Assessing the effects of seawater temperature and pH on the bioaccumulation of emerging chemical contaminants in marine bivalves

Emerging chemical contaminants [e.g. toxic metals speciation, flame retardants (FRs) and perfluorinated compounds (PFCs), among others], that have not been historically recognized as pollutants nor their toxicological hazards, are increasingly more present in the marine environment. Furthermore, the effects of environmental conditions (e.g. temperature and pH) on bioaccumulation and elimination mechanisms of these emerging contaminants in marine biota have been poorly studied until now. In this context, the aim of this study was to assess, for the first time, the effect of warmer seawater temperatures (Δ = + 4°C) and lower pH levels (Δ = - 0.4 pH units), acting alone or combined, on the bioaccumulation and elimination of emerging FRs (dechloranes 602, 603 and 604, and TBBPA), inorganic arsenic (iAs), and PFCs (PFOA and PFOS) in two estuarine bivalve species (Mytilus galloprovincialis and Ruditapes philippinarum). Overall, results showed that warming alone or combined with acidification promoted the bioaccumulation of some compounds (i.e. dechloranes 602, 604, TBBPA), but also facilitated the elimination of others (i.e. iAs, TBBPA). Similarly, lower pH also resulted in higher levels of dechloranes, as well as enhanced iAs, PFOA and PFOS elimination. Data also suggests that, when both abiotic stressors are combined, bivalves’ capacity to accumulate contaminants may be time-dependent, considering significantly drastic increase observed with Dec 602 and TBBPA, during the last 10 days of exposure, when compared to reference conditions. Such changes in contaminants’ bioaccumulation/elimination patterns also suggest a potential increase of human health risks of some compounds, if the climate continues changing as forecasted. Therefore, this first study pointed out the urgent need for further research on the effects of abiotic conditions on emerging contaminants kinetics, to adequately estimate the potential toxicological hazards associated to these compounds and develop recommendations/regulations for their presence in seafood, considering the prevailing environmental conditions expected in tomorrow’s ocean.
Bioaccessibility of contaminants of emerging concern in raw and cooked commercial seafood species: insights for food safety risk assessment

**General information**

**State:** Published  
**Organisations:** National Food Institute, Research Group for Nano-Bio Science  

**Pages:** 14-14  
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Bioavailability of emerging contaminants in seafood

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Can seafood safety be compromised in the ocean of tomorrow?

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Organisations: National Food Institute, Research Group for Nano-Bio Science
Authors: Maulvault, A. L. (Ekstern), Camacho, C. (Ekstern), Sampaio, E. (Ekstern), Barbosa, V. (Ekstern), Alves, R. N. (Ekstern), Fogaça, F. (Ekstern), Kwadijk, C. (Ekstern), Kotterman, M. (Ekstern), Sloth, J. J. (Intern), Rasmussen, R. R. (Intern), Eljarrat, E. (Ekstern), Aznar-Alemany, Ò. (Ekstern), Cunha, S. (Ekstern)
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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Carryover of CH3Hg from feed to sea bass and salmon

Contamination of food generally has a negative impact on the quality and may imply a risk to human health. Mercury (Hg) is one of the most hazardous compounds in our environment and is released from the earth’s crust by both natural and anthropogenic processes. The mercury species methylmercury is highly toxic, because affects the function of enzymes, easily crosses the blood-brain and the placenta barriers and is toxic to the nervous system (especially the developing brain). It bioaccumulates and biomagnifies through the aquatic food chain. Methylmercury is the most common mercury species in fish and humans are also mainly exposed to methylmercury from consumption of fish and other seafood. The aims of the present controlled fish feeding trials were to study the carryover from feed to fish fillets (at low spike levels (1x background level of methylmercury) and to determine toxicokinetic parameters. The study included Atlantic salmon (Salmo salar), which is one of the main farmed seafood product consumed in Europe and with production in Northen Europe as well as European seaseas (Dicentrarchus labrax) produced in Southern Europe, where it is a highly consumed seafood. The weight gain of the fish, their feed intake, feed and fish fillet contaminant level were determined to model the uptake and elimination of methylmercury. The toxicokinetics for feed with
low levels of methylmercury (41-75 ng/g) showed high assimilation and low elimination. The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under the ECsafeSEAFOOD project (grant agreement n° 311820).

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State: Published
Authors: Rasmussen, R. R. (Intern), Håland, W. (Ekstern), Larsen, B. K. (Intern), Kotterman, M. (Ekstern), Sloth, J. J. (Intern), Marques, A. T. (Ekstern), Granby, K. (Intern)
Number of pages: 1
Publication date: 2017
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ECsafeSEAFOOD_Carryover_of_MeHg_final.pdf
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**Carryover of methylmercury from feed to seabass and salmon**

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State: Published
Authors: Rasmussen, R. R. (Intern), Håland, W. (Ekstern), Larsen, B. K. (Intern), Kotterman, M. (Ekstern), Sloth, J. J. (Intern), Marques, A. T. (Ekstern), Granby, K. (Intern)
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21042f_6f62ebecb4654c2fac338c8587d6be15.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

**Detection and characterisation of aluminium-containing nanoparticles in Chinese noodles by single particle ICP-MS**

This study investigated Chinese noodles for the presence of aluminium-containing nanoparticles by using inductively coupled plasma mass spectrometry in single particle mode (spICP-MS) after enzymatic digestion by α-amylase. The aluminium concentrations in the noodle samples, determined by conventional ICP-MS without or with the use of hydrofluoric acid for digestion, were 5.4 ± 1.9 µg/g and 10.1 ± 2.2 µg/g (N = 21), respectively. Aluminium-containing nanoparticles were detected by spICP-MS in all 21 samples. Depending on the assumed particle composition, Al2O3 or Al2O3∙2SiO2∙2H2O, the median particle diameters were either below or above 100 nm, respectively. The minimum detectable particle diameter by spICP-MS was between 54 and 83 nm. The mass recovery of aluminium in the form of particles was between 5% and 18%. The presented work reports for the first time the detection of Al-containing particles in food by spICP-MS.

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State: Accepted/In press
Organisations: National Food Institute, Research Group for Nano-Bio Science, University of Granada, Danish Veterinary and Food Administration
Authors: Löschner, K. (Intern), Correia, M. (Intern), López Chaves, C. (Ekstern), Rokkjær, I. (Ekstern), Sloth, J. J. (Intern)
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Effect of cooking on levels of contaminants of emerging concern in commercial seafood

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Main Research Area: Technical/natural sciences
Conference: Seafood Safety, Brussels, Belgium, 25/01/2017 - 25/01/2017

Effects of industrial processing on essential elements and regulated and emerging contaminant levels in seafood
Mitigation of contaminants in industrial processing was studied for prawns (cooked and peeled), Greenland halibut (cold smoked) and Atlantic salmon (cold smoked and trimmed). Raw prawns had significantly higher cadmium, chromium, iron, selenium and zinc content in autumn than in spring, while summer levels typically were intermediate. Peeling raw prawns increased mercury concentration but reduced the concentration of all other elements including inorganic arsenic, total
arsenic, chromium, zinc, selenium but especially cadmium, copper and iron (p < 0.05), however interaction between seasons and processing was observed.

Non-toxic organic arsenic in raw Greenland halibut (N = 10) and salmon (N = 4) did not transform to carcinogenic inorganic arsenic during industrial cold smoking. Hence inorganic arsenic was low (<0.003 mg/kg wet weight) in both raw and smoked fillets rich in organic arsenic (up to 9.0 mg/kg for farmed salmon and 0.7 mg/kg for wild caught Greenland halibut per wet weight). Processing salmon did not significantly change any levels (calculated both per wet weight, dry weight or lipid content). Cold smoking decreased total arsenic (17%) and increased PCB congeners (10–22%) in Greenland halibut (wet weight). However PFOS, PCB and PBDE congeners were not different in processed Greenland halibut when corrected for water loss or lipid content.

General information
State: Published
Authors: Rasmussen, R. R. (Intern), Bøge Søndergaard, A. (Ekstern), Bøknæs, N. (Ekstern), Cederberg, T. L. (Intern), Sloth, J. J. (Intern), Granby, K. (Intern)
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BFI (2017): BFI-level 1
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.96 SJR 1.322 SNIP 1.589
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.213 SNIP 1.426 CiteScore 3.44
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.042 SNIP 1.381 CiteScore 3.12
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.013 SNIP 1.52 CiteScore 3.26
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.135 SNIP 1.745 CiteScore 3.52
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.12 SNIP 1.593 CiteScore 3.36
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.921 SNIP 1.216
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.818 SNIP 1.049
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.778 SNIP 1.133
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.798 SNIP 1.432
Effects of industrial processing on regulated and emerging contaminant levels in seafood

General information
State: Published
Authors: Rasmussen, R. R. (Intern), Bøge Søndergaard, A. (Ekstern), Bøknæs, N. (Ekstern), Cederberg, T. L. (Intern), Sloth, J. J. (Intern), Granby, K. (Intern)
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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Exploration of the phycoremediation potential of Laminaria digitata towards diflubenzuron, lindane, copper and cadmium in a multitrophic pilot-scale experiment
The presence of contaminants in aquatic ecosystems can cause serious problems to the environment and marine organisms. This study aims to evaluate the phycoremediation capacity of macroalgae Laminaria digitata for pesticides (diflubenzuron and lindane) and toxic elements (cadmium and copper) in seawater with the presence or absence of mussels. The photosynthetic activity was monitored in the macroalgae to assess its "physiological status". The results showed that the presence of algae decreased diflubenzuron concentration in mussels by 70% after 120 h of exposure. Additionally, this macroalgae was efficient to reduce lindane, Cu and Cd in seawater; even though not was able to reduce these contaminants in mussels. The studied pollutants did not affect the physiological status of algae. This study reveals that the application of phycoremediation with macroalgae can be an useful and effective mitigation strategy to remove/decrease contaminant levels from the aquatic environment.

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Iodine in seaweed - occurrence, speciation, bioavailability and risk assessment

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Research Group for Bioactives – Analysis and Application, Division of Risk Assessment and Nutrition
Authors: Sloth, J. J. (Intern), Rasmussen, R. R. (Intern), Holdt, S. L. (Intern), Hansen, M. (Intern)
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Publisher: Helmholtz-Zentrum Geesthacht
Main Research Area: Technical/natural sciences
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Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Oral bioaccessibility of toxic and essential elements in raw and cooked commercial seafood species available in European markets

The oral bioaccessibility of several essential and toxic elements was investigated in raw and cooked commercially available seafood species from European markets. Bioaccessibility varied between seafood species and elements. Methylmercury bioaccessibility varied between 10 (octopus) and 60 % (monkfish). Arsenic (> 64%) was the toxic element showing the highest bioaccessibility. Concerning essential elements bioaccessibility in raw seafood, selenium (73 %) and iodine (71 %) revealed the highest percentages. The bioaccessibility of elements in steamed products increased or decreased according to species. For example, methylmercury bioaccessibility decreased significantly after steaming in all species, while zinc bioaccessibility increased in fish (tuna and plaice) but decreased in molluscs (mussel and octopus). Together with human exposure assessment and risk characterization, this study could contribute to the establishment of new maximum permissible concentrations for toxic elements in seafood by the European food safety authorities, as well as recommended intakes for essential elements.

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Publication information
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Scopus rating (2016): CiteScore 4.85 SJR 1.706 SNIP 2.091
Web of Science (2016): Indexed yes
Phycoremediation of diflubenzuron, lindane, copper and cadmium potential by Laminaria digitata

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science
Authors: Cunha, S. (Ekstern), Fernandes, J. O. (Ekstern), Casal, S. (Ekstern), Anacleto, P. (Ekstern), Barbosa, V. (Ekstern), Alves, R. N. (Ekstern), H.M. van den Heuvel, F. (Ekstern), Oliveira, H. (Ekstern), Rasmussen, R. R. (Intern),

DOI: 10.1016/j.foodchem.2017.11.045
Publication: Research - peer-review › Journal article – Annual report year: 2017
Phycoremediation potential of brown macroalgae species Saccharina latissimi and Laminaria digitata towards inorganic arsenic in a multitrophic pilot-scale experiment

The presence of organic pollutants and toxic elements in aquatic ecosystems can cause serious problems to the environment and marine organisms and subsequently lead to adverse effects to human health following consumption of contaminated seafood. Hence, technological solutions for the reduction and mitigation of contaminants in the aquatic food production chain are called upon. The phycoremediation technology is a cost-effective algae-based approach that utilizes the ability of macroalgae to concentrate elements and compounds from the environment and to metabolize various molecules in their tissues. Arsenic (As) is a ubiquitous metalloid found in soils, groundwater, surface water, air, and consequently also in various food items. Arsenic is bioaccumulated in the marine food chain and total arsenic concentrations in the mg/kg range is usually found in marine organisms. The toxicity of arsenic depends on the chemical species, where inorganic arsenic is considered to be the most toxic form of arsenic. The aim of the present study was to evaluate the phycoremediation capacity of the two brown seaweed species Sugar kelp (Saccharina latissima) and Oarweed (Laminaria digitata) in a controlled multitrophic (water, algae, mussels) pilot experiment with exposure to inorganic arsenic. The results of the experiments indicated that of the two algae species used in the experiment, Laminaria digitata was more efficient for removal of arsenic from seawater and hence a better choice for phycoremediation practices towards this parameter.

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Organisations: National Food Institute, Research Group for Nano-Bio Science
Authors: Rasmussen, R. R. (Intern), Cunha, S. (Ekstern), Fernandes, J. (Ekstern), Oliveira, C. (Ekstern), Anacleto, P. (Ekstern), Barbosa, V. (Ekstern), Alves, R. N. (Ekstern), Marques, A. T. (Ekstern), H.M. van den Heuvel, F. (Ekstern), Sloth, J. J. (Intern)
Number of pages: 1
Publication date: 2017
Event: Poster session presented at Seafood Safety, Brussels, Belgium.
Risk assessment of methylmercury in five European countries considering the national seafood consumption patterns

Although seafood is a nutritious protein source, due to marine environmental pollution, seafood may also be a source of contaminants. The results obtained within the FP7-ECsafeSEAFOOD-project show that among the range of studied environmental contaminants certainly methylmercury (MeHg) requires deeper investigation. This paper presents the results of a probabilistic risk assessment for MeHg based on: (1) primary concentration data, as well as secondary data from published papers, and (2) primary species-specific consumption data collected in five European countries (Belgium, Ireland, Italy, Portugal and Spain). The results indicated that in the southern European countries, larger subgroups of the population (up to 11% in Portugal) are potentially at risk for a MeHg exposure above the Tolerable Weekly Intake (TWI) value, while this risk is much lower in Ireland and Belgium. This research confirms the substantial contribution of tuna to MeHg exposure in each of the countries. Also hake, cod, sea bream, sea bass and octopus are identified as important contributors. From this study, it is concluded that a country-specific seafood consumption advice is needed. Policy makers may adopt the results of this study in order to develop consumer advices that optimise health benefits versus potential health risks by providing species-specific information.
The influence of microplastic inclusion in feed on carryover of environmental pollutants from feed to seabass and salmon

General information
State: Published
Authors: Granby, K. (Intern), Rasmussen, R. R. (Intern), Kotterman, M. (Ekstern), Sloth, J. J. (Intern), Cederberg, T. L. (Intern), Marques, A. T. (Ekstern), Koelmans, A. (Ekstern), Larsen, B. K. (Intern)
Pages: 16-16
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Toxic metals in European Ulva spp. – evaluation of potential use in food and feed applications

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Organisations: National Food Institute, Research Group for Nano-Bio Science, Technical University of Denmark, Aarhus University
Authors: Christiansen, E. R. (Ekstern), Bruhn, A. (Ekstern), Sloth, J. J. (Intern)
Number of pages: 1
Publication date: 2017
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Main Research Area: Technical/natural sciences
Electronic versions:
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Publication: Research - peer-review › Poster – Annual report year: 2017

Accuracy of a method based on atomic absorption spectrometry to determine inorganic arsenic in food: Outcome of the collaborative trial IMEP-41

A collaborative trial was conducted to determine the performance characteristics of an analytical method for the quantification of inorganic arsenic (iAs) in food. The method is based on (i) solubilisation of the protein matrix with concentrated hydrochloric acid to denature proteins and allow the release of all arsenic species into solution, and (ii) subsequent extraction of the inorganic arsenic present in the acid medium using chloroform followed by back-extraction to acidic medium. The final detection and quantification is done by flow injection hydride generation atomic absorption spectrometry (FI-HG-AAS). The seven test items used in this exercise were reference materials covering a broad range of matrices: mussels, cabbage, seaweed (hijiki), fish protein, rice, wheat, mushrooms, with concentrations ranging from 0.074 to 7.55 mg kg(-1). The relative standard deviation for repeatability (RSDr) ranged from 4.1 to 10.3%, while the relative standard deviation for reproducibility (RSDR) ranged from 6.1 to 22.8%.

