Levels of Pesticides in Food and Food Safety Aspects

Surveillance for pesticides residues in food is performed in many countries worldwide to ensure, that consumers are not exposed to unacceptable levels of pesticides and that only pesticides approved by the authority are used and for the right applications with respect to crop, application dose, time and intervals. Foods are permitted as long as they comply with the maximum residue levels (MRLs) set by the authorities. Another purpose of monitoring pesticide residues in food can be to assess the food safety risk due to the population’s dietary exposure to pesticides. This chapter deals with monitoring of pesticide residues in food in general and shows examples of monitoring results in fruit, vegetables, cereals, food of animal origin, and processed food such as drink, infant and baby food. In addition, it describes how consumer exposures based on dietary intake estimates can be performed as part of risk assessments and examples of such exposure assessment studies are given.

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Contributors: Granby, K., Petersen, A., Herrmann, S. S., Poulsen, M. E.
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Hay for livestock feeding – Method validation

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Organisations: National Food Institute, Research group for Analytical Food Chemistry
Contributors: Herrmann, S. S., Poulsen, M. E.
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Levels of perchlorate and chlorate in foods available in Denmark

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Pesticidrester i fødevarer 2017 - Resultater fra den danske pesticidkontrol

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Organisations: Division of Risk Assessment and Nutrition , National Food Institute, Research group for Analytical Food Chemistry, Fødevarestyrelsen
Contributors: Jensen, B. H., Petersen, P. B., Herrmann, S. S., Hilbert, G., Sørensen, N. N., Grossmann, A., Christiansen, M.
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Clean-up of oat extracts for pesticide residues analysis by dSPE with PSA, C18, Z-sep or EMR-lipid, individually and combinations

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Organisations: National Food Institute, Research group for Analytical Food Chemistry
Contributors: Herrmann, S. S., Poulsen, M. E.
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Electronic versions:
2017_RAFA_cereal_clean_up_poster_sher.pdf
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Source-ID: 144700018
Research output: Research - peer-review › Poster – Annual report year: 2018

Effects of milling on the extraction efficiency of incurred pesticides in cereals
This study investigated the effects of particle size and milling temperature on the extraction efficiencies of pesticide residues from cereal flour. Samples of cereal grains (barley, oat, rye and wheat) were milled using a centrifugal mill with four different sieves (0.2, 1.0, 3.0 and 5.0 mm) or a knife mill both at room temperature and after freezing of the grain at −80°C overnight. The incurred pesticides in the test materials were extracted by the QuEChERS method and analysed by LC-MS/MS and GC-MS/MS. The particle size distribution for the milled samples was determined using a vibratory sieve shaker. Based on the pesticide levels recovered from each of the different millings and the corresponding particle size distributions, it was confirmed that smaller average particle sizes increase the extraction efficiency up to 31%, with all
other factors equal. The cereals milled at room temperature produced lower pesticide extraction efficiencies compared with cereals milled when still frozen, especially for heat-sensitive pesticides. Furthermore, milling frozen grains was easier and resulted in more homogeneous samples with smaller relative particle sizes.

**General information**
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Organisations: National Food Institute, Research group for Analytical Food Chemistry
Contributors: Herrmann, S. S., Hajeb, P., Andersen, G., Poulsen, M. E.
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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.29 SJR 0.74 SNIP 0.894
Web of Science (2017): Impact factor 2.129
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.12 SJR 0.796 SNIP 0.95
Web of Science (2016): Impact factor 2.047
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.11 SJR 0.778 SNIP 0.878
Web of Science (2015): Impact factor 1.878
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.07 SJR 0.764 SNIP 0.978
Web of Science (2014): Impact factor 1.802
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.55 SJR 1.041 SNIP 1.168
Web of Science (2013): Impact factor 2.341
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 2.12 SJR 0.906 SNIP 1.123
Web of Science (2012): Impact factor 2.22
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 2.06 SJR 0.912 SNIP 1.099
Web of Science (2011): Impact factor 1.765
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.816 SNIP 1.029
Web of Science (2010): Impact factor 2.23
Web of Science (2010): Indexed yes
Scopus rating (2009): SJR 0.754 SNIP 1.228
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Contributors: Jensen, B. H., Petersen, P. B., Andersen, J. H., Herrmann, S. S., Grossmann, A., Hilbert, G., Christiansen, M.
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Publication date: 2017

Publication information
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Electronic versions:
Pesticidrapport_2016_Final.pdf
Research output: Commissioned Final › Report – Annual report year: 2017

Role of Sample Processing Strategies at the European Union National Reference Laboratories (NRLs) Concerning the Analysis of Pesticide Residues

The guidance document SANTE 11945/2015 recommends that cereal samples be milled to a particle size preferably smaller than 1.0 mm and that extensive heating of the samples should be avoided. The aim of the present study was therefore to investigate the differences in milling procedures, obtained particle size distributions, and the resulting pesticide residue recovery when cereal samples were milled at the European Union National Reference Laboratories (NRLs) with their routine milling procedures. A total of 23 NRLs participated in the study. The oat and rye samples milled by each NRL were sent to the European Union Reference Laboratory on Cereals and Feedingstuff (EURL) for the determination of the particle size distribution and pesticide residue recovery. The results showed that the NRLs used several different brands and types of mills. Large variations in the particle size distributions and pesticide extraction efficiencies were observed even between samples milled by the same type of mill.

