active nitrite. Therefore, this curing system does not require the addition of an incubation step at the front-end of the cooking cycle.

PROCESSING CHALLENGES [6]

Starter cultures are not water soluble. Therefore, if you are processing a whole muscle product utilizing the curing system that requires the addition of a lactic acid starter culture these products must be injected. Tumbling or immersion curing alone will not provide sufficient distribution of the starter culture. Quality of natural and organic product is very dependent upon how much residual nitrite is in the product. A product that is going to offer good antioxidant protection needs to have around 50 ppm nitrite. In order to maintain cured color the product needs to contain 40-50 ppm nitrite.

REFERENCES

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Natural and Organic Meat Processing Guide

INDUSTRY TRENDS [1,2]

Over the past 10-15 years the food industry has seen a push from consumers for products that are more "label friendly" or minimally processed. Often times this means developing products with as few added ingredients as possible. However, one of the biggest challenges to meat processors is the fact that the consumer still desires the same taste and appearance in these minimally processed products that conventional products possess. Therefore, in order for processors to meet consumer demands, they must create minimally processed products without sacrificing the taste and appearance of the product.

Consumers are also demanding more natural and organic food products. According to Mintel's Global New Products Database 23% of new food and beverage launches in 2009 featured "natural" on the label. In fact, "natural" was the #1 new product claim in 2009. In addition, the Healthy Eating Report for 2008 (The Nielson Company, NY) reported that food labeled as "natural" accounted for $22.3 billion in sales in 2008.

SODIUM NITRATE/NITRITE [3]

Traditionally, cured meat products are produced with the addition of nitrate and/or nitrite in order to give the final product the typical cured meat characteristics. Nitrate is the inactive compound, while nitrite is the active compound. If the inactive form nitrate is utilized it must to be converted to the active nitrite. Nitrite in cured meat products is the main constituent of many chemical reactions that occur throughout processing and this ingredient plays a very important, functional role in processed meat products.

Functionality of nitrite in cured meat systems:

- Gives cured meat products a characteristic cured pink color
- Gives cured meat products a characteristic cured meat flavor
- Preservative – prevents the growth of Clostridium botulinum
- Antioxidant – controls the oxidation of fat

Unfortunately, nitrite is often conceived as negative in the minds of consumers and products labeled as natural or organic cannot contain any added nitrite. In order to create a more label friendly product (i.e. natural, and/or organic) that is still palatable and appealing for consumers we must replace the added nitrite with a more label friendly ingredient. Vegetables are a great source of the inactive form nitrate. There are a number of commercially available vegetable juices and vegetable powders that may be used as ingredients in natural and organic food products. However, it is important to point out that vegetable sources contain the inactive nitrate and in order to perform as they should in a processed meat system this nitrate must be converted to nitrite. Curing systems that can be utilized by processors to convert the vegetable juice or powder source of nitrate to nitrite will be discussed in a proceeding section of this document.

INDUSTRY TRENDS AND LABELING OPPORTUNITIES [3, 4, 5]

Natural

Processed meats labeled as natural must comply with the definition of natural in the United States Department of Agriculture Food Standards and Labeling Policy Book (USDA, 2005). The natural labeling claim of a meat product does not address the meat portion of the product, but rather addresses the non-meat ingredients that are added and the processing that is applied. The USDA Food Standards and Labeling Policy Book states that a natural product can not contain "any artificial flavor or flavoring, coloring ingredient, or chemical preservative, or any other artificial or synthetic ingredient; and the product and its ingredients are not more than minimally processed."

- *Minimally processed may include: smoking, roasting, freezing, drying, fermenting, and grinding.*

In addition, a list of permitted and prohibited ingredients in meat products labeled as natural can be found in the Code of Federal Regulations (CFR; 21 CFR 101.22).

Organic

Organic products must adhere to a much more defined set of regulations through the National Organic Program which is administered by the Agricultural Marketing Service branch of USDA. Through this program a national list of approved and unapproved substances for use in organic products has been developed. This list can be found in 7 CFR 205.605 (Nonagricultural substances) and 7 CFR 205.606 (Agricultural substances). Meat labeled as organic must be raised using organic management and come from a certified farm.

There are four different ways in which organic products can be labeled:

- ***"100 percent Organic"*** – Product must contain 100 percent organically produced ingredients, not counting added water and salt.
- ***"Organic"*** – Product must contain at least 95% organic ingredients, not counting added water and salt.
- ***"Made with Organic Ingredients"*** – Product must contain at least 70% organic ingredients, not counting added water and salt.
- ***Less than 70% Organic*** – Products with less than 70% organic ingredients; are not allowed to be labeled as organic and are only permitted to list those ingredients that are organic on the information/ ingredient panel of the product.

It is important to note that only those products labeled as "100 % organic" or "Organic" may use the USDA organic seal

Uncured

There is also another product labeling option than can be utilized and that is simply "uncured". These products do not contain any added nitrate or nitrite (natural nor synthetic). Any meat product that is normally cured (bacon, frankfurters, ham, etc.) can be manufactured without nitrates or nitrites. The definition and required labeling modifications of uncured meat products can be found in 9 CFR 317.17 and 9 CFR 319.2. These regulations state that the word "uncured" must appear before the common product name (i.e. Uncured Bacon). Further, the statements: "No nitrate or nitrites added" and "Not Preserved - Keep refrigerated below 40°F at all times" must also appear on the product label. That said there are a few product processing parameters (pH ≤4.6 or water activity ≤0.92) that if met the product does not require the "Not Preserved - Keep refrigerated below 40°F at all times" statement.

NATURAL CURING SYSTEMS [3, 6]

Vegetables offer an abundant source of nitrate and there are several commercially available vegetable juices and powders. Most of the vegetable juice powders and juices used in the natural curing of meat products are derived from celery because of the subtle flavor of celery and the minimal color affect on the product. These commercially available juices and powders may be listed as "(vegetable name; i.e. celery) powder", "flavoring", or "natural flavoring" on meat product labels. The majority of meat processors making a naturally cured product utilize one of two systems:

Direct addition of vegetable juice powders and/or juices

- Commercially available juices and powders are standardized up to 30,000 ppm **nitrate**.
- Requires the addition of a lactic acid starter culture. The lactic acid starter culture is needed to convert the inactive ingredient nitrate to the active ingredient nitrite.

STEP 1 – ADDITION OF NATURALLY OCCURRING NITRATE SOURCE

- Add vegetable juice powder **0.2-0.4%**
  *Maximize Levels - if you are making a more heavily spiced product use closer towards 0.4% as the spices will mask any undesirable vegetable flavors or aromas that might develop).
- Add starter culture – per manufacturer's recommendations