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Organisations: Division of Food Chemistry, National Food Institute, European Commission Joint Research Centre Institute IATA-CSIC, University of Graz, University of Barcelona, National Institute of Health, University of Aberdeen
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Web of Science (2016): Indexed yes
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.595 SNIP 2.027 CiteScore 3.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.548 SNIP 2.069 CiteScore 3.87
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.805 SNIP 2.357 CiteScore 3.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.909 SNIP 2.395 CiteScore 4.17
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.965 SNIP 2.261
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.776 SNIP 2.024
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.488 SNIP 1.703
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.467 SNIP 2.095
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.383 SNIP 1.848
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.017 SNIP 1.543
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.057 SNIP 1.449
Scopus rating (2003): SJR 0.893 SNIP 1.258
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.957 SNIP 1.238
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.805 SNIP 0.99
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.728 SNIP 0.979
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.661 SNIP 0.937
Original language: English
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Arsenic compounds in foodstuffs – the importance of speciation analysis for food safety assessment

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Organisations: National Food Institute, Research Group for Nano-Bio Science
Authors: Sloth, J. J. (Intern)
Pages: 33-34
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Volume: 22
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ISI indexed (2012): ISI indexed no
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Electronic versions:
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Links:
http://miljoogsundhed.sst.dk/blad/ms1602.pdf
Source: PublicationPreSubmission
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Chemical Contaminants: Food monitoring 2012-2013

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State: Published
Authors: Petersen, A. (Intern), Fromberg, A. (Intern), Andersen, J. H. (Intern), Sloth, J. J. (Intern), Granby, K. (Intern), Duedahl-Olesen, L. (Intern), Rasmussen, P. H. (Intern), Cederberg, T. L. (Intern)
Number of pages: 73
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Place of publication: Søborg
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Electronic versions:
Chemical_contaminants_2012_2013_1_.pdf
Source: PublicationPreSubmission
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Publication: Commissioned › Report – Annual report year: 2016

Development of an LC-ICP-MS method for zinc speciation in fish feeds

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State: Published
Authors: Silva, M. (Ekstern), Sloth, J. J. (Intern), Waagbø, R. (Ekstern), Ørmsrud, R. (Ekstern), Amlund, H. (Ekstern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Evaluation of minerals and vitamins in the Danish cultivated sugar kelp

Seaweeds are known for their nutraceutical applications, but also the ability to accumulate e.g. very high iodine concentrations and toxic heavy metals. In this study, cultivated Saccharina latissima (sugar kelp) harvested year-round was analysed for minerals (incl. heavy metals) and vitamins (vit A and E) to evaluate the nutritional value, possible risks and harvest time for optimized value and application. Rope cultivated sugar kelp was sampled both in close proximity to a blue mussel and fish farm (IMTA) and in a reference/control site, both outside Horsens fjord in Denmark, and freeze dried and stored frozen for further analyses. Sugar kelp biomass was sampled (n=3) at 2 m depth in 2013-2014. Surprisingly high concentrations of K and Ca (up to more than 100 and 150 g/kg DW, respectively) were found, along with other trace metals: Cr, Fe, Mn, Co, Cu, Na, Zn, and Se. Undesirable elements such as Pb, Hg, and inorganic As were below legislative threshold values for edible seaweed in France and food supplements in EU, whereas Cd concentrations in some seasons were above the French limits. However, a 70 kg person would need an intake of 0.77-2.0 kg DW of sugar kelp to reach the provisional tolerable weekly intake limit set for Cd. The iodine was found in so high levels (up to 5 g/kg) that this will be the limiting element for intake of sugar kelp. Moreover, the concentrations of total As found from September to March were above the EU regulatory levels for feed ingredients (40 mg/kg DW. Pb and Cd concentrations were below threshold values. The vitamin E (alpha-tocopherol) concentrations (6-25 mg/kg DW) were similar to what is found in broccoli. Generally the year-round variations were due season, and not between the two locations (reference and IMTA), so harvest time is important for optimized use, and may be conflicting with highest yields of sugar kelp. High concentrations of iodine and total As may be of concern regarding food and feed regulations, respectively.

Bibliographical note

Quantitative proteomics suggests metabolic reprogramming during ETHE1 deficiency

Deficiency of mitochondrial sulfur dioxygenase (ETHE1) causes the severe metabolic disorder ethylmalonic encephalopathy, which is characterized by early-onset encephalopathy and defective cytochrome C oxidase because of hydrogen sulfide accumulation. Although the severe systemic consequences of the disorder are becoming clear, the molecular effects are not well defined. Therefore, for further elucidating the effects of ETHE1-deficiency, we performed a large scale quantitative proteomics study on liver tissue from ETHE1-deficient mice. Our results demonstrated a clear link between ETHE1-deficiency and redox active proteins, as reflected by down-regulation of several proteins related to oxidation-reduction, such as different dehydrogenases and cytochrome P450 (CYP450) members. Furthermore, the protein data indicated impact of the ETHE1-deficiency on metabolic reprogramming through up-regulation of glycolytic enzymes and by altering several heterogeneous ribonucleoproteins (hnRNPs), indicating novel link between ETHE1 and gene expression regulation. We also found increase in total protein acetylation level, pointing out the link between ETHE1 and acetylation, which is likely controlled by both redox state and cellular metabolites. These findings are relevant for understanding the complexity of the disease and may shed light on important functions influenced by ETHE1 deficiency and by the concomitant increase in the gaseous mediator hydrogen sulfide.
There is a need for speciation analysis of selenium in fish feed and fish tissue

**General information**

State: Published
Authors: Sele, V. (Ekstern), Sloth, J. J. (Intern), Ørnsrud, R. (Ekstern), Amlund, H. (Ekstern)
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**Toxic Elements**

Food is considered the main source of toxic element (arsenic, cadmium, lead, and mercury) exposure to humans, and they can cause major public health effects. In this chapter, we discuss the most important sources for toxic element in food and the foodstuffs which are significant contributors to human exposure. The occurrence of each element in food classes from different regions is presented. Some of the current toxicological risk assessments on toxic elements, the human health effect of each toxic element, and their contents in the food legislations are presented. An overview of analytical techniques and challenges for determination of toxic elements in food is also given.

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Organisations: National Food Institute, Research Group for Nano-Bio Science, Research Group for Analytical Food Chemistry, Universiti Putra Malaysia
Authors: Hajeb, P. (Intern), Shakibazadeh, S. (Ekstern), Sloth, J. J. (Intern)
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**Arsenico totale e inorganico nei mitili italiani**

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Authors: Orletti, R. (Ekstern), Carloni, C. (Ekstern), Griffoni, F. (Ekstern), Palombo, P. (Ekstern), Velieri, F. (Ekstern), Rasmussen, R. R. (Intern), Sloth, J. J. (Intern)
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A study of lipid- and water-soluble arsenic species in liver of Northeast Arctic cod (Gadus morhua) containing high levels of total arsenic

In the present study liver samples (n = 26) of Northeast Arctic cod (Gadus morhua), ranging in total arsenic concentrations from 2.1 to 240 mg/kg liver wet weight (ww), were analysed for their content of total arsenic and arsenic species in the lipid-soluble and water-soluble fractions. The arsenic concentrations in the lipid fractions ranged from 1.8 to 16.4 mg As/kg oil of liver, and a linear correlation (r(2) = 0.80, p <0.001) was observed between the total arsenic concentrations in liver and the total arsenic concentrations in the respective lipid fractions of the same livers. The relative proportion of arsenolipids was considerably lower in liver samples with high total arsenic levels (33-240 mg/kg ww), which contained from 3 to 7% of the total arsenic in the lipid-soluble fraction. In contrast liver samples with low arsenic concentrations (2.1-33 mg/kg ww) contained up to 50% of the total arsenic as lipid-soluble species. Arsenic speciation analysis of the lipid-soluble fractions of the livers, using reversed-phase high performance liquid chromatography coupled to inductively coupled plasma mass spectrometry (HPLC-ICP-MS), revealed the presence of several arsenolipids. Three major arsenic-containing hydrocarbons (C17H39AsO, C19H41AsO and C23H37AsO) and five arsenic-containing fatty acids (C17H35AsO3, C19H39AO3, C19H37AsO3, C23H37AsO3 and C24H37AsO3) were identified using HPLC coupled to quadrupole time-of-flight mass spectrometry (qTOF-MS). Arsenobetaine was the major arsenic species in the water-soluble fraction of the livers, while dimethylarsinate, arsenocholine and inorganic arsenic were minor constituents. Inorganic arsenic accounted for less than 0.1% of the total arsenic in the liver samples. (C) 2015 Elsevier GmbH. All rights reserved.
Correlations between arsenolipids, organic and inorganic forms of arsenic, mercury and selenium in muscles and cephalothoraxes of Aristaeomorpha foliacea shrimp

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Organisations: National Food Institute, Research Group for Nano-Bio Science, Technical University of Denmark, National Kapodistrian University of Athens, National Institute for Nutrition and Seafood Research
Authors: Soultani, G. (Ekstern), Sele, V. (Ekstern), Rasmussen, R. R. (Intern), Pasias, I. (Ekstern), Stathopoulou, E. (Ekstern), Thomaidis, N. S. (Ekstern), Scoullos, M. (Ekstern), Sloth, J. J. (Intern)
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Evaluation of the Danish cultivated sugarkelp as possible future source of ingredients such as minerals and pigments

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Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Department of Environmental Engineering, Residual Resource Engineering, Research Group for Nano-Bio Science
Authors: Holdt, S. L. (Intern), Silva Marinho, G. (Intern), Sloth, J. J. (Intern), Safafar, H. (Intern), Jakobsen, J. (Intern), Angelidaki, I. (Intern)
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Exposure to lead from intake of coffee

Food and beverages is one of the primary sources of intake of and exposure to lead, with beverages accounting for almost 50%. Previous studies from Denmark have estimated that the intake of lead from coffee is very high and may contribute to up to 20% of the total lead intake from food and beverages. This estimate is, however, based on older, non-published data. In the current project extensive chemical analyses of coffee beans, drinking water and ready-to-drink coffee have been performed. The results hereof have been compared to calculations of the total intake of lead from food and beverages.

The results show that the intake of lead from coffee is considerably lower than previously estimated and account for 4.2% and 3.3% of the total lead intake from food and beverages for Danish men and women, respectively. It can generally be concluded that the intake of lead from coffee is low in comparison with other types of food, and that it does not constitute a substantial part of the total intake of lead with food and beverages.

Introduction of regulations for arsenic in feed and food with emphasis on inorganic arsenic, and implications for analytical chemistry

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Toxic elements and speciation in seafood samples from different contaminated sites in Europe
The presence of cadmium (Cd), lead (Pb), mercury (THg), methylmercury (MeHg), arsenic (TAs), inorganic arsenic (iAs), cobalt (Co), copper (Cu), zinc (Zn), nickel (Ni), chromium (Cr) and iron (Fe) was investigated in seafood collected from European marine ecosystems subjected to strong anthropogenic pressure, i.e. hotspot areas. Different species (Mytilus galloprovincialis, n=50; Chamelea gallina, n=50; Liza aurata, n=25; Platichthys flesus, n=25; Laminaria digitata, n=15; and Saccharina latissima, n=15) sampled in Tagus estuary, Po delta, Ebro delta, western Scheldt, and in the vicinities of a fish farm area (Solund, Norway), between September and December 2013, were selected to assess metal contamination and potential risks to seafood consumers, as well as to determine the suitability of ecologically distinct organisms as bioindicators in environmental monitoring studies. Species exhibited different elemental profiles, likely as a result of their ecological strategies, metabolism and levels in the environment (i.e. seawater and sediments). Higher levels of Cd (0.15-0.94mgkg(-1)), Pb (0.37-0.89mgkg(-1)), Co (0.48-1.1mgkg(-1)), Cu (4.8-8.4mgkg(-1)), Zn (75-153mgkg(-1)), Cr (1.0-4.5mgkg(-1)) and Fe (283-930mgkg(-1)) were detected in bivalve species, particularly in M. galloprovincialis from Ebro and Po deltas, whereas the highest content of Hg was found in P. flesus (0.88mgkg(-1)). In fish species, most Hg was organic (MeHg; from 69 to 79%), whereas lower proportions of MeHg were encountered in bivalve species (between 20 and 43%). The highest levels of As were found in macroalgae species L. digitata and S. latissima (41mgkg(-1) and 43mgkg(-1), respectively), with iAs accounting almost 50% of the total As content in L. digitata but not with S. latissima nor in the remaining seafood samples. This work highlights that the selection of the most appropriate bioindicator species is a fundamental step in environmental monitoring of each contaminant, especially in coastal areas. Furthermore, data clearly shows that the current risk assessment and legislation solely based on total As or Hg data is limiting, as elemental speciation greatly varies according to seafood species, thus playing a key role in human exposure assessment via food.
Arsenic-containing fatty acids and hydrocarbons in marine oils - Determination using reversed-phase HPLC-ICP-MS and HPLC-qTOF-MS

Arsenolipids are the major arsenic species present in marine oils. Several structures of arsenolipids have been elucidated the last 5 years, demonstrating the chemical complexity of this trace element in the marine environment. Several commercial fish oils and marine oils, ranging in total arsenic concentrations from 1.6 to 12.5 mg kg⁻¹ oil, were analyzed for arsenolipids using reversed-phase high performance liquid chromatography coupled with inductively coupled plasma mass spectrometry (HPLC-ICP-MS). The arsenolipids were quantified using three different arsenic-containing calibration standards; dimethylarsinate (DMA), triphenylarsinoxide (Ph₃AsO) and a synthesized arsenic-containing hydrocarbon (AsHC) (dimethylarsinoyl nonadecane; C₂₁H₄₃AsO). The observed variation in signal intensity for arsenic during the gradient elution profile in reversed-phase HPLC was compensated for by determining the time-resolved response factors for the arsenolipids. Isotopes of germanium (⁷⁴Ge) and indium (¹¹⁵In) were suited as internal standards for arsenic, and were used for verification of the arsenic signal response factors during the gradient elution. Dimethylarsinate was the most suitable calibration standard for the quantification of arsenolipids, with recoveries between 91% and 104% compared to total arsenic measurements in the same extracts. A range of marine oils was investigated, including oils of several fish species, cod liver and seal, as well as three commercial fish oils. The AsHCS - C₁₇H₃₈AsO, C₁₉H₄₂AsO and C₂₃H₃₈AsO - were identified as the major arsenolipids in the extracts of all oils by HPLC coupled with quadrupole time-of-flight mass spectrometry (qTOF-MS). Minor amounts of two arsenic-containing fatty acids (AsFAs) (C₂₃H₃₈AsO₃ and C₂₄H₃₈AsO₃) were also detected in the oils. The sum of the AsHCS and the AsFAs determined in the present study accounted for 17-42% of the total arsenic in the oils. © 2014 Elsevier B.V.

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Authors: Sele, V. (Ekstern), Sloth, J. J. (Intern), Holmelid, B. (Ekstern), Valdersnes, S. (Ekstern), Skov, K. (Intern), Amlund, H. (Ekstern)
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Arsenolipids in marine samples – Status and analytical challenges

Arsenic is an ubiquitous element that is present in the environment due to natural and anthropogenic processes. Marine samples are generally more concentrated in arsenic than terrestrial samples, with concentrations typically in the range of 1 to 100 mg kg\(^{-1}\). Arsenic has a complex chemistry and up to 100 naturally occurring arsenic species have so far been identified, both water-soluble and lipid-soluble compounds. Most research on arsenic and its chemical forms has so far focused on the water-soluble species, and a large set of data on occurrence and species exist. During the last decade an increased interest in the lipid-soluble arsenic species; the arsenolipids, has been seen.

The most common techniques within arsenic speciation include use of high performance liquid chromatography coupled to the inductively coupled plasma mass spectrometry (HPLC-ICP-MS). However, for speciation analysis of arsenolipids, where organic solvents are required for the separation of species, the ICP-MS needs to be modified by addition of oxygen and use of low solvent flow. A modified ICP-MS set-up for analysis of intact arsenolipids was first applied in 2005\(^1\). Since then, around 40 intact arsenolipids have been characterised in oils of fish, fish liver and marine algae. In this presentation, the current status and analytical challenges concerning quantitative and qualitative analysis of arsenolipids in marine oils will be discussed.
Bioavailability of cadmium: Results from in-vivo and in-vitro studies using cocoa and linseeds

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Organisations: National Food Institute, Division of Toxicology and Risk Assessment, Division of Food Chemistry
Authors: Hansen, M. (Intern), Rasmussen, R. R. (Intern), Herbst, B. K. (Intern), Sloth, J. J. (Intern)
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Bioavailability of cadmium from linseed and cocoa

The exposure of the European population to cadmium from food is high compared with the tolerable weekly intake of 2.5 μg/kg bodyweight set by EFSA in 2009. Only few studies on the bioavailability of cadmium from different food sources has been performed but this information is very important for the food authorities in order to give correct advises to the population.

The aim of this study was to investigate the bioavailability of cadmium from whole linseed, crushed linseed, cocoa and cadmium chloride in rats.

An experiment where 40 rats were divided into 4 groups and a control group and dosed with whole linseed, crushed linseed, cocoa and CdCl₂ for 3 weeks was performed. Linseed or cocoa made up 10% of the feed (by weight) and was added as a replacement for carbohydrate source. The rats were dosed for 3 weeks and the cadmium content in the rats’ kidneys was measured by ICPMS as a biomarker for the exposure during the whole life. Efforts were made to keep unintended exposure as low as possible and the cadmium content was measured in whole feed and all individual feed components.

The total intake of cadmium during the lifetime of the rats was calculated and the percentage of the cadmium which could be measured in the kidney compared to the calculated total intake was as follows: Control 2.0 %, Crushed linseed 0.9 %, whole linseed, 1.5 %, cocoa 0.7 % and CdCl₂ 4.6 %.

Based on this study it could not be concluded that the bioavailability in rats form whole linseed is lower that for crushed linseed. It was concluded that the bioavailability of cadmium from cocoa was similar or maybe a little lower than the bioavailability of cadmium from linseed.

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Organisations: National Food Institute, Division of Toxicology and Risk Assessment, Division of Food Chemistry
Authors: Hansen, M. (Intern), Rasmussen, R. R. (Intern), Sloth, J. J. (Intern)
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Bioavailability of cadmium from linseed and cocoa: A LOUS follow-up project

In Denmark and EU the exposure of cadmium from food is at a level that is relatively close to the Tolerable Daily Intake (TDI). This report describes an investigation of the bioavailability of cadmium in selected food items known to contain high levels of cadmium. The purpose was to provide data which can be used to further qualify the estimated exposure of the population to cadmium via food. The background for carrying out this investigation was the results from a survey of cadmium and cadmium compounds (Environmental Project no. 1471) conducted by the Danish EPA under the LOUS-review.

The investigation was conducted as a feeding study in rats in combination with in-vitro studies simulating the conditions in the stomach of both rats and humans. The results of the investigation do, however, not provide a basis for changing the current advice to the public neither regarding the intake of whole or crushed linseed nor the intake of cocoa and chocolate.

Determination of iodine and iodine compounds in marine samples by ICPMS and HPLC-ICPMS

By now it is a well-known fact that iodine is an essential trace element for the growth and development of the human body. Because of iodine deficiency, some countries have added iodate to salt in order to increase the iodine intake. However, some people prefer iodine from more natural sources like seaweed and fish, which contain elevated levels of iodine (fish typically 1-10 mg/kg and seaweed up to 8000 mg/kg). These marine food items may contain different iodine species, which may have different bioavailability and toxicity, and hence there is an increased interest in developing analytical methods for determining the different iodine species.

For determining the total iodine concentration in marine samples five different extraction methods were compared. The most efficient and precise method was then used for determining the total concentration of iodine in seaweed and fish samples using inductively coupled plasma mass spectrometry (ICPMS).