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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.64 SJR 1.269 SNIP 1.343
Web of Science (2017): Impact factor 3.412
Web of Science (2017): Indexed yes
Clean-up experiments of oat extracts for pesticide residues analysis by PSA, C18, Z-sep or EMR-lipid, individually and combinations

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Contributors: Herrmann, S. S., Poulsen, M. E.
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Does your milling procedure for cereals influence your pesticide residue results?

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Contributors: Poulsen, M. E., Herrmann, S. S., Hajeb, P.
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EU Proficiency test EUPT-CF10 – Incurred and Spiked Pesticide Residues in Rye Flour

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Contributors: Poulsen, M. E., Herrmann, S. S., Hajeb, P.
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Expansion of cereal multi residue method with pesticides planned for review under regulation No 396/2005 Article 12

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Organisations: National Food Institute, Division of Risk Assessment and Nutrition , Research group for Analytical Food Chemistry, Danish Veterinary and Food Administration
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Place of publication: Glostrup
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Rapport_Pesticidrester_i_foedevarer_2015.pdf
Research output: Commissioned - peer-review › Report – Annual report year: 2016

Clean-up of cereal extracts for gas chromatography-tandem quadrupole mass spectrometry pesticide residues analysis using primary secondary amine and C18

The level of co-extracted matrix in wheat and oat extracts obtained by the QuEChERS method (EN 15662) is high and the occurrence of free fatty acids generates a major matrix peak in TIC chromatograms (rt. 13-22min). Matrix can compromise the analytical performance in pesticide analysis using GC-MS/MS. In order to reduce the amount and the effects of matrix we tested the effect of using six different amounts of primary secondary amine (PSA) (0, 25, 50, 100, 150 and 200mg/ml extract) with and without the addition of six different amounts of C18 (0, 25, 50, 100, 150 and 200mg/ml extract) in the dispersive solid phase extraction (dSPE) procedure. dSPE clean-up using 25mg/ml extract significantly reduced the major matrix peak observed for wheat extracts. Higher amounts of PSA reduced the analytical response for iprodione and malathion. For oat extract 50-150mg PSA/ml extract was needed to obtain equally low intensity of the matrix peak. For oat the analytical responses of the target pesticides generally increased with increasing amount of PSA. C18 had no significant effect on the intensity of the major matrix peaks and even resulted in lower analytical responses for several of the target pesticides. Based on the present study it is concluded that the optimal dSPE clean-up procedure employs 25mg PSA/ml extract for wheat and 150mg PSA/ml extract for oat.

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Contributors: Herrmann, S. S., Poulsen, M. E.
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Journal: Journal of Chromatography A
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BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
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Scopus rating (2017): CiteScore 3.81 SJR 1.378 SNIP 1.212
Web of Science (2017): Impact factor 3.716
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.97 SJR 1.463 SNIP 1.318
Web of Science (2016): Impact factor 3.981
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.03 SJR 1.693 SNIP 1.398
Web of Science (2015): Impact factor 3.926
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.28 SJR 1.823 SNIP 1.507
Web of Science (2014): Impact factor 4.169
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.6 SJR 2.006 SNIP 1.613
Web of Science (2013): Impact factor 4.258
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 4.6 SJR 2.298 SNIP 1.697
Web of Science (2012): Impact factor 4.612
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 4.47 SJR 2.451 SNIP 1.664
Web of Science (2011): Impact factor 4.531
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.234 SNIP 1.564
Web of Science (2010): Impact factor 4.194
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.169 SNIP 1.566
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.895 SNIP 1.43
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.859 SNIP 1.539
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.982 SNIP 1.625
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.732 SNIP 1.556
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.844 SNIP 1.687
Scopus rating (2003): SJR 1.675 SNIP 1.536
Web of Science (2003): Indexed yes
Dietary exposure to volatile and non-volatile N-nitrosamines from processed meat products in Denmark

Recent epidemiological studies show a positive association between cancer incidence and high intake of processed meat. N-nitrosamines (NAs) in these products have been suggested as one potential causative factor. Most volatile NAs (VNAs) are classified as probable human carcinogens, whereas the carcinogenicity for the majority of the non-volatile NA (NVNA) remains to be elucidated. Danish adults (15–75 years) and children (4–6 years) consume 20 g and 16 g of processed meat per day (95th percentile), respectively. The consumption is primarily accounted for by sausages, salami, pork flank (spiced and boiled) and ham. This consumption results in an exposure to NVNA of 33 and 90 ng kg bw⁻¹ day⁻¹ for adults and children, respectively. The exposure to VNA is significantly lower amounting to 0.34 and 1.1 ng kg bw⁻¹ day⁻¹ for adults and children, respectively. Based on a BMDL₁₀ of 29 µg kg bw⁻¹ day⁻¹ a MOE value ≥17,000 was derived for the exposure to NA known to be carcinogenic (VNA including NSAR), indicating an exposure of low concern. The exposure to the NVNA is substantially higher and if found to be of toxicological significance the exposure may be of concern.

General information
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Organisations: Division of Food Chemistry, National Food Institute, Research group for Analytical Food Chemistry, Research group for Food Production Engineering, Division of Nutrition, Division of Risk Assessment and Nutrition, Division of Toxicology and Risk Assessment
Contributors: Herrmann, S. S., Duedahl-Olesen, L., Christensen, T., Olesen, P. T., Granby, K.
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Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.99 SJR 1.144 SNIP 1.427
Web of Science (2017): Impact factor 3.977
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.96 SJR 1.351 SNIP 1.58
Web of Science (2016): Impact factor 3.778
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.44 SJR 1.202 SNIP 1.415
Formation and mitigation of N-nitrosamines in nitrite preserved cooked sausages

Literature on formation and mitigation of N-nitrosamine (NA) and especially non-volatile NA (NVNA) in meat products is scarce and the present study is therefore a relevant contribution to the field. We found positive correlation between the levels of N-nitrosopiperidine (NPIP), N-nitrosohydroxyproline (NHPRO), N-nitrosoproline (NPRO), N-nitrosothiazolidine-4-carboxylic acid (NTCA) and N-nitroso-2-methyl-thiazolidine-4-carboxylic acid (NMTCA) and the amount of nitrite added to cooked pork sausages. The levels studied were 0, 60, 100, 150, 250 and 350 mg kg⁻¹. The levels of N-nitrosodimethylamine (NDMA) and N-nitrosopyrrolidine (NPYR) remained at or below limit of quantification. Erythorbic acid inhibited the formation of NHPRO, NPRO, NPIP and NTCA. This inhibition was for NTCA and NMTCA counteracted by addition of free iron. Ascorbyl palmitate had less inhibitory effect than erythorbic acid and a combination of the two provided no further protection. Increasing the black pepper content increased the levels of NPIP and NMTCA. Only slight effects of increased fat content and addition of tripolyphosphate were observed.

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Organisations: National Food Institute, Division of Food Chemistry
Contributors: Herrmann, S. S., Granby, K., Duedahl-Olesen, L.
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Peer-reviewed: Yes

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BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.19 SJR 1.793 SNIP 2.109
Web of Science (2017): Impact factor 4.946
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.85 SJR 1.731 SNIP 2.095
Web of Science (2016): Impact factor 4.529
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.31 SJR 1.582 SNIP 1.946
Web of Science (2015): Impact factor 4.052
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.92 SJR 1.557 SNIP 2.01
Web of Science (2014): Impact factor 3.391
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.87 SJR 1.554 SNIP 2.056
Web of Science (2013): Impact factor 3.259
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.98 SJR 1.762 SNIP 2.342
Web of Science (2012): Impact factor 3.334
ISI indexed (2012): ISI indexed yes
Occurrence of volatile and non-volatile N-nitrosamines in processed meat products and the role of heat treatment

Most of the available data on the occurrence of N-nitrosamines (NA) in processed meat products have been generated in the 1980s and 1990s and especially data on the occurrence of non-volatile NA (NVNA) are scarce. Therefore we have studied the levels of volatile nitrosamines (VNA) and NVNA in processed meat products on the Danish market (N = 70) and for comparison also products on the Belgian market (N = 20). The effect of heat treatment on the NA levels, in selected samples, was also studied, in order to enable an evaluation of how preparation before consumption affects the levels of NA. For the Danish products the mean levels of the VNA were generally low (≤0.8 μg kg⁻¹), whereas the mean levels of the NVNA were considerably higher (≤118 μg kg⁻¹). Slightly higher mean levels were indicated for the Belgian products (i.e. VNA ≤1.5 μg kg⁻¹ and NVNA ≤270 μg kg⁻¹). The sums of VNA were higher than 10 μg kg⁻¹ for one Danish sample and two Belgian samples. Levels of up to 2000 and 4000 μg kg⁻¹ of N-nitroso-thiazolidine-4-carboxylic acid (NTCA) an NVNA occurred in the Danish and the Belgian samples, respectively. The majority of the Danish processed meat products contain NVNA but also VNA occur. The levels of NA are comparable with those reported in previous and recent studies; however the frequency in which they are found may be lower and thereby also the mean contents. The levels of N-nitrosopiperidine (NPIP) increased by frying and baking, whereas varying impacts were observed for N-
nitrosoproline (NPRO), N-nitrosodimethylamine (NDMA), N-nitrosopyrrolidine (NPYR), N-nitrosodiethylamine (NDEA) and N-nitrosomethylaniline (NMA) depending on the type of product and/or the heat treatment. The levels of the NVNA, NTCA and N-nitroso-2-methyl-thiazolidine 4-carboxylic acid (NMTCA) decreased after frying and baking.

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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.06 SJR 1.502 SNIP 1.69
Web of Science (2017): Impact factor 3.667
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.86 SJR 1.492 SNIP 1.709
Web of Science (2016): Impact factor 3.496
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.65 SJR 1.498 SNIP 1.73
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.27 SJR 1.38 SNIP 1.717
Web of Science (2014): Impact factor 2.806
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.14 SJR 1.278 SNIP 1.728
Web of Science (2013): Impact factor 2.819
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.1 SJR 1.245 SNIP 1.931
Web of Science (2012): Impact factor 2.738
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.9 SJR 1.209 SNIP 1.723
Web of Science (2011): Impact factor 2.656
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.23 SNIP 1.708
Web of Science (2010): Impact factor 2.812
Web of Science (2010): Indexed yes
N-nitrosamines in processed meat products – analysis, occurrence, formation, mitigation and exposure

N-nitrosamines (NA) occur in sodium nitrite (nitrite) preserved meat products as bacon, sausages, ham and several types of luncheon meats. Several of these NA are carcinogenic and high intake of processed meat products has been associated with increased risk of cancer and other adverse health effects in some epidemiologic studies. Exposure to NA via meat products may be the underlying reason for this association. The levels of NA in processed meat products ought therefore to be as low as possible. There is a large amount of literature on the occurrence, formation and mitigation of NA in meat products already available, though several areas especially regarding non-volatile NA (NVNA) are relatively unexplored. Studies performed in actual meat products are also scarce. The more that is understood about which factors affects the formation of both volatile NA (VNA) and NVNA the more likely is it to identify strategies for the prevention of NA formation in general and not only for a few NA. The aim of the present thesis was therefore to study the role of ingoing amount of nitrite, factors relevant for industrial processing of meat, fat content and the effect of heat treatment on the formation of VNA and NVNA in meat. Secondly data on the occurrence of VNA and NVNA in processed meat products on the Danish market were to be generated and used for an evaluation of the exposure level resulting from consumption of processed meat products. A method allowing for the simultaneous determination of both VNA and NVNA has not been described in the literature. In order to meet the defined aims, a method based on acetonitrile extraction and liquid chromatography tandem mass spectrometry using both atmospheric pressure chemical ionisation and electrospray ionisation was developed and validated. Data on the occurrence of NA in processed meat products was obtained by analysing products taken from the Danish market. The mean levels of the individual VNA were generally found to be low (≤0.8 μg kg⁻¹), whereas the mean levels of the individual NVNA were considerably higher (≤118 μg kg⁻¹). The most frequently detected VNA were N-nitrosodimethylamine (NDMA) and N-nitroso-2-methyl-pyrrolidine (NPIP) and the most frequently detected NVNA were N-nitrosothiazolidine-4-carboxylic acid (NTCA) and N-nitroso-2-methyl-thiazolidine-4-carboxylic acid (NMTCA). NTCA occurred at high levels, i.e. up to 2000 μg kg⁻¹. Higher mean levels of both the VNA (≤1.5 μg kg⁻¹) and NVNA (≤270 μg kg⁻¹) were found in samples taken from the Belgian market, though the difference was not significant. Thus in spite of the National Provision that Denmark obtain allowing an ingoing amount of sodium nitrite of 60 mg kg⁻¹ instead of 150 mg kg⁻¹ according to EU regulation, no significant differences between the mean levels of NA in the Danish samples and the Belgian samples could be demonstrated. The relationship between the ingoing amount of nitrite and the levels of VNA and NVNA was studied in both minced meat and sausages. The levels of N-nitrosodihydroxyproline (NHPRO), N-nitrosopropionyl (NPRO), NTCA, NMTCA, N-nitrososarcosine (NSAR), and N-nitrosopiperidine (NPIP) were found to be positively related to the ingoing amount of nitrite. The same could not be demonstrated for the commonly assayed NDMA and NPYR of which the levels remained low even when 350 mg kg⁻¹ nitrite was added. This may indicate that the relevant precursors are not present. Studies by others have indicated especially the formation of NDMA to depend more on factors as meat quality including feeding and/or breeding conditions and processing factors as temperatures and duration of drying and storage than on the ingoing amount of nitrite.

A range of studies were performed using both minced pork meat and sausages in order to evaluate the effects of sodium chloride, antioxidants (erythorbic acid and ascorbylv
Simultaneous determination of volatile and non-volatile nitrosamines in processed meat products by liquid chromatography tandem mass spectrometry using atmospheric pressure chemical ionisation and electrospray ionisation

A sensitive, selective and generic method has been developed for the simultaneous determination of the contents (μg kg⁻¹ range) of both volatile nitrosamines (VNA) and non-volatile nitrosamines (NVNA) in processed meat products. The extraction procedure only requires basic laboratory equipment and a small volume of organic solvent. Separation and quantification were performed by the developed LC–(APCI/ESI)MS/MS method. The method was validated using spiked samples of three different processed meat products. Satisfactory recoveries (50–130%) and precisions (2–23%) were obtained for eight VNA and six NVNAs with LODs generally between 0.2 and 1μg kg⁻¹. The validation results show that results obtained for one meat product is not always valid for other meat products. We were not able to obtain satisfactory results for N-nitrosodiethylamine (NDEA) and N-nitrosomethylaniline (NMA) either increased or decreased. From the data acquired on the occurrence of NA in meat products on the Danish market it was estimated that consumption at the 95th percentile of these products resulted in an exposure to VNA of 0.5 ng kg⁻¹ day⁻¹ and 1.6 ng kg⁻¹ day⁻¹ for Danish adults and children, respectively. The calculated Margin Of Exposure (MOE) was well above 10,000 indicating that the exposure is of low concern. Though, it cannot be ruled out that the exposure to these VNA is accountable for the stronger association between adverse health effects and consumption of processed meat than for consumption of red meat. The 96 th percentile exposure to the NVNA was estimated to be considerably higher (47-129 ng kg⁻¹ day⁻¹); though this exposure level is not possible to risk assess because data concerning the toxicological relevance of these compounds are lacking.

Overall the present thesis show that if nitrite is used for meat preservation and/or colouration the levels of NA generally increase. Because of the possible adverse health effects of NA the exposure level ought to be kept at a minimum. Based on the present knowledge it is evaluated that low levels of NA in processed meat products are best achieved by using as little nitrite as possible and use it in combination with erythorbic acid (~1000 mg kg⁻¹) or another C-vitamin compound. Furthermore by storing the processed meat products protected from oxygen, depletion of the erythorbic acid is prevented. The European Food Safety Authority has concluded that microbiological safe meat products generally may be produced by the addition of 50 mg kg⁻¹ of nitrite. Other means besides nitrite addition can insure the microbiological safety. However, the occurrence of the carcinogenic NDMA and perhaps NPYR seems neither to be related to the levels of nitrite or to the levels of erythorbic acid.
Occurrence and dietary exposure of volatile and non-volatile N-Nitrosamines in processed meat products

Nitrite and nitrate have for many decades been used for preservation of meat. However, nitrite can react with secondary amines in meat to form N-Nitrosamines (NAs), many of which have been shown to be genotoxic1 . The use of nitrite therefore ought to be limited as much as possible. To maintain a high level of consumer protection Denmark obtains National low limits of the nitrite use in meat products. An estimation of the dietary exposure to volatile NAs (VNA) and non-volatile NAs (NVNA) is necessary when performing a risk assessment of the use of nitrite and nitrate for meat preservation.

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Herrmann, S. S., Duedahl-Olesen, L., Granby, K.
Number of pages: 1
Publication date: 2013
Peer-reviewed: Yes
Event: Abstract from 6th International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic.

Electronic versions:
Poster rafa 2013 final.pdf
Source: dtu
Source-ID: u::9909

Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2013

Occurrence of n-nitrosamines in processed meat products on the danish market and dietary exposure estimates

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Herrmann, S. S., Duedahl-Olesen, L., Granby, K.
Number of pages: 1
Pages: 399
Publication date: 2013

Host publication information
Title of host publication: Book of abstracts 6th international symposium of recent advances in food analysis
Probabilistic assessment of the cumulative dietary exposure of the population of Denmark to endocrine disrupting pesticides

The four pesticides epoxiconazole, prochloraz, procymidone and tebuconazole, are commonly used pesticides, all suspected of acting as endocrine disrupters. In the present study, we assessed the acute cumulative dietary exposure to the women of child bearing age and the general population of Denmark to these pesticides from the intake of fruit and vegetables. The assessment was carried out using the probabilistic approach combined with the relative potency factor (RPF) approach. Residue data for prochloraz, procymidone, and tebuconazole were obtained from the Danish monitoring programme 2006–2009, while residue data for epoxiconazole were obtained from the Swedish monitoring programme carried out in the period 2007–2009. Food consumption data were obtained from the Danish nationwide dietary survey conducted in 2000–2002. Relative potency factors for the four pesticides were obtained from rat studies. Prochloraz was used as the index compound. All four pesticides increased nipple retention in male offspring, and epoxiconazole, prochloraz, and tebuconazole also increased the gestation period in pregnant rat dams. For women of childbearing age, the high-end cumulative exposure (99.9th percentile) was calculated to 9% of the Adjusted Reference Value (ARV) for the effect on nipple retention and to 1% of the ARV for the effect on increased gestation period.

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry, Division of Toxicology and Risk Assessment
Pages: 113-120
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Food and Chemical Toxicology
Volume: 55
ISSN (Print): 0278-6915
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.99 SJR 1.144 SNIP 1.427
Web of Science (2017): Impact factor 3.977
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.96 SJR 1.351 SNIP 1.58
Web of Science (2016): Impact factor 3.778
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.44 SJR 1.202 SNIP 1.415
Web of Science (2015): Impact factor 3.584
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.12 SJR 1.038 SNIP 1.369
Web of Science (2014): Impact factor 2.895
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Adverse effects on sexual development in rat offspring after low dose exposure to a mixture of endocrine disrupting pesticides

The present study investigated whether a mixture of low doses of five environmentally relevant endocrine disrupting pesticides, epoxiconazole, mancozeb, prochloraz, tebuconazole and procymidine, would cause adverse developmental toxicity effects in rats. In rat dams, a significant increase in gestation length was seen, while in male offspring increased nipple retention and increased incidence and severity of genital malformations were observed. Severe mixture effects on gestation length, nipple retention and genital malformations were seen at dose levels where the individual pesticides caused no or smaller effects when given alone. Generally, the mixture effect predictions based on dose-additivity were in good agreement with the observed effects. The results indicate that there is a need for modification of risk assessment procedures for pesticides, in order to take account of the mixture effects and cumulative intake, because of the potentially serious impact of mixed exposure on development and reproduction in humans.
Determination of free and bound volatile and non-volatile nitrosamines in nitrite cured meat products

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Herrmann, S. S., Duedahl-Olesen, L., Granby, K.
Number of pages: 1
Publication date: 2012
Peer-reviewed: Yes
Event:
Keywords: N-Nitrosamines, Nitrite, Curing, Processed meat, LC-MS/MS

Bibliographical note
Poster presentation (D-28)
Source: dtu
Source-ID: u::5491
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2012

Developmental toxicity effects in experimental animals after mixed exposure to endocrine disrupting pesticides

General information
State: Published
Organisations: National Food Institute, Division of Toxicology and Risk Assessment, Division of Food Chemistry, Department of Informatics and Mathematical Modeling, DTU Data Analysis, Technical University of Denmark
Number of pages: 165
Publication date: 2012

Publication information
Publisher: Miljøstyrelsen
ISBN (Print): 978-87-92779-72-4
Original language: English
Pesticidrester i fødevarer 2009: Resultater fra den danske pesticidkontrol

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute, Danish Veterinary and Food Administration
Contributors: Jensen, B. H., Petersen, A., Christensen, H. B., Andersen, J. H., Herrmann, S. S., Poulsen, M. E., Hilbert, G., Grossmann, A., Holm, M.
Number of pages: 67
Publication date: 2010

Publication Information
Publisher: Ministeriet for Fødevarer, Landbrug og Fiskeri
Original language: Danish
URLs:
http://www.foedevarestyrelsen.dk/fdir/pub/2010003/rapport.pdf
Source: orbit
Source-ID: 272733
Research output: Research - peer-review › Report – Annual report year: 2010

Will correction for recovery change the outcome of a proficiency test?

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Poulsen, M. E., Christensen, H. B., Herrmann, S. S.
Publication date: 2010
Peer-reviewed: No
Event: Poster session presented at 8th European Pesticide Residue Workshop, Strasbourg, France.
Electronic versions:
PA 087 Poulsen.pdf
Source: orbit
Source-ID: 272612
Research output: Research › Poster – Annual report year: 2010

Preliminary results for the EUPT-C3

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Poulsen, M. E., Hjorth, K., Christensen, H. B., Herrmann, S. S.
Publication date: 2009

Event Information
Event: Nordic Pesticide Residue Workshop : 15 - 16 June 2009
Location: Oscarsborg, Norway
Source: orbit
Source-ID: 246646
Research output: Research › Sound/Visual production (digital) – Annual report year: 2009

Proficiency test on incurred and spiked pesticide residues in cereals
A proficiency test on incurred and spiked pesticide residues in wheat was organised in 2008. The test material was grown in 2007 and treated in the field with 14 pesticides formulations containing the active substances, alpha-cypermethrin, bifenthrin, carbendazim, chlorimequat, chlorpyrifos-methyl, difenconazole, epoxiconazole, glyphosate, iprodione, malathion, pirimicarb, prochloraz, spiroxamin and trifloxystrobin. After harvest, the test material was additionally spiked in the laboratory with three pesticides, that where the residues were too low, and axozystrobin. In total, 72 laboratories submitted
results and z-scores were calculated for all laboratories and pesticides, except for glyphosate where only five laboratories submitted results and summed weighted z-scores were calculated for the laboratories with a sufficient scope. For several pesticides, the submitted results were strongly depending on the extraction procedure and consequently the assigned values were calculated based on part of the results. Acceptable z-scores were obtained by 56-97% of the participants.

**General information**

State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Poulsen, M. E., Christensen, H. B., Herrmann, S. S.
Pages: 477-485
Publication date: 2009
Peer-reviewed: Yes

**Publication information**

Journal: Accreditation and Quality Assurance
Volume: 14
Issue number: 8-9
ISSN (Print): 0949-1775
Ratings:
  - BFI (2019): BFI-level 1
  - Web of Science (2019): Indexed yes
  - BFI (2018): BFI-level 1
  - Web of Science (2018): Indexed yes
  - BFI (2017): BFI-level 1
  - Scopus rating (2017): CiteScore 0.51 SJR 0.316 SNIP 0.697
  - Web of Science (2017): Impact factor 0.667
  - Web of Science (2017): Indexed yes
  - BFI (2016): BFI-level 1
  - Scopus rating (2016): CiteScore 0.67 SJR 0.299 SNIP 0.748
  - Web of Science (2016): Impact factor 0.725
  - BFI (2015): BFI-level 1
  - Scopus rating (2015): CiteScore 0.73 SJR 0.374 SNIP 1.037
  - Web of Science (2015): Impact factor 1.01
  - Web of Science (2015): Indexed yes
  - BFI (2014): BFI-level 1
  - Scopus rating (2014): CiteScore 0.71 SJR 0.347 SNIP 0.782
  - Web of Science (2014): Impact factor 0.966
  - BFI (2013): BFI-level 1
  - Scopus rating (2013): CiteScore 0.69 SJR 0.397 SNIP 0.838
  - Web of Science (2013): Impact factor 1.048
  - ISI indexed (2013): ISI indexed yes
  - BFI (2012): BFI-level 1
  - Scopus rating (2012): CiteScore 0.62 SJR 0.365 SNIP 0.751
  - Web of Science (2012): Impact factor 1.132
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
  - BFI (2011): BFI-level 1
  - Scopus rating (2011): CiteScore 0.61 SJR 0.365 SNIP 0.657
  - Web of Science (2011): Impact factor 1.036
  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2011): Indexed yes
  - BFI (2010): BFI-level 1
  - Scopus rating (2010): SJR 0.353 SNIP 0.774
  - Web of Science (2010): Impact factor 0.797
  - BFI (2009): BFI-level 1
  - Scopus rating (2009): SJR 0.443 SNIP 0.624
  - Web of Science (2009): Indexed yes
Analysis of pesticides often authorised for use in cereals by GC-MS/MS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Herrmann, S. S., Poulsen, M. E., Christensen, H. B.
Publication date: 2008
Peer-reviewed: No
Source: orbit
Source-ID: 235411
Research output: Research › Poster – Annual report year: 2008

Fødevaresikkerhed og sundhed i relation til økologiske fødevarer

General information
State: Published
Organisations: Division of Microbiology and Risk Assessment, National Food Institute, Division of Food Chemistry, Division of Toxicology and Risk Assessment, University of Copenhagen
Pages: 395-428
Publication date: 2008

Host publication information
Title of host publication: Udvikling, vækst og integritet i den danske økologisektor
Publisher: Internationalt Center for Forskning i Økologisk Jordbrug og Fødevaresystemer
ISBN (Print): 978-87-991343-6-6
(ICOFS-rapport; No. 1/2008).
Electronic versions:
E11B4d01.pdf
Source: orbit
Source-ID: 235337
Research output: Research › Book chapter – Annual report year: 2008
Levels of Pesticides in Food and Food Safety Aspects

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Granby, K., Petersen, A., Herrmann, S. S., Poulsen, M. E.
Pages: 287-318
Publication date: 2008

Host publication information
Title of host publication: Analysis of Pesticides in Food and Environmental Samples
Publisher: CRC Press
Editor: Tadeo, J. L.
ISBN (Print): 9780849375521
Source: orbit
Source-ID: 233194
Research output: Research › Book chapter – Annual report year: 2008

Pesticidrester i fødevarer 2007 – Resultater af den danske pesticidkontrol

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Christensen, H. B., Herrmann, S. S., Petersen, A., Poulsen, M. E., Jensen, B. H., Holm, M.
Publication date: 2008

Publication information
Place of publication: Danmark
Publisher: Ministeriet for Fødevarer, Landbrug og Fiskeri
ISBN (Print): 978-87-92109-78-1
Original language: Danish
Source: orbit
Source-ID: 235410
Research output: Communication › Report – Annual report year: 2008

Proficiency test on incurred and spiked pesticide residues in cereals

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Poulsen, M. E., Christensen, H. B., Herrmann, S. S.
Publication date: 2008
Peer-reviewed: No
Source: orbit
Source-ID: 236779
Research output: Research › Poster – Annual report year: 2008

Draft Assessment Report for tau-fluvalinate: Residues in or on treated products, food and feed for fludioxonil: Afsnit B5 og B7

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: EFSA Publication
Publication date: 2007

Publication information
Original language: English
Source: orbit
Source-ID: 244737
Research output: Research - peer-review › Report – Annual report year: 2007
Matrix peaks in GC analysis of cereals – Problems and solutions

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Herrmann, S. S., Poulsen, M. E., Christensen, H. B.
Publication date: 2007

Event information
Event: The Community Reference Laboratory (CRL) training course for pesticide residues in food
Location: Valencia, Spain
Source: orbit
Source-ID: 238757
Research output: Research › Sound/Visual production (digital) – Annual report year: 2007

Pesticidrester i fødevarer 2006 –: resultater af den danske pesticidkontrol

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Christensen, H. B., Herrmann, S. S., Petersen, A., Poulsen, M. E., Lind, R. L., Holm, M., Cederberg, D. L.
Publication date: 2007

Publication information
Publisher: Fødevarestyrelsen
ISBN (Print): 978-87-92109-26-2
Original language: Danish
(FødevareRapport; No. 2007:16).
Electronic versions:
pesticidrester.pdf
Source: orbit
Source-ID: 238756
Research output: Research › Report – Annual report year: 2007

Frequency of residues of acute toxic pesticides in samples of fruit and vegetables analysed in the Danish pesticide monitoring programme 2002 and 2003

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Jensen, B. H., Herrmann, S. S.
Publication date: 2004
Peer-reviewed: No
Source: orbit
Source-ID: 238977
Research output: Research › Poster – Annual report year: 2004

Projects:

Chemical profiling of Processed Meat
Niklas, A. A., PhD Student, National Food Institute
Duedahl-Olesen, L., Main Supervisor, National Food Institute
Herrmann, S. S., Supervisor, National Food Institute
Ionas, A. C., Supervisor, National Food Institute
01/02/2019 → 31/01/2022
Project: PhD

Formation and mitigation of nitroso compounds in food
Herrmann, S. S., PhD Student, National Food Institute
Granby, K., Main Supervisor, National Food Institute
Duedahl-Olesen, L., Supervisor, National Food Institute
Baron, C. P., Examiner, National Food Institute
Crews, C., Examiner
Lund, M. N., Examiner
Technical University of Denmark
01/06/2011 → 30/09/2014
Award relations: Formation and mitigation of nitroso compounds in food
Project: PhD

Activities:

**EURL/NRL Workshop and training on Cereals and Feeding Stuff, Copenhagen 2018**
Period: 14 Nov 2018 → 15 Nov 2018
Susan Strange Herrmann (Organizer)
Mette Erecius Poulsen (Organizer)
National Food Institute
Research group for Analytical Food Chemistry
Degree of recognition: International

**Related event**

**EURL/NRL Workshop and training on Cereals and Feeding Stuff, Copenhagen 2018**
14/11/2018 → 15/11/2018
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Joint EURL/NRLs (FV-SRM) Pesticide Residue Workshop 2018**
Period: 27 Sep 2018 → 28 Sep 2018
Susan Strange Herrmann (Participant)
Amadeo Fernandez-Alba (Organizer)
National Food Institute
Research group for Analytical Food Chemistry
Degree of recognition: International

**Related event**

**Joint EURL/NRLs (FV-SRM) Pesticide Residue Workshop 2018**
27/09/2018 → 28/09/2018
Almeria, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**12th European Pesticide Residue Workshop**
Period: 22 May 2018 → 25 May 2018
Susan Strange Herrmann (Participant)
National Food Institute
Research group for Analytical Food Chemistry
Degree of recognition: International

**Related event**

**12th European Pesticide Residue Workshop**
22/05/2018 → 25/05/2018
Münich, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Training course on the application of HRAMS in routine for pesticide residues in food of plant origin– EU/RL/NRL training course
Period: 4 Dec 2017 → 5 Dec 2017
Susan Strange Herrmann (Organizer)
Mette Erecius Poulsen (Organizer)
National Food Institute
Research group for Analytical Food Chemistry
Degree of recognition: International

Related event
Training course on the application of HRAMS in routine for pesticide residues in food of plant origin– EU/RL/NRL training course: HRSMS training course
04/12/2017 → 05/12/2017
Almeria, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

8th International Symposium on Recent Advances in Food Analysis
Period: 7 Nov 2017 → 10 Nov 2017
Susan Strange Herrmann (Participant)
National Food Institute
Research group for Analytical Food Chemistry
Description
Degree of recognition: International

Related event
8th International Symposium on Recent Advances in Food Analysis
07/11/2017 → 10/11/2017
Prague, Czech Republic
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Joint EURL FV/CF/AO/SRM-Workshop for Pesticide Residues in Food and Feed
Period: 26 Sep 2017 → 29 Sep 2017
Susan Strange Herrmann (Organizer)
National Food Institute
Research group for Analytical Food Chemistry
Description
Degree of recognition: International

Related event
Joint EURL FV/CF/AO/SRM-Workshop for Pesticide Residues in Food and Feed
26/09/2017 → 29/09/2017
Freiburg, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Kompetence projekt for rådgivere ved fødevareinstituttet
Period: 1 Nov 2016 → 27 Mar 2017
Susan Strange Herrmann (Guest lecturer)
National Food Institute
Research group for Analytical Food Chemistry
Related event

**Kompetence projekt for rådgivere ved fødevareinstituttet**
01/11/2016 → 27/03/2017
Denmark
Activity: Talks and presentations › Conference presentations

**Workshop and training 2016 for Pesticide Residues in Cereals and Feedingstuff**
Period: 20 Sep 2016 → 22 Sep 2016
Susan Strange Herrmann (Organizer)
Mette Erelius Poulsen (Organizer)
National Food Institute
Research group for Analytical Food Chemistry
Degree of recognition: International

Related event

**Workshop and training 2016 for Pesticide Residues in Cereals and Feedingstuff**
20/09/2016 → 22/09/2016
Holte, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**11th European Pesticide Residue Workshop**
Period: 24 May 2016 → 27 May 2016
Susan Strange Herrmann (Participant)
National Food Institute
Research group for Analytical Food Chemistry

Related event

**11th European Pesticide Residue Workshop: EPRW16**
24/05/2016 → 27/05/2016
Limassol, Cyprus
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Joint EURL/NRL/OfL Workshop for Pesticide Residue in Food**
Period: 30 Sep 2015 → 2 Oct 2015
Susan Strange Herrmann (Organizer)
Mette Erelius Poulsen (Organizer)
National Food Institute
Research group for Analytical Food Chemistry

Related event

**Joint EURL/NRL/OfL Workshop for Pesticide Residue in Food**
30/09/2015 → 02/10/2015
Stuttgart, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**CRL/NRL workshop: Extraction of cereals**
Period: 21 Sep 2010 → 22 Sep 2010
Susan Strange Herrmann (Lecturer)
National Food Institute
Division of Food Chemistry

Related external organisation
Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

CRL/NRL workshop: Results from EUPT-C4 - Corrected versus not corrected results
Period: 21 Sep 2010 → 22 Sep 2010
Susan Strange Herrmann (Lecturer)
National Food Institute
Division of Food Chemistry
Related external organisation

Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

CRL/NRL workshop: Results from EUPT-C4 - Incurred pesticides in rye
Period: 21 Sep 2010 → 22 Sep 2010
Susan Strange Herrmann (Lecturer)
National Food Institute
Division of Food Chemistry
Related external organisation

Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

7th European Pesticide Residue Workshop
Period: 1 Jun 2008 → 5 Jun 2008
Susan Strange Herrmann (Organizer)
National Food Institute
Research group for Analytical Food Chemistry
Description
Nordic Pesticide Residue Workshop
Related event
7th European Pesticide Residue Workshop
01/06/2008 → 05/06/2008
Berlin, Germany
Activity: Attending an event › Participating in or organising a conference

Press clippings:

Pressekontakt-Anvendelse af nitrit til opretholdelse af mikrobiologisk sikre kødprodukter.
Susan Strange Herrmann
11/01/2016
Subject
Pressekontakt-Anvendelse af nitrit til opretholdelse af mikrobiologisk sikre kødprodukter.
National Food Institute, Research group for Analytical Food Chemistry
Media contribution (1)

Pressekontakt-Anvendelse af nitrit til opretholdelse af mikrobiologisk sikre kødprodukter.
11/01/2016
Premieres lignes, television, Television
Sandrine Rigaud
Susan Strange Herrmann