

Nitrates/Nitrites in meat products

Nitrates and nitrites are used widely in the meat industry to cure. They are usually mixed with meat binders and cure ingredients and are added to dry sausages, semi-dry sausages, preserved meat and preserved meat byproducts such as ham and salami. They can be added in the form of sodium and potassium salts (ex: sodium nitrate, sodium nitrite, potassium nitrate and potassium nitrite).

Use

Nitrates and nitrites are used to:

- control the growth of spores
- provide cured meat flavor and colour
- extend the shelf life of meat products

Control the growth of spores

Nitrates/nitrites control the growth of spores, particularly from *Clostridium botulinum*. These spores are a real concern in the food industry, because they can survive normal heat processing. Under the right conditions, they can produce vegetative cells, which can create a lethal toxin.

Influence on colour

Nitrites cause a colour reaction in the meat and add an appealing pink colour to cooked products. Meat products without nitrates/nitrites are brown or gray coloured.

Nitrates undergo a chemical reaction and are converted to nitrites. Then, nitrites react with the protein of the meat (myoglobin), and are converted to nitrosomyoglobin (bright red). When cooked, nitrosomyoglobin is converted to nitrosohemochrome (pink pigment). This bright pink colour is normally associated with cured meat such as wieners, bologna and ham.

Why are nitrates/nitrites restricted in Canada?

The use of nitrates or nitrites is restricted because high levels can be hazardous to humans. Excess nitrates can react with aminoacids in proteins during processing and form carcinogenic nitrosamines. Processors should have their systems checked during formulation to ensure the right levels are used.

How much nitrate/nitrite can be used?

Health Canada has identified maximum nitrites/nitrate levels in the Food and Drug Regulation, Division 16, Table XI (Table 1). These levels are well above those needed to stop the growth *Clostridium botulinum* spores.

Table 1. Maximum level of use for nitrites/nitrates

Meat product	Maximum level of use ¹	
	Ounces per 100 pound	Parts per million ²
Cured meat and meat by-products ³ (except bacon)	0.32	200
Side bacon	0.19	100

¹ levels are calculated before smoking, cooking or fermentation

²parts per million (ppm) = mg/kg or mg/l

³including cured hams, loins and shoulder, poultry products

How to comply with the regulations

To comply with the regulations regarding the nitrate/nitrite levels in your products, you need to know the precise concentration of nitrates/nitrites in your recipes. Your supplier should be able to tell you what they are in your cure mix or meat binder. Use this information to calculate the amount of nitrates/nitrites in your formulation, based on your recipe.

For example, if your cure mix contains five per cent of nitrates and you use 36 grams in 10 kilograms of product, your product would have 179 parts per million.

Calculations:

The amount of nitrates you are adding is $0.05 \times 36 \text{ grams} = 1.8 \text{ grams}$

The product weight is 10.036 kilograms

There are 1,000 grams in a kilogram, so 36 grams = 0.036 kilograms.

$0.036 \text{ kilograms} + 10 \text{ kilograms} = 10.036 \text{ kilograms of product}$

So, you will have 1.8 grams of nitrates in 10.036 kilograms of product.

To convert to parts per million (milligrams/kilograms)

There are 1,000 milligrams in a gram, so 1.8 grams = 1800 milligrams.

$1,800 \text{ milligrams} / 10.036 \text{ kilograms} = 179.4 \text{ milligrams/kilograms (parts per million)}$

NOTE: milligrams/kilograms can be expressed as parts per million, because one thousand milligrams = a kilogram.

You can also test your raw products for the total concentration of nitrates/nitrites at an external laboratory. To comply with the regulations, the sum of nitrates and nitrites should not exceed the maximum level (Table 1).

Related Links

Curing - Chapter 4 – Annex A Meat Hygiene Manual of Procedures

www.inspection.gc.ca/english/anima/meavia/mmopmmhv/chap4/annexae.shtml

Nitrate/nitrite Testing – Chapter 5 - Meat Hygiene Manual of Procedures

www.inspection.gc.ca/english/anima/meavia/mmopmmhv/chap5/5-4e.shtml#5.6.2

Nitrite in Meat – University of Minnesota

www.extension.umn.edu/distribution/nutrition/DJ0974.html

References

Hyytia, E., Eerola, S., Hielm, S., Korkeala, H., 1997. Sodium nitrite and potassium nitrate in control of nonproteolytic *Clostridium botulinum* outgrowth and toxigenesis in vacuum-packed cold-smoked rainbow trout. *International Journal of Food Microbiology* 37: 63-72.

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