Furthermore 32 marine samples were analyzed for contents of iodide, iodate, moniodotyrosine (MIT) and diiodotyrosine (DIT). The samples were extracted using the enzyme pancreatin followed by analysis with reversed phase high performance liquid chromatography (HPLC) coupled to ICPMS. These studies may be a stepping stone for further studies that can clarify the cycle and implications of iodine species in relation to the use of marine food items as iodine sources.
Iodine excretion has decreased in Denmark between 2004 and 2010 - the importance of iodine content in milk

Fortification with the essential trace element iodine is widespread worldwide. In the present study, results on iodine excretion and intake of iodine-rich foods from a cross-sectional study carried out in 2004-5, 4 to 5 years after the implementation of mandatory iodine fortification, were compared with data in a study carried out in 2008-10. The 2008-10 study was a follow-up of a cross-sectional study carried out before iodine fortification was implemented. Participants in the cross-sectional studies were randomly selected. Both studies were carried out in the cities of Aalborg and Copenhagen in Denmark. The median urinary iodine concentration decreased in women from 97 μg/l (n 2862) to 78 μg/l (n 2041) (P<0·001). The decrease persisted after adjustment for age, city and education, and if expressed as estimated 24 h iodine excretion. The prevalence of users of iodine containing dietary supplements increased from 29·4 to 37·3 % (P<0·001). The total fluid intake increased in women (P<0·001), but the intake of other iodine-rich foods did not change. The median urinary iodine concentration did not change in men (114 μg/l (n 708) and 107 μg/l (n 424), respectively), while the total fluid intake decreased (P= 0·001). Iodine content was measured in milk sampled in 2000-1 and in 2013. The iodine content was lower in 2013 (12 (sd 3) μg/100 g) compared with that in 2000-1 (16 (sd 6) μg/100 g) (P<0·001). In conclusion, iodine excretion in women has decreased below the recommended level. The reason might probably, at least partly, be a decreased content of iodine in milk.

General information
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Organisations: National Food Institute, Division of Nutrition, Division of Food Chemistry, Aalborg University, Bispebjerg University Hospital, Capital Region of Denmark, Slagelse Hospital
Authors: Rasmussen, L. B. (Intern), Carlé, A. (Ekstern), Jørgensen, T. (Ekstern), Knuthsen, P. (Intern), Motavaf, A. K. (Ekstern), Perrild, H. (Ekstern), Bjergved, L. (Ekstern), Sloth, J. J. (Intern), Laurberg, P. (Ekstern), Ovesen, L. (Ekstern)
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Review of arsenic contamination, exposure through water and food and low cost mitigation options for rural areas
Arsenic (As) is a toxic metalloid found to be an important groundwater contaminant of mainly natural geogenic origin worldwide particularly in large deltas and along major rivers in poor regions of South- and East-Asia. Excessive and long-term human intake of toxic inorganic As with food and water is causing arsenicosis, which is disfiguring, disabling, and leading to potentially fatal diseases like skin- and internal cancers. It is estimated that more than 100 million people mainly in developing countries are at risk. The arsenicosis situation in affected countries has been named the largest chemical threat to public health ever experienced and arsenicosis is spreading to regions where near-sterile well water loaded with As has replaced microbial suspect surface water containing lower As concentrations. This review provides an overview of the state of the art knowledge on the water and food As intake and exposure, and how the As chemistry in water and food may influence chosen mitigation strategies. Although reports on severe health effects from exposure to As in water are abundant there are several weak points in our knowledge on causes and prevalence of arsenicosis in order to devise effective mitigation. The main mitigation strategies focus on drinking water based on exploration of As-free water and As removal from extracted water, whereas mitigation strategies on cooking water and reducing exposure through food are quite often overlooked. The experiences of adopted low cost methods for lowering the human intake of As in rural areas are critically evaluated in terms of public acceptance, sustainability and impact on arsenicosis. © 2013 Elsevier Ltd.

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Organisations: Department of Environmental Engineering, Urban Water Engineering, National Food Institute, Division of Food Chemistry, University of Copenhagen
Authors: Sharma, A. K. (Intern), Tjell, J. C. (Intern), Sloth, J. J. (Intern), Holm, P. E. (Ekstern)
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Total and inorganic As in seafood products caught in an environment facing a mining and industrial area in Sardinia (Italy)

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Toxic Elements in Food: Occurrence, Binding, and Reduction Approaches

Toxic elements such as mercury, arsenic, cadmium, and lead, sometimes called heavy metals, can diminish mental and central nervous system function; elicit damage to blood composition as well as the kidneys, lungs, and liver; and reduce energy levels. Food is considered one of the main routes of their entry into the human body. Numerous studies have been performed to examine the effects of common food processing procedures on the levels of toxic elements in food. While some studies have reported negative effects of processing, several have shown that processing practices may have a positive effect on the reduction of toxic elements in foodstuffs. A number of studies have also introduced protocols and suggested chemical agents that reduce the amount of toxic elements in the final food products. In this review, the reported methods employed for the reduction of toxic elements are discussed with particular emphasis on the chemical binding of both the organic and inorganic forms of each element in various foods. The molecular groups and the ligands by which the food products bind with the metals and the types of these reactions are also presented.

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry, University Putra Malaysia
Authors: Hajeb, P. (Ekstern), Sloth, J. J. (Intern), Shakibazadeh, S. (Ekstern), Mahyudin, N. A. (Ekstern), Afsah-Hejri, L. (Ekstern)
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BFI (2015): BFI-level 1
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Scopus rating (2012): SJR 2.572 SNIP 3.318 CiteScore 5.13
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.442 SNIP 1.986 CiteScore 2.98
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BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.031 SNIP 1.504
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.101 SNIP 2.62
Scopus rating (2007): SJR 0.796 SNIP 2.003
Scopus rating (2006): SJR 0.576 SNIP 1.661
Scopus rating (2005): SJR 0.787 SNIP 2.05
Scopus rating (2004): SJR 0.702 SNIP 2.073
Scopus rating (2003): SJR 0.439 SNIP 1.332
Original language: English
Urinary excretion of arsenicals following daily intake of various seafoods during a two weeks intervention

The excretion pattern of arsenic (As) species after seafood intake varies widely depending on species ingested and individual handling. We have previously reported the 72h urinary excretion of arsenicals following a single dose of seafood. Here, we report the excretion patterns in the same 37 subjects following 15days daily consumption of either 150g cod, salmon, blue mussels or potato (control), followed by a 72h period with a low-As diet. In all seafood groups, total As (tAs) in plasma and urinary excretion of tAs, arsenobetaine (AB) and dimethylarsinate (DMA) increased significantly after the intervention. Confirming the single dose study AB and DMA excreted were apparently endogenously formed from other arsenicals ingested. Total tAs excretion was 1386, 763 and 303μg in the cod, blue mussel and salmon groups, respectively; about twice the amounts after the single dose study indicating accumulation of arsenicals. In the cod group, rapid excretion after the single dose was associated with lower total As in blood and less accumulation after two weeks with seafood indicating lower accumulation. In the blue mussels group only, inorganic As (iAs) excretion increased significantly, whilst methylarsonate (MA) strongly increased, indicating a possible toxicological concern of repeated mussel consumption.
Use of alkaline or enzymatic sample pretreatment prior to characterization of gold nanoparticles in animal tissue by single-particle ICPMS.

Inductively coupled plasma mass spectrometry in single-particle mode (spICPMS) is a promising method for the detection of metal-containing nanoparticles (NPs) and the quantification of their size and number concentration. Whereas existing studies mainly focus on NPs suspended in aqueous matrices, not much is known about the applicability of spICPMS for determination of NPs in complex matrices such as biological tissues. In the present study, alkaline and enzymatic treatments were applied to solubilize spleen samples from rats, which had been administered 60-nm gold nanoparticles (AuNPs) intravenously. The results showed that similar size distributions of AuNPs were obtained independent of the sample preparation method used. Furthermore, the quantitative results for AuNP mass concentration obtained with spICPMS following alkaline sample pretreatment coincided with results for total gold concentration obtained by conventional ICPMS analysis of acid-digested tissue. The recovery of AuNPs from enzymatically digested tissue, however, was approximately four times lower. Spiking experiments of blank spleen samples with AuNPs showed that the lower recovery was caused by an inferior transport efficiency of AuNPs in the presence of enzymatically digested tissue residues.

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Organisations: National Food Institute, Division of Food Chemistry
Authors: Löschner, K. (Intern), Brabrand, M. S. J. (Intern), Sloth, J. J. (Intern), Larsen, E. H. (Intern)
Pages: 3845-3851
Publication date: 2014
Arsenic speciation in food – current status on standardization of methods for specific determination of inorganic arsenic

General information
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Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern)
Number of pages: 3
Publication date: 2013
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Main Research Area: Technical/natural sciences
Electronic versions:
Abstract_Sloth_EURL_meeting_Rome_OCT2013.pdf

Relations
Activities:
Arsenic speciation in food – current status on standardization of methods for specific determination of inorganic arsenic
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2013

Arsenic in fish oil
Fish oil can contain relatively high concentrations of the element arsenic. In fish oil, arsenic is present in the form of lipid-soluble arsenic compounds; arsenolipids. This is a relatively new group of arsenic-containing compounds that we currently have limited knowledge about. What are the chemical compounds of arsenolipids? How much is present in fish oil? And are the compounds toxic? These questions can only be answered when the analytical foundation is in place.

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry, Nasjonalt institutt for ernærings- og sjømatforskning
Authors: Sele, V. (Intern), Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Armlund, H. (Ekstern)
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Publication date: 2013
Main Research Area: Technical/natural sciences

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Chemical Contaminants. Food monitoring 2004-2011

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry, Division of Nutrition, Division of Toxicology and Risk Assessment
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Publication information
Place of publication: Søborg
Consumer leather exposure: an unrecognized cause of cobalt sensitization

BACKGROUND: A patient who had suffered from persistent generalized dermatitis for 7 years was diagnosed with cobalt sensitization, and his leather couch was suspected as the culprit, owing to the clinical presentation mimicking allergic chromium dermatitis resulting from leather furniture exposure.

MATERIALS AND METHODS: The cobalt spot test, X-ray fluorescence, inductively coupled plasma mass spectrometry and scanning electron microscopy were used to determine cobalt content and release from the leather couch that caused the dermatitis and from 14 randomly collected samples of furniture leather.

RESULTS: The sample from the patient's leather couch, but none of the 14 random leather samples, released cobalt in high concentrations. Dermatitis cleared when the patient stopped using his couch.

CONCLUSIONS: Cobalt is used in the so-called pre-metallized dyeing of leather products. Repeated studies have found high levels of cobalt sensitization, but not nickel sensitization, in patients with foot dermatitis. We raise the possibility that cobalt may be widely released from leather items, and advise dermatologists to consider this in patients with positive cobalt patch test reactions. © 2013 John Wiley & Sons A/S. Published by John Wiley & Sons Ltd.
Detection of arsenic-containing hydrocarbons in a range of commercial fish oils by GC-ICPMS analysis

The present study describes the use of a simple solid-phase extraction procedure for the extraction of arsenic-containing hydrocarbons from fish oil followed by analysis using gas chromatography (GC) coupled to inductively coupled plasma mass spectrometry (ICPMS). The procedure permitted the analysis of a small sample amount, and the method was applied on a range of different commercial fish oils, including oils of anchovy (Engraulis ringens), Atlantic herring (Clupea harengus), sand eel (Ammodites marinus), blue whiting (Micromesistius poutassou) and a commercial mixed fish oil (mix of oils of Atlantic herring, Atlantic cod (Gadus morhua) and saithe (Pollachius virens)). Total arsenic concentrations in the fish oils and in the extracts of the fish oils were determined by microwave-assisted acid digestion and ICPMS. The arsenic concentrations in the fish oils ranged from 5.9 to 8.7 mg kg⁻¹. Three dominant arsenic-containing hydrocarbons in addition to one minor unidentified compound were detected in all the oils using GC-ICPMS. The molecular structures of the arsenic-containing hydrocarbons, dimethylarsinoyl hydrocarbons (C₁₇H₃₈AsO, C₁₉H₄₂AsO, C₂₃H₃₈AsO), were verified using GC coupled to tandem mass spectrometry (MS/MS), and the accurate masses of the compounds were verified using quadrupole time-of-flight mass spectrometry (qTOF-MS). Additionally, total arsenic and the arsenic-containing hydrocarbons were studied in decontaminated and in non-decontaminated fish oils, where a reduced arsenic concentration was seen in the decontaminated fish oils. This provided an insight to how a decontamination procedure originally ascribed for the removal of persistent organic pollutants affects the level of arsenolipids present in fish oils. © 2013 Springer-Verlag Berlin Heidelberg.

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Organisations: National Food Institute, Division of Food Chemistry, National Institute for Nutrition and Seafood Research
Authors: Sele, V. (Ekstern), Amlund, H. (Ekstern), Berntssen, M. H. G. (Ekstern), Berntsen, J. A. (Ekstern), Skov, K. (Intern), Sloth, J. J. (Intern)
Pages: 5179-5190
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Speciation analysis of lipid-soluble arsenic compounds (arsenolipids) in marine oils – new compounds and new challenges
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Publication: Research - peer-review › Journal article – Annual report year: 2013
Determination of inorganic arsenic in food and feed – European initiatives in research and standardization of methods

The European legislation on trace elements concerning food and feed safety is based on total element concentrations expressed as maximum levels. However, information on the total content of an element does not always provide adequate information for evaluation of e.g. bioavailability and toxicity. These parameters may vary quite significantly depending on how the element is bound, i.e. its speciation, defined as the distribution of an element amongst defined chemical species in a system. The most important practical application of elemental speciation is in the area of toxicology and with the help of more detailed toxicological knowledge on the individual chemical elemental species should lead to more specific legislation.

The present lecture will use arsenic as an illustrative example, where inorganic arsenic is considered much more toxic than organic bound and analytical methods for selective determination of inorganic arsenic are required in order to perform a correct risk assessment of dietary exposure.

The lecture will provide the current status for recent and ongoing European initiatives and projects on methods for specific determination of inorganic arsenic in foodstuffs and feedingstuffs and expected future developments within this emerging scientific area will be discussed.

General information

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Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern), Rasmussen, R. R. (Intern)
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Inorganic arsenic – SPE HG-AAS method for rice tested in-house and collaboratively

General information

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Organisations: National Food Institute, Division of Food Chemistry
Authors: Rasmussen, R. R. (Intern), Qian, Y. (Intern), Sloth, J. J. (Intern)
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Inorganic arsenic - SPE HG-AAS method for RICE tested in-house and collaboratively

General information

State: Published
Inorganic arsenic - SPE HG-AAS method for RICE tested in-house and collaboratively

Arsenic (As) is a trace element present in the environment and consequently in various food items, e.g. rice, which may contain relatively high concentration of arsenic compared to other foodstuffs of plant origin. Rice contains most often three forms of arsenic: inorganic arsenic (iAs) and the methylated species monomethylarsonic acid (MA) and dimethylarsinic acid (DMA). Dietary intake of iAs is of special concern due to its carcinogenicity to humans, whereas DMA and MA are considered of less toxicological importance. Rice grains and rice-based products are staple foods in many countries and is one of the major contributors to the iAs exposure in many countries.

The work presented here describes the development, validation and application of a simple and inexpensive method for inorganic arsenic (iAs) determination in rice samples. The separation of iAs from organoarsenic compounds (MA and DMA) was done by off-line solidphase extraction (SPE) followed by hydride generation atomic absorption spectrometry (HG-AAS) detection. Water bath heating (90 °C, 60 min) of samples with dilute nitric acid and hydrogen peroxide solubilised and oxidized all iAs to arsenate (AsV). Loading of buffered sample extracts (pH 6±1) followed by selective elution of arsenate from a strong anion exchange SPE cartridge enabled the selective iAs quantification by HG-AAS, measuring total arsenic (As) in the SPE eluate. The in-house validation gave mean recoveries of 101–106 % for spiked rice samples and in two reference samples. The limit of detection was 0.02 mg/kg, and repeatability and intra-laboratory reproducibility were less than 6 and 9 %, respectively. The SPE HG-AAS method produced similar results compared to parallel high-performance liquid chromatography coupled to inductively coupled plasma mass spectrometry (ICP-MS) analysis. The SPE separation step was tested collaboratively, where the laboratories (N=10) used either HG-AAS or ICP-MS for iAs determination in a wholemeal rice powder. The trial gave satisfactory results (HorRat value of 1.6) and did not reveal significant difference (t test, p>0.05) between HG-AAS and ICP-MS quantification. The iAs concentration in 36 rice samples purchased on the Danish retail market varied (0.03–0.60 mg/kg), with the highest concentration found in a red rice sample.

Method validation and analysis of nine dithiocarbamates in fruits and vegetables by LC-MS/MS

An analytical method for separation and quantitative determination of nine dithiocarbamates (DTCs) in fruits and vegetables by using LC-MS/MS was developed, validated and applied to samples purchased in local supermarkets. The nine DTCs were ziram, ferbam, thiram, maneb, zineb, nabam, metiram, mancozeb and propineb. Validation parameters of mean recovery for two matrices at two concentration levels, relative repeatability (RSDr), relative within-laboratory reproducibility (RSDR) and LOD were obtained for the nine DTCs. The results from the analysis of fruits and vegetables served as the basis for an exposure assessment within the given commodities and a risk assessment by comparing the calculated exposure to the acceptable daily intake and acute reference dose for various exposure groups. The analysis indicated positive findings of DTCs in apples, pears, plums, table grapes, papaya and broccoli at concentrations ranging from 0.03 mg/kg to 2.69 mg/kg expressed as the equivalent amount of CS2. None of the values exceeded the Maximum residue level (MRL) set by the European Union, and furthermore, it was not possible to state whether illegal use had taken place or not, because a clear differentiation between the various DTCs in the LC-MS/MS analysis was lacking. The exposure and risk assessment showed that only for maneb in the case of apples and apple juice, the acute reference dose was exceeded for infants in the United Kingdom and for children in Germany, respectively.
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Authors: Schmidt, B. (Intern), Christensen, H. B. (Intern), Petersen, A. (Intern), Sloth, J. J. (Intern), Poulsen, M. E. (Intern)
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Web of Science (2016): Indexed yes
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Web of Science (2015): Indexed yes
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Scopus rating (2012): SJR 0.907 SNIP 1.12 CiteScore 2.12
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Web of Science (2012): Indexed yes
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ISI indexed (2011): ISI indexed no
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Methylmercury determined by HPLC-ICP-MS in marine food and feed: in-house method validation and inter-laboratory comparison

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Authors: Rasmussen, R. R. (Intern), Svendsen, M. E. (Intern), Rokkjær, I. (Ekstern), Sloth, J. J. (Intern), Amlund, H. (Ekstern), van der Lee , M. (Ekstern)
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Methylmercury determined by HPLC-ICP-MS in marine food and feed: in-house method validation and inter-laboratory comparison

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Authors: Rasmussen, R. R. (Intern), Svendsen, M. E. (Intern), Amlund, H. (Ekstern), Lee, M. K. V. D. (Ekstern), Rokkjær, I. (Ekstern), Sloth, J. J. (Intern)
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Occurrence and sorption properties of arsenicals in marine sediments
The content of total arsenic, the inorganic forms: arsenite (As(III)) and arsenate (As(V)), the methylated forms: monomethylarsonic acid and dimethylarsinic acid (DMA), trimethylarsenic oxide, tetramethylarsenonium ion and arsenobetaine was measured in 95 sediment samples and 11 pore water samples from the Baltic Sea near the island of Bornholm at depths of up to 100 m. As(III+V) and DMA were detected in the sediment and As(III+V) was detected in the sediment pore water. Average total As concentration of 10.6 ± 7.4 mg/kg dry matter (DM) in the sediment corresponds to previously reported values in the Baltic Sea and other parts of the world. Existing data for on-site measurements of sorption coefficients (Kd) of arsenicals in marine and freshwater sediments show large variability from 1,000 L/kg. In this work, calculated sorption coefficients (Kd and Koc) for As(III+V) showed significant correlation with depth, dissolved oxygen (DO), salinity and sediment classification; for depths 9 mg/L and sand/silt/clay sediments the Kd was 118 ± 76 L/kg DM and for depths >70 m, salinity >11 %, DO <9 mg/L and muddy sediments the Kd was 513 ± 233 L/kg DM. The authors recommend using the found Kd value for arsenic in marine sediments when conditions are similar to the Baltic Sea. At locations with significant anthropogenic point sources or where the local geology contains volcanic rock and sulphide mineral deposits, there may be significantly elevated arsenic concentrations, and it is recommended to determine on-site Kd values.

General information
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Organisations: National Food Institute, Division of Food Chemistry, Aarhus University, Rambøll Oil and Gas
Authors: Fauser, P. (Ekstern), Sanderson, H. (Ekstern), Hedegaard, R. S. V. (Intern), Sloth, J. J. (Intern), Larsen, M. M. (Ekstern), Krongaard, T. (Ekstern), Bossi, R. (Ekstern), Larsen, J. B. (Ekstern)
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Main Research Area: Technical/natural sciences

Publication information
Journal: Environmental Monitoring and Assessment
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Speciation of arsenic by IC-ICP-MS: future standard method and its application on baby food samples

Arsenic is known to most people as extremely poisonous and several criminal authors have used this fact to assassinate their characters in novels for decades. However, the authors seldom or never mention which of the species of arsenic they use, although that is elementary for the outcome of the intended murder. For example the organic compound arsenobetaine, the main arsenic species in marine organisms, is regarded as basically harmless to humans while the inorganic forms of arsenic, arsenite and arsenate found in rice, are toxic. To enable the evaluation of the true toxicity from arsenic in food, some kind of speciation analysis has to be performed. In this work, the concentration of inorganic arsenic in some baby food samples is evaluated. The applied methodology has recently been tested in a collaborative trial as a candidate standardized method for the determination of inorganic arsenic in foodstuffs by CEN (The European Committee
SPE HG-AAS method for the determination of inorganic arsenic in rice—results from method validation studies and a survey on rice products

The present paper describes the development, validation and application of a method for inorganic arsenic (iAs) determination in rice samples. The separation of iAs from organoarsenic compounds was done by off-line solid-phase extraction (SPE) followed by hydride generation atomic absorption spectrometry (HG-AAS) detection. This approach was earlier developed for seafood samples (Rasmussen et al., Anal Bioanal Chem 403:2825–2834, 2012) and has in the present work been tailored for rice products and further optimised for a higher sample throughput and a lower detection limit. Water bath heating (90 °C, 60 min) of samples with dilute HNO3 and H2O2 solubilised and oxidised all iAs to arsenate (AsV). Loading of buffered sample extracts (pH 6 ± 1) followed by selective elution of arsenate from a strong anion exchange SPE cartridge enabled the selective iAs quantification by HG-AAS, measuring total arsenic (As) in the SPE eluate. The in-house validation gave mean recoveries of 101–106 % for spiked rice samples and in two reference samples. The limit of detection was 0.02 mg kg−1, and repeatability and intra-laboratory reproducibility were less than 6 and 9 %, respectively. The SPE HG-AAS method produced similar results compared to parallel high-performance liquid chromatography coupled to inductively coupled plasma mass spectrometry (ICP-MS) analysis. The SPE separation step was tested collaboratively, where the laboratories (N = 10) used either HG-AAS or ICP-MS for iAs determination in a wholemeal rice powder. The trial gave satisfactory results (HorRat value of 1.6) and did not reveal significant difference (t test, p > 0.05) between HG-AAS and ICP-MS quantification. The iAs concentration in 36 rice samples purchased on the Danish retail market varied (0.03–0.60 mg kg−1), with the highest concentration found in a red rice sample.
Total and inorganic arsenic in dietary supplements based on herbs, other botanicals and algae—a possible contributor to inorganic arsenic exposure

The content of total and inorganic arsenic was determined in 16 dietary supplements based on herbs, other botanicals and algae purchased on the Danish market. The dietary supplements originated from various regions, including Asia, Europe and USA. The contents of total and inorganic arsenic was determined by inductively coupled plasma mass spectrometry (ICP-MS) and anion exchange HPLC-ICP-MS, respectively, were in the range of 0.58 to 5.0 mg kg\(^{-1}\) and 0.03 to 3.2 mg kg\(^{-1}\), respectively, with a ratio between inorganic arsenic and total arsenic ranging between 5 and 100 %. Consumption of the recommended dose of the individual dietary supplement would lead to an exposure to inorganic arsenic within the range of 0.07 to 13 μg day\(^{-1}\). Such exposure from dietary supplements would in worst case constitute 62.4 % of the range of benchmark dose lower confidence limit values (BMDL01 at 0.3 to 8 μg kg bw\(^{-1}\) kg\(^{-1}\) day\(^{-1}\) put down by European Food Safety Authority (EFSA) in 2009, for cancers of the lung, skin and bladder, as well as skin lesions. Hence, the results demonstrate that consumption of certain dietary supplements could contribute significantly to the dietary exposure to inorganic arsenic at levels close to the toxicological limits established by EFSA.

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Dietary supplements, Inorganic arsenic, Speciation analysis, HPLC-ICP-MS, Dietary exposure

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Arsenolipids in fish oil determined by GC-ICPMS

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Authors: Sele, V. (Ekstern), Amlund, H. (Ekstern), Julshamn, K. (Ekstern), Sloth, J. J. (Intern)
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Arsenolipids in marine oils and fats: A review of occurrence, chemistry and future research needs
Numerous studies have focused on arsenic in marine organisms, and relatively high natural levels of the element have been reported in marine samples. Despite their seemingly consistent presence in marine oils and fats, there is currently only limited knowledge available on arsenic compounds that exhibit lipid soluble characteristics, the arsenolipids, in contrast to the water-soluble arsenic species. The development of analytical techniques has, however, renewed the interest in these arsenic species and significant novel findings have been published in the last couple of years. The aim of this review is to present current knowledge on the occurrence and chemistry of arsenolipids in marine oils, and to identify future research needs. The occurrence of arsenolipids and their relevance in marine organisms will be discussed, in addition to their relevance for consumers and industry, with respect to feed and food safety and legislative issues. Analytical techniques, including techniques in the early work on arsenolipids in addition to methods employed today, and relevant sample preparation will be discussed.

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BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.597 SNIP 1.962 CiteScore 4.31
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.595 SNIP 2.027 CiteScore 3.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.548 SNIP 2.069 CiteScore 3.87
Determination of Arsenic Species in Marine Samples using Cation Exchange HPLC-ICP-MS

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry, National Institute for Nutrition and Seafood Research
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Larsen, E. H. (Intern)
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Edition: 2
Determination of Inorganic Arsenic in Rice by Anion Exchange HPLC-ICP-MS

General information
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Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern), Herbst, M. B. K. (Intern), Hedegaard, R. S. V. (Intern), Rasmussen, R. R. (Intern)
Pages: 13-14
Publication date: 2012

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Links:
http://www.chem.agilent.com/en-US/Products/Instruments/atomicspectroscopy/Pages/speciation2_eHB.aspx
Publication: Research - peer-review › Book chapter – Annual report year: 2012

Development and validation of an SPE HG-AAS method for determination of inorganic arsenic in samples of marine origin

The present paper describes a novel method for the quantitative determination of inorganic arsenic (iAs) in food and feed of marine origin. The samples were subjected to microwave-assisted extraction using diluted hydrochloric acid and hydrogen peroxide, which solubilised the analytes and oxidised arsenite (As(III)) to arsenate (As(V)). Subsequently, a pH buffering of the sample extract at pH 6 enabled selective elution of As(V) from a strong anion exchange solid-phase extraction (SPE) cartridge. Hydride generation atomic absorption spectrometry (HG-AAS) was applied to quantify the concentration of iAs (sum of As(III) and As(V)) as the total arsenic (As) in the SPE eluate. The results of the in-house validation showed that mean recoveries of 101-104% were achieved for samples spiked with iAs at 0.5, 1.0 and 1.5 mg kg(-1), respectively. The limit of detection was 0.08 mg kg(-1), and the repeatability (RSD(r)) and intra-laboratory reproducibility (RSD(IR)) were less than 8% and 13%, respectively, for samples containing 0.2 to 1.5 mg kg(-1) iAs. The trueness of the SPE HG-AAS method was verified by confirming results obtained by parallel analysis using high-performance liquid chromatography coupled to inductively coupled plasma mass spectrometry. It was demonstrated that the two sets of results were not significantly different (P <0.05). The SPE HG-AAS method was applied to 20 marine food and feed samples, and concentrations of up to 0.14 mg kg(-1) of iAs were detected.

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Rasmussen, R. R. (Intern), Hedegaard, R. S. V. (Intern), Larsen, E. H. (Intern), Sloth, J. J. (Intern)
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Main Research Area: Technical/natural sciences

Publication information
Journal: Analytical and Bioanalytical Chemistry
Volume: 403
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BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.03 SJR 0.943 SNIP 1.039
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Humans seem to produce arsenobetaine and dimethylarsinate after a bolus dose of seafood

Seafood is the predominant food source of several organoarsenic compounds. Some seafood species, like crustaceans and seaweed, also contain inorganic arsenic (iAs), a well-known toxicant. It is unclear whether human biotransformation of ingested organoarsenicals from seafood result in formation of arsenicals of health concern. The present controlled dietary study examined the urinary excretion of arsenic compounds (total arsenic (tAs), iAs, AB (arsenobetaine), dimethylarsinate (DMA) and methylarsonate (MA)) following ingestion of a single test meal of seafood (cod, 780μg tAs, farmed salmon, 290μg tAs or blue mussel, 690μg tAs or potato (control, 110μg tAs)) in 38 volunteers. The amount of ingested tAs excreted via the urine within 0–72h varied significantly among the groups: Cod, 74% (52–92%), salmon 56% (46–82%), blue mussel 49% (37–78%), control 45% (30–60%). The estimated total urinary excretion of AB was higher than the amount of ingested AB in the blue mussel group (112%) and also ingestion of cod seemed to result in more AB, indicating possible endogenous formation of AB from other organoarsenicals. Excretion of iAs was lower than ingested (13–22% of the ingested iAs was excreted in the different groups). Although the ingested amount of iAs+DMA+MA was low for all seafood groups (1.2–4.5% of tAs ingested), the urinary DMA excretion was high in the blue mussel and salmon groups, counting for 25% and 11% of the excreted tAs respectively. In conclusion our data indicate a possible formation of AB as a result of
biotransformation of other organic arsenicals. The considerable amount of DMA excreted is probably not only due to methylation of ingested iAs, but due to biotransformation of organoarsenicals making it an inappropriate biomarker of iAs exposure in populations with a high seafood intake.

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Organisations: Division of Food Chemistry, National Food Institute, Oslo and Akershus University College of Applied Sciences, National Institute for Nutrition and Seafood Research, Institute for Chemistry-Analytical Chemistry, Norwegian Institute of Public Health, Statistics Norway
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BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.12 SJR 1.394 SNIP 1.334
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.449 SNIP 1.349 CiteScore 3.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.787 SNIP 1.766 CiteScore 4.32
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.552 SNIP 1.596 CiteScore 3.75
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.534 SNIP 1.362 CiteScore 3.31
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.696 SNIP 1.51 CiteScore 3.7
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.657 SNIP 1.491
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.495 SNIP 1.39
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.368 SNIP 1.414
Scopus rating (2007): SJR 1.304 SNIP 1.614
Scopus rating (2006): SJR 1.189 SNIP 1.507
Scopus rating (2005): SJR 1.08 SNIP 1.334
Scopus rating (2004): SJR 0.811 SNIP 0.97
Scopus rating (2003): SJR 0.76 SNIP 1.183
Scopus rating (2002): SJR 0.943 SNIP 1.264
Scopus rating (2001): SJR 0.941 SNIP 1.261
Scopus rating (2000): SJR 0.904 SNIP 1.149
Scopus rating (1999): SJR 0.706 SNIP 1.371
ICP-MS and HPLC-ICP-MS for large scale monitoring of total arsenic and inorganic arsenic in Norwegian seafood

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry, National Institute for Nutrition and Seafood Research, Institute of Marine Research
Authors: Julshamn, K. (Ekstern), Nilsen, B. M. (Ekstern), Frantzen, S. (Ekstern), Valdersnes, S. ( Ekstern), Måge, A. (Ekstern), Nedreaas, K. (Ekstern), Fliegel, D. (Ekstern), Sloth, J. J. (Intern)
Number of pages: 1
Publication date: 2012
Main Research Area: Technical/natural sciences
Electronic versions:
2012 NordicPlasma iAs in norwegian fish Fliegel-JJSL.pdf

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Publication: Research - peer-review › Poster – Annual report year: 2012

ICPMS as an element-specific detector for the analysis of trace element species and nanoparticles

General information
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Organisations: Division of Food Chemistry, National Food Institute, Technical University of Denmark
Authors: Sloth, J. J. (Intern), Trier, X. (Intern), Loeschner, K. (Ekstern), Larsen, E. H. (Intern)
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JJSL DSMS møde Svendborg Jan2012.pdf
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Is it possible to agree on a value for inorganic arsenic in food? The outcome of IMEP-112

Two of the core tasks of the European Union Reference Laboratory for Heavy Metals in Feed and Food (EU-RL-HM) are to provide advice to the Directorate General for Health and Consumers (DG SANCO) on scientific matters and to organise proficiency tests among appointed National Reference Laboratories. This article presents the results of the 12th proficiency test organised by the EU-RL-HM (IMEP-112) that focused on the determination of total and inorganic arsenic in wheat, vegetable food and algae. The test items used in this exercise were: wheat sampled in a field with a high concentration of arsenic in the soil, spinach (SRM 1570a from NIST) and an algae candidate reference material. Participation in this exercise was open to laboratories from all around the world to be able to judge the state of the art of the determination of total and, more in particular, inorganic arsenic in several food commodities. Seventy-four laboratories from 31 countries registered to the exercise; 30 of them were European National Reference Laboratories. The assigned values for IMEP-112 were provided by a group of seven laboratories expert in the field of arsenic speciation analysis in food. Laboratory results were rated with z and ζ scores (zeta scores) in accordance with ISO 13528. Around 85 % of the participants performed satisfactorily for inorganic arsenic in vegetable food and 60 % did for inorganic arsenic in wheat, but only 20 % of the laboratories taking part in the exercise were able to report satisfactory results in the algae test material.
Major and minor arsenic compounds accounting for the total urinary excretion of arsenic following intake of blue mussels (Mytilus edulis): A controlled human study

Blue mussels (Mytilus edulis) accumulate and biotransform arsenic (As) to a larger variety of arsenicals than most seafood. Eight volunteers ingested a test meal consisting of 150g blue mussel (680μg As), followed by 72h with an identical, low As controlled diet and full urine sampling. We provide a complete speciation, with individual patterns, of urinary As excretion. Total As (tAs) urinary excretion was 328±47μg, whereof arsenobetaine (AB) and dimethylarsinate (DMA) accounted for 66% and 21%, respectively. Fifteen minor urinary arsenicals were quantified with inductively coupled plasma mass spectrometry (ICPMS) coupled to reverse-phase, anion and cation-exchange high performance liquid chromatography (HPLC). Thio-arsenicals and non-thio minor arsenicals (including inorganic As (iAs) and methylarsonate (MA)) contributed 10% and 7% of the total sum of species excretion, respectively, but there were large individual differences in the excretion patterns. Apparently, formation of thio-arsenicals was negatively correlated to AB formation and excretion, possibly indicating a metabolic interrelationship. The results may be of toxicological relevance since DMA and MA have been classified as possibly carcinogenic, and six of the excreted As species were thio-arsenicals which recently have been recognized as toxic, while iAs toxicity is well known.

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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.96 SJR 1.322 SNIP 1.589
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.213 SNIP 1.426 CiteScore 3.44
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.042 SNIP 1.381 CiteScore 3.12
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.013 SNIP 1.52 CiteScore 3.26
ISI indexed (2013): ISI indexed yes
Quantitative Characterization of Gold Nanoparticles by Field-Flow Fractionation (FFF) Coupled On-Line with Light Scattering Detection and ICP-MS

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Schmidt, B. (Intern), Löschner, K. (Intern), Sloth, J. J. (Intern), Larsen, E. H. (Intern)
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Speciation analysis of trace elements in foodstuffs by HPLC- and GC-ICPMS

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Authors: Sloth, J. J. (Intern)
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Electronic versions:
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Specific Migration of Organotin Compounds from Food Contact Materials — Selective Determination by GC-ICP-MS

General information
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Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern), Trier, X. (Intern), Herbst, M. B. K. (Intern), Jensen, L. K. (Intern), Larsen, E. H. (Intern)
Pages: 85-88
Publication date: 2012

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Main Research Area: Technical/natural sciences
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The CONffIDENCE project - The outcome of WP3 on heavy metals

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Authors: Sloth, J. J. (Intern)
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Original language: English
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JJSL_Conffidence_WP3_presentation_stakeholder_workshop_brussel_200912.pdf

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Oral presentation
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Source-ID: u::5029
Publication: Research › Sound/Visual production (digital) – Annual report year: 2012
Total and inorganic arsenic in fish samples from Norwegian waters.
The contents of total arsenic and inorganic arsenic were determined in fillet samples of Northeast Arctic cod, herring, mackerel, Greenland halibut, tusk, saithe and Atlantic halibut. In total, 923 individual fish samples were analysed. The fish were mostly caught in the open sea off the coast of Norway, from 40 positions. The determination of total arsenic was carried out by inductively coupled plasma mass spectrometry following microwave-assisted wet digestion. The determination of inorganic arsenic was carried out by high-performance liquid chromatography–ICP-MS following microwave-assisted dissolution of the samples. The concentrations found for total arsenic varied greatly between fish species, and ranged from 0.3 to 110 mg kg⁻¹ wet weight. For inorganic arsenic, the concentrations found were very low.
A novel speciation alternative for the determination of inorganic arsenic in marine samples

Arsenic (As) is bioaccumulated from seawater to concentrations in the mg/kg range in marine animals. More than 50 naturally-occurring arsenic containing species, both inorganic and organic forms, have been identified in marine animals. The organic forms are mainly considered to be non-toxic, whereas inorganic arsenic is highly toxic and exposure may lead to severe adverse effects including cancer. Since seafood is the major dietary source for arsenic exposure in the European population, arsenic speciation analysis of marine samples is highly relevant for food safety. However, most data collected in the official EU food control today are reported as total arsenic. High Performance Liquid Chromatography Inductively Coupled Plasma Mass Spectrometry (HPLC-ICP-MS) is a useful but expensive tool for metal speciation analysis. Our novel, simple and inexpensive method for determination of inorganic arsenic in marine based food is based on microwave extraction, species separation by strong anion solid phase extraction (SPE) and hydride generation atomic absorption spectrometry (HG-AAS) detection. Separation organic arsenic compounds (e.g. MA, DMA and AB) and inorganic arsenic in the form of As(V) is possible due to different charges (pKa values) of the arsenic species at a specific pH. SPE method development and sample extraction was evaluated using HPLC-ICP-MS. No degradation or conversion of organic arsenic species such as AB, MA or DMA were observed under the chosen extraction conditions. In brief: The sample is heated with a hydrochloric acid and hydrogen peroxide solution (20 minutes at 90 °C with 0.06 M HCl, 3 % H2O2). Hereby the sample is solubilised and As(III) is oxidised to As(V). Inorganic arsenic is selectively separated from other arsenic compounds using strong anion exchange SPE. The procedure include first pre-condition of the column, then loading of the buffered samples (pH 5.0-7.5), washing with 0.5 M acetic acid and finally elution of the sample from the column by 0.5 M HCl. The concentration of arsenic is determined by HG-AAS using external standards. The method SPE-HG-AAS was in-house validated by spiked and naturally incurred marine samples. Mean recoveries of the spiked samples were 101–104 %. The limit of detection was determined to 0.08 mg/kg and was calculated as three times the standard deviation at intra-laboratory reproducibility conditions divided by the average recovery, both at the lowest spike level (0.5 mg/kg). The in-house reproducibility standard deviations were less than ≤13 % for samples containing 0.2 to 1.5 mg/kg inorganic arsenic. The results obtained by SPE-HG-AAS and HPLC-ICP-MS detection were not significantly different (95 % confidence). Acknowledgement: Funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 211326.
Course on Advanced Analytical Chemistry and Chromatography

Methods of analytical chemistry constitute an integral part of decision making in chemical research, and students must master a high degree of knowledge, in order to perform reliable analysis. At DTU departments of chemistry it was thus decided to develop a course that was attractive to master students of different direction of studies, to Ph.D. students and to professionals that need an update of their current state of skills and knowledge. A course of 10 ECTS points was devised with the purpose of introducing students to analytical chemistry and chromatography with the aim of including theory, exercises, presentations, practices and procedures, and reporting. After the course the students are able to perform the tasks of analytical laboratories at the level of laboratory leader. Subjects of quality assurance are difficult to make interesting to the students but in this course exercises are included that encourage students in a competitive manner to demonstrate their laboratory skills under the conditions of method validation. This tutorial procedure proved successful in the sense that students were able to understand and report the results according to standard operations procedures. The students are provided with detailed oral instructions and limited instructions in writing thus allowing them to conceive their own approach to designing the experimental setup in close collaboration with teachers. There are several teachers of different DTU departments affiliated to the course allowing the students to meet the foremost experts of technology in specialized areas of chemical analysis and chromatography. Laboratory exercises are performed at different laboratories that provide access to high-quality apparatus. The students are evaluated by a report of exercises extending to 2½ ECTS and an oral examination in the remaining part of the syllabus covering 7.5 ECTS.

Does the determination of inorganic arsenic in rice depend on the method?

In answering a request from the Directorate General for Health and Consumers of the European Commission, the European Union Reference Laboratory for Heavy Metals in Feed and Food, with the support of the International Measurement Evaluation Program, organized a proficiency test (PT), IMEP-107, on the determination of total and inorganic arsenic (As) in rice. The main aim of this PT was to judge the state of the art of analytical capability for the determination of total and inorganic As in rice. For this reason, participation in this exercise was open to laboratories from all over the world. Some 98 laboratories reported results for total As and 32 for inorganic As. The main conclusions of IMEP-107 were that the concentration of inorganic As determined in rice does not depend on the analytical method applied and that introduction of a maximum level for inorganic As in rice should not be postponed because of analytical concerns.
Effects of prenatal exposure to surface-coated nanosized titanium dioxide (UV-Titan). A study in mice (vol 7, 16, 2010)

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Organisations: Division of Food Chemistry, National Food Institute, Division of Toxicology and Risk Assessment, Roskilde University, National Research Center for Working Environment, University of Copenhagen
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Main Research Area: Technical/natural sciences

Publication information
Journal: Particle and Fibre Toxicology
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 9.4 SJR 2.742 SNIP 2.165
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3 SNIP 2.013 CiteScore 8.84
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.359 SNIP 1.81 CiteScore 6.94
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.713 SNIP 2.388 CiteScore 8.5
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.032 SNIP 2.075 CiteScore 8.84
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.705 SNIP 1.887 CiteScore 7.51
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.102 SNIP 1.385
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.138 SNIP 1.743
Web of Science (2009): Indexed yes
Heavy metals in feed - Current regulation, risk assessment, methods of analysis, examples and future trends

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Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern)
Publication date: 2011

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http://www.akademie-fresenius.de/konferenz/output.php?kurs=278
Source: orbit
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Publication: Research › Sound/Visual production (digital) – Annual report year: 2011

IMEP-32: Determination of inorganic arsenic in animal feed of marine origin: A Collaborative Trial Report
A collaborative study, IMEP-32, was conducted in accordance with international protocols to determine the performance characteristics of an analytical method for the determination of inorganic arsenic in animal feed of marine origin. The method would support Directive No 2002/32/EC of the European Parliament and the Council on undesirable substances in animal feed [1] where it is indicated that "Upon request of the competent authorities, the responsible operator must perform an analysis to demonstrate that the content of inorganic arsenic is lower than 2 ppm". The method is based on solid phase extraction (SPE) separation of inorganic arsenic from organoarsenic compounds followed by detection with hydride generation atomic absorption spectrometry (HG-AAS). The collaborative study investigated different types of samples of marine origin, including complete feed (unsiked and spiked), fish meal (unsiked and spiked), fish fillet (spiked) and a lobster hepatopancreas (unsiked). In total seven samples were investigated within the concentration range of 0.07 – 2.6 mg kg⁻¹. The test samples were dispatched to 23 laboratories in 12 different countries. Nineteen participants reported results. The performance characteristics are presented in this report. All method performance characteristics obtained in the frame of this collaborative trial indicates that the proposed SPE-HG-AAS standard method is fit for the intended analytical purpose.

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Authors: Sloth, J. J. (Intern), Cordeiro, F. (Ekstern), Rasmussen, R. R. (Intern), Hedegaard, R. S. V. (Intern), Emteborg, H. (Ekstern), Verbist, I. (Ekstern), Danier, J. (Ekstern), de la Calle, M. B. (Ekstern)
Number of pages: 41
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Publisher: European Union
Mercury speciation analysis in marine samples by HPLC-ICPMS

Mercury (Hg) is a naturally occurring element, which is found in the earth’s crust and can be released into the environment through both natural and anthropogenic processes. Mercury exists as elemental mercury (metallic), inorganic mercury and organic mercury (primarily methylmercury). Methylmercury is highly toxic, particularly to the nervous system, and the developing brain is thought to be the most sensitive target organ for methylmercury toxicity. Methylmercury bioaccumulates and biomagnifies along the food chain and it is the most common mercury species in fish and seafood. Human exposure to methylmercury is mainly from fish and other seafood consumption. A simple method for the determination of methylmercury in marine based foods and feeds has been developed and in-house validated. The applied HPLC-ICPMS method was inspired by Vallant et al (2007). Samples were extracted with 5 M hydrochloric acid by sonication. Hereby the protein-bound mercury species are released. The extracts were then centrifuged (10 min at 3170 x g) and the supernatant decanted (extraction step was repeated twice). The combined extracts were added 10 M sodium hydroxide to increase pH, following further dilution in the mobile phase and filtering prior to analysis. Analysis of mercury species were performed using HPLC-ICPMS equipped with a MicroMist nebuliser. Typical plasma conditions were 1500 W RF power, 15 l/min, 0.97 l/min and 0.17 l/min for plasma, carrier and makeup gas, respectively. Analysis was performed in the time resolved analysis mode monitoring the $^{202}$Hg, $^{198}$Hg, $^{35}$Cl (m/z) with 1 s (Hg) and 0.01 s (Cl) integration time per data point. Separation of inorganic mercury and methylmercury was obtained on a polymer-based cation-exchange column (150×2.1 mm id, 10 μm) using isocratic elution (0.2 ml/min at 40 °C). The mobile phase (pH~3) consisted of L-cysteine (0.5% w/w), pyridine (50 mmol/L), methanol (5% v/w) and formic acid (0.8% v/w). Total run time 10 min. External calibration standards (0–10 μg/L) were run before and after the samples in order to quantify the methylmercury species by peak height (m/z 202). The methylmercury method was validated by triplicate analysis of certified reference materials (DORM-2, TORT-2 and DORM-3) and 4 other fish and feed samples of marine origin, repeated on 3 different days. The limit of detection and quantification were 0.027 and 0.054 mg/kg, respectively. The limits were calculated as three and ten times the standard deviation at intra-laboratory reproducibility conditions of a natural fortified sample with low content (0.06 mg/kg) divided by average recoveries for certified reference materials. Mean recoveries of the reference materials were 94–102%. The in-house reproducibility standard deviations were less than ±12% for samples containing 0.15 to 4.47 mg/kg and less than ±20% for samples with 0.06 mg/kg. Vallant B, Kadnar R and Goessler W (2007) J Anal Atom Spectrom 22, 322–325. Acknowledgement: Funding from the European Community’s Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 211326.

General Information

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Organisations: Division of Food Chemistry, National Food Institute
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Main Research Area: Technical/natural sciences
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Novel developments and future needs in methods of analysis for trace element species in food and feed control

General Information

State: Published
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Authors: Sloth, J. J. (Intern)
Publication date: 2011
Performance of laboratories in speciation analysis in seafood – Case of methylmercury and inorganic arsenic

The international measurement evaluation program (IMEP) has together with the European Reference Laboratory for Heavy Metals in Feed and Food (EU-RL-HM) carried out two interlaboratory comparisons (ILC) in 2010 on the measurement of trace metals, as well as methylmercury and inorganic arsenic in seafood. In IMEP-109 only EU National Reference Laboratories (NRL) took part, while IMEP-30 was open to all laboratories. In this article only methylmercury and inorganic arsenic analysis will be discussed, as these appear generally to be more problematic measurands. They are also particularly interesting to legislators, as no maximum limits have been set yet for them in European legislation. The aim of the two ILCs was to produce more information to help tackling this issue. The results of the two exercises were pooled together, evaluated, and compared with former ILC projects for methylmercury and inorganic arsenic analysis. Results for inorganic arsenic were spread, but not method dependant. The measurand seems to be difficult to analyse in this matrix and possible method issues were identified. Methylmercury results were satisfactory, but not many laboratories perform this type of analysis because it is generally believed that specific instrumentation is needed. As an answer to this presumption, alternatives are suggested.
Quantitative Characterization of Gold Nanoparticles by Field-Flow Fractionation Coupled Online with Light Scattering Detection and Inductively Coupled Plasma Mass Spectrometry

An analytical platform coupling asymmetric flow field-flow fractionation (AF4) with multiangle light scattering (MALS), dynamic light scattering (DLS), and inductively coupled plasma mass spectrometry (ICPMS) was established and used for separation and quantitative determination of size and mass concentration of nanoparticles (NPs) in aqueous suspension. Mixtures of three polystyrene (PS) NPs between 20 and 100 nm in diameter and mixtures of three gold (Au) NPs between 10 and 60 nm in diameter were separated by AF4. The geometric diameters of the separated PS NPs and the hydrodynamic diameters of the Au and PS NPs were determined online by MALS and DLS, respectively. The three separated Au NPs were quantified by ICPMS and recovered at 50–95% of the injected masses, which ranged between approximately 8–80 ng of each nanoparticle size. Au NPs adhering to the membrane in the separation channel was found to be a major cause for incomplete recoveries. The lower limit of detection (LOD) ranged between 0.02 ng Au and 0.4 ng Au, with increasing LOD by increasing nanoparticle diameter. The analytical platform was applied to characterization of Au NPs in livers of rats, which were dosed with 10 nm, 60 nm, or a mixture of 10 and 60 nm nanoparticles by intravenous injection. The homogenized livers were solubilized in tetramethylammonium hydroxide (TMAH), and the recovery of Au NPs from the livers amounted to 86–123% of their total Au content. In spite of successful stabilization with bovine serum albumin even in alkaline medium, separation of the Au NPs by AF4 was not possible due to association with undissolved remains of the alkali-treated liver tissues as demonstrated by electron microscopy images.
Speciation analysis of trace elements in food and feed - status and future developments
Speciation analysis of trace elements in relation to food and feed control - status and future developments

Speciation of arsenic and mercury in feed: why and how?

Speciation of arsenic and mercury in feed: why and how?

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern)
Number of pages: 23
Publication date: 2011

Publication information
Original language: English
Publisher: DTU Food
Main Research Area: Technical/natural sciences
Electronic versions:
enews_JJSL AOAC_meeting_Speciation....ew_Orleans_Sept2011_final_red.pdf
Links:
Source: orbit
Source-ID: 255878
Publication: Research › Sound/Visual production (digital) – Annual report year: 2011

The understanding of the mechanisms of biological activities and biotransformation of trace elements such as arsenic and mercury has improved during recent years with the help of chemical speciation studies. However, the most important practical application of elemental speciation is in the area of toxicology. Toxicological knowledge on the individual trace element species can lead to more specific legislation of hazardous substances found in feed. Examples here are arsenic, where the inorganic forms are the most toxic, and mercury, where the organic form methylmercury is more toxic than inorganic mercury. In the present paper an overview of the current knowledge on arsenic and mercury speciation in feed and analytical methodologies for arsenic and mercury speciation analysis are given. Additionally the current status and expected future developments within legislation for trace element speciation in feed as well as initiatives for the establishment of standardized methods for determination of inorganic arsenic and methylmercury are presented.

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Hedegaard, R. S. V. (Intern), Sloth, J. J. (Intern)
Pages: 45-51
Publication date: 2011
Main Research Area: Technical/natural sciences

Publication information
Journal: Biotechnologie, Agronomie, Societe et Environnement
Volume: 15
Issue number: S1
ISSN (Print): 1370-6233
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
Speciation of Heavy Metals – an important parameter for risk assessment of feed and food safety in aquaculture

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern)
Publication date: 2011

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
JJSL.pdf
Links:
Source: orbit
Source-ID: 275315
Publication: Research - peer-review › Journal article – Annual report year: 2011

Speciation of Heavy Metals – an important parameter for risk assessment of feed and food safety in aquaculture

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern)
Publication date: 2011

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
JJSL.pdf
Links:
https://www.was.org/WasMeetings/meetings/Default.aspx?code=WA2011
Source: orbit
Source-ID: 278438
Publication: Research › Sound/Visual production (digital) – Annual report year: 2011
Arsenic speciation in marine samples – focus on shellfish and seafood safety

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 262418
Publication: Research › Paper – Annual report year: 2010

Arsenolipids in fish oils

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Sele, V. (Intern), Amlund, H. (Ekstern), Lundebye, A. (Ekstern), Herbst, M. B. K. (Intern), Sloth, J. J. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 264752
Publication: Research › Poster – Annual report year: 2010

Arsenolipids in seafood

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute, National Institute for Nutrition and Seafood Research
Authors: Sele, V. (Ekstern), Lundebye, A. (Ekstern), Sloth, J. J. (Intern), Amlund, H. (Ekstern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 270689
Publication: Research › Poster – Annual report year: 2010

Determination of inorganic arsenic by MAE-SPE-HG-AAS - A simple and inexpensive speciation alternative

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Hedegaard, R. S. V. (Intern), Sloth, J. J. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 257359
Publication: Research › Poster – Annual report year: 2010

Determination of inorganic arsenic - food and feed

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern)
Publication date: 2010
Event: Paper presented at 5th EU Reference Laboratory Workshop, Brussels, Belgium.
Main Research Area: Technical/natural sciences
Source: orbit
Effects of prenatal exposure to surface-coated nanosized titanium dioxide (UV-Titan). A study in mice

Background: Engineered nanoparticles are smaller than 100 nm and designed to improve or achieve new physicochemical properties. Consequently, also toxicological properties may change compared to the parent compound. We examined developmental and neurobehavioral effects following maternal exposure to a nanoparticulate UV-filter (UV-titan L181). Methods: Time-mated mice (C57BL/6 BomTac) were exposed by inhalation 1h/day to 42 mg/m^3 aerosolized powder (1.7·10^6 n/cm^3; peak-size: 97 nm) on gestation days 8-18. Endpoints included: maternal lung inflammation; gestational and litter parameters; offspring neurofunction and fertility. Physicochemical particle properties were determined to provide information on specific exposure and deposition. Results: Particles consisted of mainly elongated rutile titanium dioxide (TiO2) with an average crystallite size of 21 nm, modified with Al, Si and Zr, and coated with polyalcohols. In exposed adult mice, 38 mg Ti/kg was detected in the lungs on day 5 and differential cell counts of bronchoalveolar lavage fluid revealed lung inflammation 5 and 26-27 days following exposure termination, relative to control mice. As young adults, prenatally exposed offspring tended to avoid the central zone of the open field and exposed female offspring displayed enhanced prepulse inhibition. Cognitive function was unaffected (Morris water maze test). Conclusion: Inhalation exposure to nano-sized UV Titan dusts induced long term lung inflammation in time-mated adult female mice. Gestationally exposed offspring displayed moderate neurobehavioral alterations. The results are discussed in the light of the observed particle size distribution in the exposure atmosphere and the potential pathways by which nanoparticles may impart changes in fetal development.

General Information

State: Published
Organisations: Division of Food Chemistry, Division of Toxicology and Risk Assessment, National Food Institute, Section for Indoor Environment, Department of Civil Engineering, National Research Center for Working Environment
Pages: 16
Publication date: 2010
Main Research Area: Technical/natural sciences

Publication Information

Journal: Particle and Fibre Toxicology
Volume: 7
ISSN (Print): 1743-8977
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 9.4 SJR 2.742 SNIP 2.165
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3 SNIP 2.013 CiteScore 8.84
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.359 SNIP 1.81 CiteScore 6.94
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.713 SNIP 2.388 CiteScore 8.5
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.032 SNIP 2.075 CiteScore 8.84
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.705 SNIP 1.887 CiteScore 7.51
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.102 SNIP 1.385
Metal accumulation and food safety in wastewater-fed aquatic production systems in Hanoi, Vietnam. Risk assessment of the human dietary intake of different elements

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Jensen, B. H. (Intern), Sloth, J. J. (Intern), Petersen, A. (Intern)
Publication date: 2010

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 272736
Publication: Research - peer-review › Report – Annual report year: 2010

Rapid Methods for Metal Speciation

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern)
Publication date: 2010
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 257358
Publication: Research › Paper – Annual report year: 2010

Stability of arsenic compounds in seafood samples during processing and storage by freezing
In this study, the stability of arsenic compounds in fresh and frozen samples of raw, boiled and fried Atlantic cod (Gadhus morhua), Atlantic salmon (Salmo salar) and blue mussel (Mytilus edulis) were examined. Results show that the total arsenic concentrations of the fresh Atlantic cod and Atlantic salmon samples were not different from the frozen samples within the same seafood type. For blue mussel, the total arsenic concentration decreased significantly after storage. Inorganic arsenic was found only in blue mussels and, importantly, no significant increase of inorganic arsenic was observed after processing or after storage by freezing. The content of tetramethylarsionium ion was generally low in all samples types, but increased significantly in all fried samples of both fresh and frozen seafood. Upon storage by freezing, the arsenobetaine content was reduced significantly, but only in the samples of blue mussels.
The role of GC-ICPMS in food analysis applications

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern)
Publication date: 2010

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 268706
Publication: Research › Sound/Visual production (digital) – Annual report year: 2010

AFFF-MALS-ICP-MS and electron microscopy for the characterization of nanoparticles in biological studies

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute, National Research Center for Working Environment, Chinese Academy of Sciences
Authors: Löschner, K. (Intern), Schmidt, B. (Intern), Jensen, K. A. (Ekstern), Gao, X. (Ekstern), Sloth, J. J. (Intern), Larsen, E. H. (Intern)
Publication date: 2009
Event: Poster session presented at 4th International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 252220
Publication: Research › Poster – Annual report year: 2009

Analytical Platform for Characterization of Inorganic Nanoparticles: Combination of Field Flow Fraction, Light Scattering Detection and Inorganic Mass Spectrometry

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Schmidt, B. (Intern), Sloth, J. J. (Intern), Larsen, E. H. (Intern), Koch, C. B. (Ekstern)
Publication date: 2009
Event: Poster session presented at 2009 European Winter Conference on Plasma Spectrochemistry, Graz, Austria.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 240308
Publication: Research › Poster – Annual report year: 2009
Detection and characterisation of nanoparticles by field flow fractionation (FFF) using multi-angle light scattering (MALS) and ICPMS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Larsen, E. H. (Intern), Schmidt, B. (Intern), Löschner, K. (Intern), Sloth, J. J. (Intern)
Publication date: 2009
Event: Abstract from 2009 European Winter Conference on Plasma Spectrochemistry, Graz, Austria.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 246718
Publication: Research › Conference abstract for conference – Annual report year: 2009

Determination of inorganic arsenic in food and feed by MAE-SPE-HG-AAS – a simple, inexpensive and fast speciation alternative

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Hedegaard, R. S. V. (Intern), Larsen, E. H. (Intern), Sloth, J. J. (Intern), Hansen, M. (Intern)
Publication date: 2009

Publication information
Original language: English
Main Research Area: Technical/natural sciences
speciation of arsenic
Source: orbit
Source-ID: 251722
Publication: Education › Sound/Visual production (digital) – Annual report year: 2009

Determination of inorganic arsenic in food and feed by MAE-SPE-HG-AAS-A simple, inexpensive and fast speciation alternative

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Hedegaard, R. S. V. (Intern), Hansen, M. (Intern), Larsen, E. H. (Intern), Sloth, J. J. (Intern)
Publication date: 2009
Event: Poster session presented at 2009 European Winter Conference on Plasma Spectrochemistry, Graz, Austria.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 246723
Publication: Research › Poster – Annual report year: 2009

Heavy metal speciation. How and why?

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Hedegaard, R. S. V. (Intern), Larsen, E. H. (Intern), Sloth, J. J. (Intern), Hansen, M. (Intern)
Publication date: 2009

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Speciation of arsenic and mercury, Feed
Source: orbit
Source-ID: 251726
Publication: Research › Sound/Visual production (digital) – Annual report year: 2009
Seafood og kemisk fødevaresikkerhed - classics og newcomers

General information
State: Published
Organisations: National Food Institute
Authors: Sloth, J. J. (Intern), Duedahl-Olesen, L. (Intern), Cederberg, T. L. (Intern), Andersen, J. H. (Intern), Petersen, J. H. (Intern)
Publication date: 2009

Publication information
Original language: Danish
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 250725
Publication: Communication › Sound/Visual production (digital) – Annual report year: 2009

Speciation issues in food control - are we ready?

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern), Hedegaard, R. S. V. (Intern), Trier, X. T. (Intern), Julshamn, K. (Ekstern), Larsen, E. H. (Intern)
Publication date: 2009
Event: Abstract from 2009 European Winter Conference on Plasma Spectrochemistry, Graz, Austria.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 246713
Publication: Research › Conference abstract for conference – Annual report year: 2009

Trace Element Speciation Analysis - recent and future trends in food analysis

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Hedegaard, R. S. V. (Intern), Julshamn, K. (Ekstern), Larsen, E. H. (Intern)
Publication date: 2009
Event: Paper presented at 4th International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Speciation, inorganic arsenic, organotin
Source: orbit
Source-ID: 252218
Publication: Research › Paper – Annual report year: 2009

Absorption, Excretion, and Retention of Selenium From a High Selenium Yeast in Men With a High Intake of Selenium

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Bügel, S. (Ekstern), Larsen, E. H. (Intern), Sloth, J. J. (Intern), Flytlie, K. (Ekstern), Overvad, K. (Ekstern), Steenberg, L. C. (Ekstern), Moesgaard, S. (Ekstern)
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: Food & Nutrition Research
Volume: 52
ISSN (Print): 1654-6628
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Arsen-grænseværdier i fiskeolie skal undersøges

General information
State: Published
Organisations: Division of Food Production Engineering, National Food Institute, Division of Food Chemistry
Authors: Jørgensen, S. B. (ed.) (Intern), Sloth, J. J. (Intern)
Publication date: 2008
Main Research Area: Technical/natural sciences

Publication information
Journal: FoodDTU Midt i Ugen
Original language: Danish
Source: orbit
Source-ID: 233205
Publication: Research - peer-review › Journal article – Annual report year: 2008

Metal In Food – Et forskningsprojekt om forurening af fødevarer med metaller under produktion

General information
State: Published
Organisations: Materials and Surface Engineering, Department of Mechanical Engineering, Division of Food Chemistry, National Food Institute
Authors: Hilbert, L. R. (Ekstern), Møller, P. (Ekstern), Jellesen, M. S. (Intern), Larsen, E. H. (Intern), Sloth, J. J. (Intern), Poulsen, L. K. (Ekstern), Schnoor, H. J. (Ekstern)
Possibly enhanced Gd-excretion in dialysate, but no clinical benefit of 3-5 months treatment with sodium thiosulfate in nephrogenic systemic fibrosis

Background. Gd-related nephrogenic systemic fibrosis was successfully treated with intravenous sodium thiosulfate according to a recent case report. Methods. Four haemodialysis patients with severe Gd-related nephrogenic systemic fibrosis were treated with intravenous sodium thiosulfate for 3-5 months. Symptoms and patients' experiences were investigated. The dialysate Gd content was monitored. Results. We observed no major clinical improvements in any patient. In one patient, we found slightly improved joint motion. Two patients had a subjective impression of slight improvements of joint motion and skin abnormalities. The dialysate Gd content was raised by the treatment, up to fivefold. Conclusions. We could not confirm that sodium thiosulfate treatment results in marked and rapid improvement in late stages of Gd-related nephrogenic systemic fibrosis. However, dialysate contents of Gd seemed to increase. It is unknown whether increased Gd excretion will lead to long-term clinical improvements in late stages of nephrogenic systemic fibrosis.
Speciation analysis of arsenic and tin by LC- or GC-ICPMS – food safety aspects

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern)
Publication date: 2008
Event: Abstract from Danish Symposium on Analytical Chemistry : DanSAK9, Lyngby, Denmark, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 235059
Publication: Research › Conference abstract for conference – Annual report year: 2008

Stability of Arsenic Compounds in Seafood Samples During Storage by Freezing

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Dahl, J. (Ekstern), Sloth, J. J. (Intern), Molin, M. (Ekstern), Amlund, H. (Ekstern), Julshamn, K. (Ekstern)
Publication date: 2008
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 235061
Publication: Research › Poster – Annual report year: 2008

Strategy for in vivo and in vitro toxicity testing of engineered nanoparticles in the Nanotest project
Survey of total and inorganic arsenic content in blue mussels (Mytilus edulis L.) from Norwegian fiords: Revelation of unusual high levels of inorganic arsenic

The present study reports the findings of unusual high levels of inorganic arsenic in samples of blue mussels (Mytilus edulis L.). A total of 175 pooled samples of blue mussels from various locations along the Norwegian coastline were analyzed for their content of total arsenic and inorganic arsenic. Total arsenic was determined using inductively coupled plasma mass spectrometry (ICPMS) following microwave-assisted acidic digestion of the samples. Inorganic arsenic was determined using an anion-exchange HPLC-ICPMS method following microwave-assisted alkaline solubilization of the samples. For the majority of the samples (78%) the concentration of total arsenic was below 3 mg kg⁻¹ wet weight (ww) and inorganic arsenic constituted...
Uptake of Iodide From Water in Atlantic Halibut Larvae (Hippoglossus Hippoglossus L.)

The natural diet of marine fish larvae, copepods, contain 60-350 mg I kg(-1), while live feed used in commercial hatcheries have iodine concentrations in the range of 1 mg kg(-1). Seawater is also considered to be an important source of iodine for marine fish. The question asked in this study is whether Atlantic halibut larvae are capable of absorbing iodide from the water and if so, can the seawater sustain the iodine requirement during larval development and metamorphosis. Levels of iodide and iodate in seawater samples from four different rearing facilities were analysed. All samples contained relative low levels of iodide (0-22 nM) and except for samples from one site; the levels of iodide and iodate were in agreement with previously published data. The uptake of iodide from seawater was measured by incubating Atlantic halibut larvae in water...
with a constant level of radioactive iodide (I-125(-)) and increasing levels of cold iodide (I-127(-)). To evaluate whether the uptake of iodide would change during metamorphosis, three different developmental stages (pre metamorphic, metamorphic and post metamorphic) were examined. The uptake was similar for all three stages, increasing with increasing concentration of iodide in the water. The highest level of iodide used was 2000 nM, 100 times higher than what was measured in the seawater samples. The uptake curves did not seem to reach equilibrium. This may be due to a constant nonspecific uptake or that the equilibrium level is higher than 2000 nM. The uptake was partly blocked by perchlorate (ClO3-) which is a known inhibitor of the sodium iodide symporter. This indicates that the Atlantic halibut larvae accumulate iodide through both specific and non-specific uptake pathways.
Analytical Platform for Characterisation of Inorganic Nanoparticles

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute, Division of Toxicology and Risk Assessment
Authors: Schmidt, B. (Intern), Sloth, J. J. (Intern), Lam, H. R. (Intern), Larsen, E. H. (Intern)
Publication date: 2007
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245658
Publication: Research › Poster – Annual report year: 2007

Analytical Platform for Characterisation of Inorganic Nanoparticles

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute, Division of Toxicology and Risk Assessment
Authors: Sloth, J. J. (Intern), Schmidt, B. (Intern), Lam, H. R. (Intern), Larsen, E. H. (Intern)
Publication date: 2007
Event: Poster session presented at International Symposium on Nanotechnology in Environmental Protection and Pollution, Fort Lauderdale, USA.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245655
Publication: Research › Poster – Annual report year: 2007

Arsen i fôr og mat - analyse og toksikogisk vurdering

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Måge, A. (Ekstern), Amlund, H. (Ekstern), Larsen, E. H. (Intern)
Publication date: 2007
Main Research Area: Technical/natural sciences
Source: orbit
Arsen – på den fede måde

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Amlund, H. (Ekstern), Herbst, M. B. K. (Intern), Larsen, E. H. (Intern)
Pages: 26-28
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Dansk Kemi
Volume: 88
Issue number: 8
ISSN (Print): 0011-6335
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2007): Indexed yes
Web of Science (2004): Indexed yes
Original language: Danish
Source: orbit
Source-ID: 245643
Publication: Communication › Journal article – Annual report year: 2007

Determination of Arsenic Species in Marine Samples Using Cation-Exchange HPLC-ICP-MS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Larsen, E. H. (Intern)
Publication date: 2007

Host publication information
Title of host publication: Handbook of Hyphenated ICP-MS Applications
Publisher: Agilent Technologies, Inc
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245645
Publication: Communication › Book chapter – Annual report year: 2007

Determination of trace element species using ICPMS coupled with GC and HPLC

General information
State: Published
Organisations: National Food Institute, Division of Food Chemistry
Authors: Sloth, J. J. (Intern)
Publication date: 2007
Event: Abstract from The 11th Nordic Seminar on ICP/MS, ICP/OES and AAS, Knivsta, Sweden
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245666
Publication: Research › Conference abstract for conference – Annual report year: 2007

Kilder og niveauer af kemiske fødevareforureninger

General information
Kilder og niveauer af kemiske fødevareforureninger

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Granby, K. (Intern), Cederberg, T. L. (Intern), Duedahl-Olesen, L. (Intern), Petersen, J. H. (Intern), Poulsen, M. E. (Intern), Sloth, J. J. (Intern)
Pages: 3-16
Publication date: 2007
Main Research Area: Technical/natural sciences

Publication information
Journal: Miljø og Sundhed
Volume: 35
ISSN (Print): 1395-5241
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: Danish
Source: orbit
Source-ID: 239620
Publication: Communication › Journal article – Annual report year: 2007

Produktion af blødeskallede strandkrabber i Danmark - en ny marin akvakulturproduktion

General information
State: Published
Organisations: Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Division of Food Chemistry, National Food Institute
Authors: Fischer, K. (Intern), Cold, U. (Intern), Jørgensen, K. (Intern), Larsen, E. (Intern), Rasmussen, O. (Ekstern), Sloth, J. J. (Intern)
Number of pages: 111
Publication date: 2007

Publication information
Place of publication: Lyngby
Publisher: Danmarks Fiskeriundersøgelser
ISBN (Print): 978-87-7481-031-5
Original language: Danish
Series: DFU-rapport
Number: 169-07
Main Research Area: Technical/natural sciences
Electronic versions:
169-07, elektronisk_index.pdf.pdf
Links:

Bibliographical note
Rapport til: Ministeriet for Fødevarer, Landbrug og Fiskeri. Projektet er støttet af Direktoratet for FødevareErhverv og EU
Source: orbit
Source-ID: 225414
Produktion af blødskallede strandkrabber i Danmark – en ny marin akvakulturproduktion

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Process and Product Technology, Division of Food Chemistry, National Food Institute
Authors: Fischer, K. (Intern), Cold, U. (Intern), Jørgensen, K. (Intern), Larsen, E. P. (Ekstern), Rasmussen, O. S. (Ekstern), Sloth, J. J. (Intern)
Publication date: 2007

Specific Migration of Organotin Compounds from Food Contact Materials - Selective Determination using GC-ICPMS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Trier, X. T. (Intern), Sloth, J. J. (Intern), Herbst, M. B. K. (Intern), Jensen, L. K. (Intern), Larsen, E. H. (Intern)
Publication date: 2007
Event: Poster session presented at 3rd International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245657
Publication: Research › Poster – Annual report year: 2007

Specific Migration of Organotin Compounds from Food Contact Materials – Selective Determination using GC-ICPMS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Trier, X. T. (Intern), Herbst, M. B. K. (Intern), Jensen, L. K. (Intern), Larsen, E. H. (Intern)
Publication date: 2007
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245659
Publication: Research › Poster – Annual report year: 2007

Survey of pesticide residues in table grapes: Determination of processing factors, intake and risk assessment
The differences in residue pattern between Italy and South Africa, the main exporters of table grapes to the Danish market, were investigated. The results showed no major differences with respect to the number of samples with residues, with residues being found in 54-78% of the samples. Exceedances of the European Union maximum residue limit (MRL) were found in five samples from Italy. A number of samples were rinsed to study the possible reduction of residues. For copper, iprodione, procymidine and dithiocarbamates a significant effect of rinsing was found (20-49% reduction of residues). However, no significant effect was found for organophosphorus pesticides and pyrethroids, whereas the number of samples with residues of benzilates, phenylamids and triazoles was insufficient to demonstrate any significant effects. An intake calculation showed that the average intake from Italian grapes was 3.9 μg day(-1) for pesticides and 21 μg day(-1) for copper. Correspondingly, the intakes from South African grapes were 2.6 and 5.7 μg day(-1) respectively. When the total exposure of pesticides from grapes were related to acceptable daily intake, expressed as the sum of Hazard Quotients, the exposure were approximately 0.5% for Italian samples and 1% for South African samples.

General information
State: Published
monitoring programme, copper, rinsing, pesticide residues, intake calculations, table grapes, hazard quotient, processing factors
Survey on organotin compounds in Danish seafood using GC-ICPMS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Hansen, H. K. (Ekstern), Herbst, M. B. K. (Intern), Larsen, E. H. (Intern)
Publication date: 2007
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245672
Publication: Research › Conference abstract for conference – Annual report year: 2007

Arsenic exposure from seafood in healthy adult Norwegians - a randomized controlled diet trial

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Publication date: 2006
Event: Poster session presented at 6th International Conference on Dietary Assessment Methods, Copenhagen, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Total Abstracts ICDAM6.pdf
Source: orbit
Source-ID: 245661
Publication: Research › Poster – Annual report year: 2006

Arsen i fiskeolje som føringsreidens til oppdrettsfisk - en ny utfordring?

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Amlund, H. (Ekstern), Sloth, J. J. (Intern), Berntsson, H. G. (Ekstern), Haldorsen, A. (Ekstern), Julshamn, K. (Ekstern)
Pages: 56-57
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Norsk Fiskeoppdrett
ISSN (Print): 0332-7132
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Source: orbit
Source-ID: 247871
Publication: Research - peer-review › Journal article – Annual report year: 2006

Arsen i fiskeolje som føringsreidens til oppdrettsfisk – en ny utfordring?

General information
State: Published
Organisations: National Food Institute
Authors: Amlund, H. (Ekstern), Sloth, J. J. (Intern), Berntssen, M. H. G. (Ekstern), Haldorsen, A. K. (Ekstern), Julshamn, K. (Ekstern)
of inorganic arsenic in blue mussel (Mytilus edulis L) from the Norwegian coastline – impact on seafood safety

Prevention of cancer by intervention with selenium (PRECISE) pilot trial: Selenium in nails, plasma and whole blood as biomarkers of yeast selenium intake

Survey of organotin compounds in seafood from Denmark by GC-ICPMS

The occurrence of arsenic in food and feed and toxicological implications
Uptake and speciation of selenium in garlic cultivated in soil amended with symbiotic fungi (mycorrhiza) and selenate

The scope of the work was to investigate the influence of selenate fertilisation and the addition of symbiotic fungi (mycorrhiza) to soil on selenium and selenium species concentrations in garlic. The selenium species were extracted from garlic cultivated in experimental plots by proteolytic enzymes, which ensured liberation of selenium species contained in peptides or proteins. Separate extractions using an aqueous solution of enzyme-deactivating hydroxylamine hydrochloride counteracted the possible degradation of labile selenium species by enzymes (such as alliinase) that occur naturally in garlic. The selenium content in garlic, which was analysed by ICP-MS, showed that addition of mycorrhiza to the natural soil increased the selenium uptake by garlic tenfold to 15 μg g⁻¹ (dry mass). Fertilisation with selenate and addition of mycorrhiza strongly increased the selenium content in garlic to around one part per thousand. The parallel analysis of the sample extracts by cation exchange and reversed-phase HPLC with ICP-MS detection showed that gamma-glutamyl-Se-methyl-selenocysteine amounted to 2/3, whereas methylselenocysteine, selenomethionine and selenate each amounted to a few percent of the total chromatographed selenium in all garlic samples. Se-allyl-selenocysteine and Se-propyl-selenocysteine, which are selenium analogues of biologically active sulfur-containing amino acids known to occur in garlic, were searched for but not detected in any of the extracts. The amendment of soil by mycorrhiza and/or by selenate increased the content of selenium but not the distribution of detected selenium species in garlic. Finally, the use of two-dimensional HPLC (size exclusion followed by reversed-phase) allowed the structural characterisation of gamma-glutamyl-Se-methyl-selenocysteine and gamma-glutamyl-Se-methyl-selenomethionine in isolated chromatographic fractions by quadrupole time-of-flight mass spectrometry.

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Larsen, E. H. (Intern), Lobinski, R. (Ekstern), Burger-Meyer, K. (Ekstern), Hansen, M. (Intern), Ruzik, R. (Ekstern), Mazurowska, L. (Ekstern), Rasmussen, P. H. (Intern), Sloth, J. J. (Intern), Scholten, O. (Ekstern), Kik, C. (Ekstern)
Pages: 1098-1108
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Analytical and Bioanalytical Chemistry
Volume: 385
Issue number: 6
ISSN (Print): 1618-2642
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.03 SJR 0.943 SNIP 1.039
An analytical method for the determination of inorganic arsenic in fish samples using HPLC-ICP-MS has been developed. The fresh homogenised sample was subjected to microwave-assisted dissolution by sodium hydroxide in ethanol, which dissolved the sample and quantitatively oxidised arsenite (As(III)) to arsenate (As(V)). This allowed for the determination of inorganic arsenic as a single species, i.e. As(V), by anion-exchange HPLC-ICP-MS. The completeness of the oxidation was verified by recovery of As(V) which was added to the samples as As(III) prior to the dissolution procedure. The full recovery of As(V) at 104 +/- 7% (n=5) indicated good analytical accuracy. The uncertified inorganic arsenic content in the certified reference material TORT-2 was 0.186 +/- 0.014 ng g(-1) (n=6). The method was employed for the determination of total arsenic and inorganic arsenic in 60 fish samples including salmon from fresh and saline waters and in plaice. The majority of the results for inorganic arsenic were lower than the LOD of 3 ng g(-1), which corresponded to less than one.
per thousand of the total arsenic content in the fish samples. For mackerel, however, the recovery of As(III) was incomplete and the method was not suited for this fat-rich fish.

**General information**
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Larsen, E. H. (Intern), Engman, J. (Ekstern), Sloth, J. J. (Intern), Hansen, M. (Intern), Jorhem, L. (Ekstern)
Pages: 339-346
Publication date: 2005
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Analytical and Bioanalytical Chemistry
Volume: 381
Issue number: 2
ISSN (Print): 1618-2642
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.03 SJR 0.943 SNIP 1.039
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.064 SNIP 1.083 CiteScore 3.07
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.126 SNIP 1.222 CiteScore 3.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.229 SNIP 1.282 CiteScore 3.55
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.347 SNIP 1.282 CiteScore 3.51
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.363 SNIP 1.275 CiteScore 3.47
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.354 SNIP 1.236
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.272 SNIP 1.237
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.144 SNIP 1.076
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.08 SNIP 1.096
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.981 SNIP 1.051
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.963 SNIP 1.134
Web of Science (2005): Indexed yes
Is seawater a reliable source of iodine for Atlantic halibut (Hippoglossus hippoglossus L.)?

Report on three aliphatic dimethylarsinoyl compounds as common minor constituents in marine samples. An investigation using high-performance liquid chromatography inductively coupled plasma mass spectrometry and electrospray ionisation tandem mass spectrometry

Three water-soluble aliphatic arsenicals, dimethylarsinoyl acetate (DMAA), dimethylarsinoyl ethanol (DMAE), and dimethylarsinoyl propionate (DMAP), were identified in marine biological samples. Sample extracts in methanol/water (1 + 1) were analysed by cation-exchange high-performance liquid chromatography/inductively coupled plasma mass spectrometry (HPLC/ICPMS). Eluate fractions from the HPLC/ICPMS analyses containing the compounds in question were collected and subjected to analysis by electrospray ionisation tandem mass spectrometry (ESI-MS/MS), which provided supportive evidence for the structures of the three compounds. The concentrations of the three arsenicals were determined in 37 marine organisms comprising algae, crustaceans, bivalves, fish and mammals by HPLC/ICPMS. The three arsenicals DMAA, DMAE and DMAP, which occurred at mug kg⁻¹ concentrations, were detected in 25, 23 and 17 of the 37 samples analysed, respectively. The limits of detection were 2-3 mug kg⁻¹ dry mass. The data illustrate that the three compounds are common minor constituents in marine samples. This is the first report on DMAE and DMAP as naturally occurring species in marine samples. The presence of DMAA and DMAE supports a proposed biosynthesis of arsenobetaine (AB) from dimethylarsinoylribosides. Alternative proposals, which explain the presence of the compounds in marine samples, are addressed briefly in the paper.
Report on three dimethylarsinoylarsenicals as common minor constituents in seafood samples. An investigation using HPLC-ICP-MS and ESI-MS-MS, Rapid Communications in Mass Spectrometry

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Larsen, E. H. (Intern), Julshamn, K. (Ekstern)
Publication date: 2005
Speciation analysis of arsenic – Development of selective methodologies for assessment of seafood safety

General information
State: Published
Organisations: Unknown
Authors: Sloth, J. J. (Intern)
Publication date: 2005

Publication information
ISBN (Print): 82-7744-128-2
Original language: English
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245639
Publication: Research › Report – Annual report year: 2005

Survey of inorganic arsenic in marine animals and marine certified reference materials by anion exchange high-performance liquid chromatography-inductively coupled plasma mass spectrometry

A method for the determination of inorganic arsenic in seafood samples using high-performance liquid chromatography-inductively coupled plasma mass spectrometry is described. The principle of the method relied on microwave-assisted alkaline dissolution of the sample, which at the same time oxidized arsenite [As(III)] to arsenate [As(V)], whereby inorganic arsenic could be determined as the single species As(V). Anion exchange chromatography using isocratic elution with aqueous ammonium carbonate as the mobile phase was used for the separation of As(V) from other coextracted organoarsenic compounds, including arsenobetaine. The stability of organoarsenic compounds during the sample pretreatment was investigated, and no degradation/conversion to inorganic arsenic was detected. The method was employed for the determination of inorganic arsenic in a variety of seafood samples including fish, crustaceans, bivalves, and marine mammals as well as a range of marine certified reference materials, and the results were compared to values published in the literature. For fish and marine mammals, the results were in most cases below the limit of detection. For other sample types, inorganic arsenic concentrations up to 0.060 mg kg(-1) were found. In all samples, the inorganic arsenic content constituted less than 1% of the total arsenic content.

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Larsen, E. H. (Intern), Julshamn, K. (Ekstern)
Pages: 6011-6018
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Agricultural and Food Chemistry
Volume: 53
Issue number: 15
ISSN (Print): 0021-8561
Ratings:
BFI (2018): BFI-level 2
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.45 SJR 1.291 SNIP 1.344
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.236 SNIP 1.253 CiteScore 3.23
Web of Science (2015): Indexed yes
Total arsenic and inorganic arsenic content in Norwegian fish feed products

General information
State: Published
Organisations: National Institute for Nutrition and Seafood Research
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Lundebye, A. K. (Ekstern)
Arsenic speciation analysis – emphasis on inorganic arsenic in seafood
Selective arsenic speciation analysis of human urine reference materials using gradient elution ion-exchange HPLC-ICP-MS

Arsenic speciation analysis was performed in two human urine certified reference materials (NIES No. 18 and NIST SRM2670a) and three human urine control materials (Seronorm, Medisafe and Lyphocheck). The samples were diluted 1+3 prior to analysis by gradient elution anion or cation exchange high-performance liquid chromatography (HPLC) coupled with inductively coupled plasma mass spectrometry (ICP-MS). Nine arsenic species, including arsenic acid, arsenous acid, monomethylarsonic acid, dimethylarsinic acid, arsenobetaine, trimethylarsine oxide, dimethylarsinoylacetic acid, trimethylarsionipropionate and dimethylarsinoylethanol, were determined in the urines. Additionally, several unknown arsenicals were detected. This is the first time that dimethylarsinoylacetic acid and trimethylarsoniopropionate have been reported in human urine. The sums of the species concentrations determined by the chromatographic approaches were identical with the reference values given for total arsenic. The obtained values for arsenobetaine and dimethylarsinic acid were identical with the values certified for the NIES No. 18 urine CRM. The speciation data presented here may be valuable for the quality assurance of analytical method development and surveys of arsenic in urine samples.
Selenium From a High Se Yeast Supplement Is Well Absorbed and Retained in Humans

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Bügel, S. (Ekstern), Larsen, E. H. (Intern), Sloth, J. J. (Intern), Flytlie, K. (Ekstern), Overvad, K. (Ekstern), Steenberg, L. C. (Ekstern), Moesgaard, S. (Ekstern)
Pages: 206-209
Publication date: 2004
Main Research Area: Technical/natural sciences

Publication information
Journal: Metal Ions in Biology and Medicine
Volume: 8
ISSN (Print): 1257-2535
Original language: English
Source: orbit
Source-ID: 229572
Publication: Research - peer-review › Journal article – Annual report year: 2004

Specieringsanalyse i sjømat ved bruk av HPLC og GC koblet til ICPMS

General information
State: Published
Organisations: Unknown
Authors: Sloth, J. J. (Intern), Amlund, H. (Ekstern), Berntssen, M. H. G. (Ekstern), Solli, B. (Ekstern), Julshamn, K. (Ekstern)
Publication date: 2004

Original language: Norwegian
Source: unknown
Source-ID: 247895
Publication: Research › Journal article – Annual report year: 2004
Arsenic speciation analysis using HPLC coupled to ICPMS

General information
State: Published
Organisations: University of Bergen
Authors: Sloth, J. J. (Intern)
Publication date: 2003
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245689
Publication: Research › Conference abstract for conference – Annual report year: 2004

Arsenic species in marine samples

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Larsen, E. H. (Intern), Julshamn, K. (Ekstern)
Publication date: 2003
Event: Abstract from The 5th International Symposium on Speciation of Elements in Biological, Environmental and Toxicological Sciences, Almuñécar, Spain.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245688
Publication: Research › Conference abstract for conference – Annual report year: 2003

Determination of arsenic species in marine CRMs by ion-exchange HPLC-ICPMS – emphasis on minor constituents

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Larsen, E. H. (Intern)
Publication date: 2003
Event: Poster session presented at Winter Plasma Conference on Plasmaspectrochemistry, Garmisch-Partenkirchen, Germany.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245681
Publication: Research › Poster – Annual report year: 2003

Determination of organoarsenic species in marine samples using gradient elution cation exchange HPLC-ICP-MS

A method for the determination of arsenic species in marine samples using high performance liquid chromatography coupled to inductively coupled mass spectrometry (HPLC-ICP-MS) has been developed. Cation exchange HPLC with gradient elution using pyridine formate as the mobile phase was employed for the separation of a large number of arsenicals that occurred in the samples. The arsenic species were extracted using a 50% (v/v) methanol-water mixture and mechanical agitation overnight. The effect of the sample matrix on HPLC retention time was investigated and showed a dramatic effect for arsenobetaine and dimethylarsinic acid, whereas the cationic arsenecholine ion and tetramethylarsonium ion were not affected. The accuracy of the method for DMA, AsB and TMAs was validated with the CRMs DORM-2 and BCR626 Tuna. The concentrations found for arsenobetaine, dimethylarsinic acid and tetramethylarsonium ion were within the certified limits and low detection limits of 0.002-0.005 μg g⁻¹ dry mass (as As) for the different arsenic species were obtained. At least 23 different organic arsenic species were detected in a scallop kidney in one analytical run of 25 min duration. The ability of our analytical method to detect that many species simultaneously is useful for the study of the distribution and of the metabolic pathways of arsenic species in marine samples.

General information
State: Published
Determination of total selenium and Se-77 in isotopically enriched human samples by ICP-dynamic reaction cell-MS

This paper describes an analytical method for the simultaneous quantitative determination of total selenium (Se) and Se-77 in isotopically enriched human plasma, urine and faeces by inductively coupled plasma-dynamic reaction cell-mass spectrometry (ICP-DRC-MS). The samples originated from a human study in which a single dose of 327 mug Se-77 (99.3% pure) had been given as intrinsically Se-77-labelled yeast, following administration for six weeks of 300 mug d(-1) of selenium also as selenised yeast with natural isotope abundance. Prior to analysis, the plasma and urine samples and the digested faecal samples were diluted using an aqueous diluent containing 0.5% Triton X-100, 2% nitric acid and 3% methanol. Selenium was detected as Se-76, Se-77 and Se-80 by ICP-DRC-MS. Selenium originating from the natural isotope abundance yeast and other selenium sources from the diet was determined as Se-80, which was unaffected by the isotope enrichment. The degree of enrichment of Se-77 was estimated from the measured Se-77 signal intensity (natural abundance plus enrichment) minus the natural abundance of this isotope, which was calculated from measurement of Se-76. Quantification of the enriched amount of selenium Se-77 was carried out against standard additions calibration curves (natural isotope abundance) by correcting the slope of the Se-77 calibration curve according to the 99.3% abundance of this isotope in the enriched fraction. The limits of detection for selenium with natural abundance were 0.1 mug l(-1), 0.2 mug l(-1) and 6 mug kg(-1) and the minimum detectable increase in Se-77 was 0.38 mug l(-1), 0.58 mug l(-1) and 15 mug kg(-1) (corresponding to 0.21%, 0.63% and 0.61% of the mean total selenium concentrations in this study) in plasma, urine and faeces, respectively. The accuracy was controlled by analysis of the reference materials Seronorm Serum and BCR 185 Bovine Liver.

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute, Pharma Nord Aps.
Authors: Sloth, J. J. (Intern), Larsen, E. H. (Intern), Bügel, S. H. (Ekstern), Moesgaard, S. (Ekstern)
Pages: 317-322
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Analytical Atomic Spectrometry
Volume: 18
Issue number: 4
ISSN (Print): 0267-9477
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.009 SNIP 1.18 CiteScore 3.3
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.002 SNIP 1.208 CiteScore 3.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.979 SNIP 1.395 CiteScore 3.22
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.064 SNIP 1.233 CiteScore 3.24
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.195 SNIP 1.095 CiteScore 2.99
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Investigation on the arsenic content in processed seafood

General information
State: Published
Organisations: University of Bergen
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern)
Publication date: 2003
Event: Poster session presented at Colloquium Spectroscopicum Internationale XXXIII, Granada, Spain, .
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 229835
Publication: Research - peer-review › Journal article – Annual report year: 2003

Selenium speciation and isotope composition in 77Se-enriched yeast using gradient elution HPLC separation and ICP-dynamic reaction cell-MS

A batch of Se-77-labelled and enriched yeast was characterised with regard to isotopic composition and content of selenium species for later use in a human absorption study based on the method of enriched stable isotopes. The abundance of the six stable selenium isotopes was determined by ICP-MS equipped with a dynamic reaction cell (DRC). The results showed that the Se-77 isotope was enriched to 98.5 atom-%, whereas the remaining selenium was present as the other five isotopes at low abundance. The low-molecular Se-77 containing species, which were biosynthesised by the yeast during fermentation using the enriched Se-77-selenite as substrate, were released by enzymatic hydrolysis using (I), a beta-glucosidase followed by a protease mixture, and (II), a commercial protease preparation. For selenium speciation the chromatographic selectivity of the cation exchange HPLC system was adjusted to the separation of over 30 selenium species occurring in the hydrolysates by applying gradient elution using pyridinium formate as mobile phase. The quantitative results obtained by detection with ICP-DRC-MS of Se-77 and Se-80 showed that both enzymatic sample
preparation systems released 90 - 95% of the yeast's selenium content. The total area of the cation exchange chromatograms, however, amounted to 64% of the total selenium content in the yeast, which was 1390 µg g(-1). In the enzymatic extracts selenomethionine (SeMet) constituted 82% of all separated and quantified selenium species, which was equivalent to 53% of the total selenium content in the yeast. Oxidation of SeMet to selenomethionine- Se- oxide (SeOMet) occurred during sample preparation. The degree of formation of SeOMet was large and variable when using enzyme system I, but low when using enzyme II.

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Larsen, E. H. (Intern), Sloth, J. J. (Intern), Hansen, M. (Ekstern), Moesgaard, S. (Ekstern)
Pages: 310-316
Publication date: 2003
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Analytical Atomic Spectrometry
Volume: 18
Issue number: 4
ISSN (Print): 0267-9477
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.009 SNIP 1.18 CiteScore 3.3
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.002 SNIP 1.208 CiteScore 3.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.979 SNIP 1.395 CiteScore 3.22
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.064 SNIP 1.233 CiteScore 3.24
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.195 SNIP 1.095 CiteScore 2.99
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.119 SNIP 1.129 CiteScore 3.03
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.393 SNIP 1.202
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.106 SNIP 1.093
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.209 SNIP 1.083
Scopus rating (2007): SJR 1.255 SNIP 1.143
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.369 SNIP 1.031
Scopus rating (2005): SJR 1.353 SNIP 1.15
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.701 SNIP 1.254
Web of Science (2004): Indexed yes
Arsenic speciation in marine samples by cation-exchange HPLC-ICPMS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Larsen, E. H. (Intern)
Publication date: 2002
Event: Abstract from Workshop on Arsenic Speciation, Ghent, Belgium.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245682
Publication: Research › Conference abstract for conference – Annual report year: 2002

Arsenic speciation in marine samples by cation-exchange HPLC-ICPMS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Larsen, E. H. (Intern)
Publication date: 2002
Event: Abstract from The 5th Conference on Arsenic Exposure and Health Effects, San Diego, California, USA.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245683
Publication: Research › Conference abstract for conference – Annual report year: 2002

Arsenic speciation in marine samples by cation-exchange HPLC-ICPMS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Julshamn, K. (Ekstern), Larsen, E. H. (Intern)
Publication date: 2002
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245684
Publication: Research › Poster – Annual report year: 2002

Determination of Selenium and the 77Se Fraction in Human Serum, Urine and Faeces

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Larsen, E. H. (Intern)
Publication date: 2002
Analyse af sporelementer i levnedsmidler ved ICP-DRC-MS

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Larsen, E. H. (Intern)
Pages: 34-40
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Dansk Kemi
Volume: 81
Issue number: 9
ISSN (Print): 0011-6335
Ratings:
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Web of Science (2007): Indexed yes
Web of Science (2004): Indexed yes
Original language: Danish

Bibliographical note
Tillæg

Den dynamiske reaktionscelle

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern), Larsen, E. H. (Intern)
Publication date: 2000
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245664
Publication: Research › Poster – Annual report year: 2000

Den dynamiske reaktionscelle – nye muligheder og udfordringer for ICPMS-teknikken

General information
State: Published
Organisations: Division of Food Chemistry, National Food Institute
Authors: Sloth, J. J. (Intern)
Publication date: 2000
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 245679
Publication: Research › Conference abstract for conference – Annual report year: 2000

Determination of trace elements using ICP-DRC-MS
The application of inductively coupled plasma dynamic reaction cell mass spectrometry for measurement of selenium isotopes, isotope ratios and chromatographic detection of selenoamino acids

Inductively coupled plasma dynamic reaction cell mass spectrometry (ICP-DRC-MS) was characterised for the detection of the six naturally occurring selenium isotopes. The potentially interfering argon dimers at the selenium masses m/z 74, 76, 78 and 80 were reduced in intensity by approximately five orders of magnitude by using methane as reactive cell gas in the DRC. By using 3% v/v methanol in water for carbon-enhanced ionisation of selenium, the sensitivity of Se-80 was 10^4 counts s^-1 per ng ml^-1 of selenium, and the estimated limit of detection was 6 pg ml^-1. The precision of the isotope ratios was close to the theoretical values for selenium concentrations at 1 and 10 ng ml^-1. The accuracy of the isotope ratios, however, was improved by correcting the count rate of all selenium isotopes equivalent to the formation of SeH at 9.6 +/- 0.5% one mass unit above the selenium isotopes. A linear relationship (r <0.98) was found between the error of the corrected isotope ratios and the difference in mass from the Se-80 reference isotope. This indicated that the error was caused by mass bias. The slope of the curve at -3.0% error per mass unit can be used for correction of the measured ratios. Deuterated methane used as the DRC gas showed that hydrogen transfer from methane was not involved in the formation of SeH as SeD was absent in the mass spectrum. The almost interference-free detection of selenium by ICP-DRC-MS made the detection of the Se-80 isotope possible for detection of selenoamino acids separated by cation exchange HPLC. The limit of detection of the HPLC-ICP-DRC-MS method was in the range 3-5 pg as selenium.
Determination of Ultra-trace Amounts of Arsenic(III) by Flow Injection Hydride Generation Atomic Absorption Spectrometry with On-line Preconcentration by Coprecipitation with Lanthanum Hydroxide or Hafnium Hydroxide

A time-based flow-injection (FI) procedure for the determination of ultra-trace amounts of inorganic arsenic(III) is described, which combines hydride generation atomic absorption spectrometry (HG-AAS) with on-line preconcentration of the analyte by inorganic coprecipitation-dissolution in a filterless knotted Microline reactor. The sample and coprecipitating agent are mixed on-line and merged with an ammonium buffer solution, which promotes a controllable and quantitative collection of the generated hydroxide on the inner walls of the knotted reactor incorporated into the FI-HG-AAS system. Subsequently the precipitate is eluted with 1 mol/l hydrochloric acid, allowing ensuing determination of the analyte via hydride generation. The preconcentration of As(III) was tested by coprecipitation with two different inorganic coprecipitating agents namely La(III) and Hf(IV). It was shown that As(III) is more effectively collected by lanthanum hydroxide than by hafnium hydroxide, the sensitivity achieved by the former being ca. 25% better. With optimal experimental conditions and with a sample consumption of 6.7 ml per assay, an enrichment factor of 32 was obtained at a
sample frequency of 33 samples/h. The limit of detection (3s) was 0.003 µg/l and the precision (relative standard deviation) was 1.0% (n = 11) at the 0.1 µg/l level.

**General information**
State: Published
Organisations: Department of Chemistry, Division of Food Chemistry, National Food Institute, Department of Chemistry
Authors: Nielsen, S. (Intern), Sloth, J. J. (Intern), Hansen, E. H. (Intern)
Pages: 867-880
Publication date: 1996
Conference: Seventh International Conference on Flow Injection Analysis (ICFIA '95), Seattle, WA, USA, 01/01/1995
Main Research Area: Technical/natural sciences

**Publication information**
Volume: 43
Issue number: 6
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.162 SNIP 1.27 CiteScore 4.19
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.187 SNIP 1.327 CiteScore 3.99
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.201 SNIP 1.296 CiteScore 3.71
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.201 SNIP 1.399 CiteScore 3.74
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.421 SNIP 1.46 CiteScore 3.74
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.429 SNIP 1.518 CiteScore 3.91
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.456 SNIP 1.366
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.319 SNIP 1.338
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2007): SJR 1.428 SNIP 1.506
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.305 SNIP 1.377
Scopus rating (2005): SJR 1.113 SNIP 1.453
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.173 SNIP 1.523
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.987 SNIP 1.353
Determination of Ultra-Trace Amounts of Selenium(IV) by Flow Injection Hydride Generation Atomic Absorption Spectrometry with On-line Preconcentration by Co-precipitation with Lanthanium Hydroxide. Part II. On-line Addition of Coprecipitating Agent

A flow injection procedure for the determination of ultra-trace amounts of selenium(IV) is described, which combines hydride generation atomic absorption spectrometry (HGAAS) with on-line preconcentration of the analyte by co-precipitation-dissolution in a filterless knotted Microline reactor. Based on a previously published procedure that requires the off-line premixing of sample and co-precipitating agent, the present approach facilitates on-line addition of the coprecipitant to the time-based aspirated sample. The sample and the coprecipitating agent (lanthanum nitrate) are mixed on-line and merged with an ammonium buffer solution of pH 9.1, which promotes precipitation and quantitative collection on the inner walls of an incorporated knotted Microline reactor. The Se(IV) preconcentrated by coprecipitation with the generated lanthanum hydroxide precipitate is subsequently eluted with hydrochloric acid, allowing an ensuing determination via hydride generation. At different sample flow rates, i.e., 4.8, 6.4 and 8.8 ml/min, enrichment factors of 30, 40 and 46, respectively, were obtained at a sampling frequency of 33 samples/h. The detection limit (3s) was 0.005 µg/l at a sample flow rate of 6.4 ml/min and the precision (relative standard deviation) was 0.5% (n = 11) at the 0.1 µg/l level.
Projects:

Udvikling af bæredygtige innovative fødevareingredienser på basis af ørredrestprodukter

National Food Institute

Division of Industrial Food Research

Division of Food Chemistry

Period: 01/01/2014 → 31/12/2015

Number of participants: 11

Acronym: DANFomega

Project participant:

Nouard, Marie-Louise (Intern)

Nielsen, Henrik Hauch (Intern)

Sloth, Jens Jørgen (Intern)

Rasmussen, Rie Romme (Intern)

Berner, Lis (Intern)

Vu, Thi Thu Trang (Intern)

Hansen, Erik D. (Ekstern)

Ørum, Poul (Ekstern)

Barlach, Anders (Ekstern)

Project Manager, organisational:

Honoré, Lone (Ekstern)

Project Manager, academic:

Jacobsen, Charlotte (Intern)

Financing sources

Source: Public research programme (public)

Name of research programme: Grønt Udviklings- og DemonstrationsProgram (GUDP)

Amount: 10,940,907.00 Danish Kroner

Year of approval: 2014

Project
ECSafeSEAFOOD. Priority environmental contaminants in seafood: safety assessment, impact and public perception

Seafood has been recognised as a high-quality, healthy and safe food type and is one of the most important food commodities consumed worldwide. However, seafood, like other types of food, can also be a source of harmful environmental contaminants with potential to impact on human health.

ECSafeSEAFOOD will assess food safety issues related to priority contaminants present in seafood as a result of environmental contamination (including those originating from harmful algal blooms and those associated with marine litter) and evaluate their impact on public health. ECSafeSEAFOOD will provide scientific evidence to serve as a basis for further development of common food safety, public health and environmental policies and measures, by seeking to establish a quantitative link between the contamination of the marine environment and that of seafood.

www.ecsafeseafood.eu

National Food Institute
Division of Food Chemistry

National Institute of Aquatic Resources
Section for Aquaculture
Period: 15/02/2013 → 15/02/2017
Number of participants: 4
Acronym: ECsafeSEAFOOD
Project ID: 31180
Project participant:
Granby, Kit (Intern)
Sloth, Jens Jørgen (Intern)
Larsen, Bodil Katrine (Intern)
Rasmussen, Rie Romme (Intern)

Relations
Activities:
Effects of industrial processing on regulated and emerging contaminant levels in seafood
Arsenic compounds in foodstuffs – recent developments in speciation analysis and food safety assessment
Toksikologiske effekter af akkumulering af nanopartikler i leveren

National Food Institute
Period: 01/09/2012 → 07/11/2017
Number of participants: 8
Phd Student:
Modrzynska, Justyna (Intern)
Supervisor:
Löschner, Katrin (Intern)
Jørgensen, Anne Thoustrup (Intern)
Vogel, Ulla Birgitte (Intern)
Main Supervisor:
Ravn-Haren, Gitte (Intern)
Examiner:
Sloth, Jens Jørgen (Intern)
Larsen, Agnete (Ekstern)
Strøger, Tobias J. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Extraction and characterisation of highly biocative ingredients from Nordic marine algae

National Food Institute
Period: 01/06/2012 → 21/04/2016
Number of participants: 6
Phd Student:
Hermund, Ditte Baun (Intern)
Supervisor:
Nielsen, Kristian Fog (Intern)
Main Supervisor:
Jacobsen, Charlotte (Intern)
Examiner:
Sloth, Jens Jørgen (Intern)
Andersen, Mogens Larsen (Ekstern)
Hotchkiss, Sarah (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Development and characterization of nano-microstructures as carrier for bioactive compounds

National Food Institute
Period: 01/10/2011 → 02/09/2015
Number of participants: 6
Phd Student:
Boutrup Stephansen, Karen (Intern)
Supervisor:
Chronakis, Ioannis S. (Intern)
Main Supervisor:
Jessen, Flemming (Intern)
Examiner:
Sloth, Jens Jørgen (Intern)
Foian, Peter (Ekstern)
Arsenolipids in fish oil, fish feed, fish and other seafood

Arsenic exists in many different chemical forms in the marine environment, of which the water-soluble arsenicals are well studied. However, knowledge regarding the so-called arsenolipids (lipid soluble arsenic compounds) is so far limited, although arsenolipids are present in considerable quantities in fish oil (reported concentrations range from 4 to 15 mg As/kg). The present project aims to generate knowledge on arsenolipids in fish oil and other marine samples, with a main aim of developing methods for the determination of arsenolipids in marine samples using capillary HPLC-ICPMS and capillary HPLC-ESI MS/MS. The results obtained within the project will be of importance to national and international food authorities in their evaluation and risk assessment of the consequences of arsenolipids for food safety and fish welfare. Furthermore, the results will also be of value for the aquaculture industry and the fishery sector.

Division of Food Chemistry
National Food Institute
National Institute for Nutrition and Seafood Research
Period: 01/01/2010 → 31/12/2012
Number of participants: 3
Project participant:
Amlund, Heidi (Ekstern)
Sele, Veronika (Ekstern)
Project Manager, organisational:
Sloth, Jens Jørgen (Intern)

Electronic Transmission of Chemical Occurrence Data (CFP/EFSA/DATEx/2009/01)
The objective of this call is that the successful applicants implement and test an electronic system for the transmission of food contaminant and eventually pesticide residues data to EFSA, according to EFSA standards.

National Food Institute
Division of Food Chemistry
DFVA Regional Laboratory
Period: 01/11/2009 → 31/07/2011
Number of participants: 5
Project participant:
Jensen, Bodil Hamborg (Intern)
Duedahl-Olesen, Lene (Intern)
Sloth, Jens Jørgen (Intern)
Jørgensen, Kevin (Intern)
Project Manager, academic:
Andersen, Jens Hinge (Intern)
Contaminants in food and feed: Inexpensive detection for control of exposure (CONffIDENCE)

Safer food, through rapid and cost efficient tests for detecting chemical contaminants in food and animal feed, is the major goal of this project. It is co-ordinated by RIKILT, Institute of Food Safety, The Netherlands and the project consortium consists of 17 partners from 10 European countries. DTU Food is leader of WP3 on heavy metals, which focuses on the development of simplified and inexpensive methods for the determination of inorganic arsenic and methylmercury. Since seafood is the major dietary source for both arsenic and mercury in the European population, the project will focus on marine feed and seafood as sample matrices of interest. The methods developed at DTU Food are based on microwave assisted extraction techniques followed by solid phase extraction of the analyte of interest combined with detection with atomic absorption spectrometry (SPE-AAS). The method's performance will be evaluated in international collaborative trials and used in surveys on fish and fish feed.

National Food Institute
Division of Food Chemistry
Tampere University of Technology

Period: 01/05/2008 → 30/04/2012
Number of participants: 4
Acronym: CONffIDENCE
Project participant:
Karp, Matti (Ekstern)
Hedegaard, Rikke Susanne Vingborg (Intern)
Rasmussen, Rie Romme (Intern)

Project Manager, organisational:
Sloth, Jens Jørgen (Intern)

Relations
Activities:
Arsenic compounds in foodstuffs –recent developments in speciation analysis and food safety assessment

Content, bioavailability and health effects of trace elements and bioactive components in organic agricultural systems

The main objective is to study the impact of relevant organic agricultural practices on the ability of plants to assimilate trace elements from the soil and to synthesise bioactive secondary metabolites and antioxidant vitamins with health promoting effects. Moreover, in comparison with conventionally cultivated crops, the possible improved uptake rate of bioactive compounds in humans and animal models will be studied. The specific objectives are: 1. To screen the content of trace elements together with other relevant bioactive constituents in a wide selection of commonly consumed organic crops. Multivariate methods of data analysis will be employed to differentiate between the agricultural systems. 2. To characterise and optimise the content of trace elements and bioactive compounds in crop plants harvested from two well-defined organic cultivation systems that include combinations of plant species, soil type, crop rotations and fertilizers. 3. To assess the bioavailability of the bioactive compounds in human intervention studies employing prepared diets based on the crops produced within the systems. 4. To study the effects of foods on health and well being after long-term consumption using the rat as a model.

Division of Food Chemistry
National Food Institute
University of Copenhagen

Aarhus University

Period: 07/01/2007 → 31/12/2010
Number of participants: 7
Project participant:
Husted, Søren (Ekstern)
Larsen, Erik Huusfeldt (Intern)
Knuthsen, Pia (Intern)
Jakobsen, Jette (Intern)
Sloth, Jens Jørgen (Intern)
Kápolna, Emese (Intern)
Søltoft, Malene (Intern)

Project
**Biosynthesis of cancer-preventive organoselenium compounds by metabolically engineered yeast (YESSEL)**

Selenium is an essential element that may have cancer-preventive properties. By using biotechnological research methods, the YESSEL project will develop yeast strains as cell factories for synthesis of organic selenium compounds with promising properties towards prevention of disease. The hypothesis is that yeast can be engineered for improved production of target selenium species such as methylselenocysteine or selenium-sulphur conjugates. Furthermore, the project will test if these target compounds are safer than selenomethionine that is predominant in natural yeast. The project will map, engineer and optimise the metabolic routes in yeast leading to the target selenium compounds. The selenium compounds produced by the various strain modifications of yeasts will be characterised by advanced mass spectrometric methods, such as HPLC-ICP-MS and Q-TOF-MS.

Department of Systems Biology  
Division of Food Chemistry  
National Food Institute  
Laboratoire Bio-inorganique et Environnement  
University of Copenhagen  
Pharma Nord Aps.  
Period: 01/01/2007 → 31/12/2009  
Number of participants: 11  
Project participant:  
Olsson, Lisbeth (Intern)  
Smedsgaard, Jørn (Intern)  
Lobinski, Ryszard (Ekstern)  
Krath, Britta (Ekstern)  
Dragsted, Lars Ove (Ekstern)  
Vanelli, Valeria (Ekstern)  
Paulin, Helge (Ekstern)  
Moesgaard, Sven (Ekstern)  
Nellemann, Christine (Intern)  
Sloth, Jens Jørgen (Intern)  
Project Manager, organisational:  
Larsen, Erik Huusfeldt (Intern)  

**Analytical characterization of nanoparticles**

The hypothesis is that the mere nanometre size of matter, and its associated large surface area, may lead to adverse effects in living organisms including humans. