Practical Use of Nitrite and Basis for Dosage in the Manufacture of Meat Products - DTU Orbit (03/11/2019)

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The use of nitrite (NaNO₂) in the manufacture of salted (cured) meat products has a long tradition in the industry, dating back to the early twentieth century. Nitrite serves several technological purposes, primarily by the formation of a stable red colour in the meat and the inhibition of the growth of Clostridium botulinum. According to an assessment report by the European Food Safety Authority (The EFSA Journal, 14, p. 1-134, 2003) all evidence points to that it is the added amount of nitrite rather than the residual amount of nitrite in the product which exerts the antimicrobial effect. Nitrite also has a desirable anti-oxidant activity and contributes to the formation of pleasant flavours.

A systematic literature review on the function and use of nitrite in meat leads to a tentative first conclusion that if the level of nitrite added to meat products is sufficient to protect against possible toxin formation from C. botulinum, then the other technological reasons for using nitrite can be accomplished within the range of 50-100 mg/kg added nitrite, as is recommended by European Food Safety Authority (EFSA), see the reference above. A similar conclusion was earlier reached after a large number of experiments were conducted in Denmark in collaboration with the Danish meat manufacturing industry in 1981-1983. Wiltshire bacon and certain canned products largely for export were not investigated in this study, however.

The adverse effects of nitrite can mainly be ascribed to the risk of forming nitrosamines from secondary amines and nitrite when curing meat products, in particular when they are heated to high temperatures, typically during frying. This issue is well described in the literature and is not pursued further, as it is not part of the assignment for the report.

In the present report the existing EU legislation on the use of nitrite is reviewed and critically compared with Danish legislation. For heat sterilised products the EU limit of 100 mg/kg on added nitrite is identical to the level specified in Danish legislation. This is the only group of products where there is complete agreement between EU and Danish legislation with respect to the use of nitrite in meat.

For bacon the EU limit of 175 mg/kg on residual nitrite is obviously higher than the DK limit of 150 mg/kg on added nitrite. The issue of limits for nitrite in bacon is important, because bacon is usually fried and is therefore a product prone to expose consumers to nitrosamines.

For cured, raw ham (“spegeskinker”) the EU limit for Rohschinken of 50 mg/kg on residual nitrite may be comparable to the DK limit of 150 mg/kg on added nitrite, considering that most of the added nitrite is decomposed during the curing process. However, a strictly quantitative conversion from added to residual amount of nitrite is not possible.

For raw fermented sausages, the EU limit of 180 mg/kg on added nitrite for a number of specified Central European sausages is obviously higher than the DK limit of 100 mg/kg on added nitrite for fermented sausages. Arguments for maintaining this high level are lacking in the available literature, and on the basis of what can be deduced with respect to the manufacturing processes for these products, it is hard to conceive of substantial arguments for the high level of 180 mg/kg.

For other heat-treated, but not sterilised meat products, the EU limit of 50 mg/kg on residual nitrite in the British speciality, jellied veal and brisket, is roughly comparable with a range of Danish products, where Danish legislation specifies from 60 to 150 mg/kg added nitrite. Denmark has specifically exempted the addition of nitrite in liver paste and meat balls, thus specifying a limit of 0 mg/kg for these particular, common products in Danish cuisine.

A major reason for the discrepancies between the EU and DK legislation is that Directive 2006/52/EC in many cases specifies residual amounts, while Denmark specifies added amounts of nitrite. Denmark’s position is in accordance with the recommendations by EFSA. However, it should be adduced that assessments of the added amount of nitrite are difficult to state for certain traditional curing processes, such as dry cured hams and traditional immersion curing of whole meat in a vat. The particularities of the production methods make such a quantification rather uncertain. Furthermore, some dry cured products from South Europe are made with nitrate, which slowly and only partly is converted to nitrite and further to NO during the curing process. The Danish limitations on the use of nitrate are identical to those of Directive 2006/52/EC.

In conclusion, most of the Danish product categories comply with EFSA’s recommended ingoing (added) nitrite level of 50-100 mg/kg. However, there is an issue regarding bacon and some unspecified products where Danish legislation allows 150 mg/kg. With regard to in particular dry cured products there is also an issue on how to specify limits on the use of nitrite in a meaningful way.

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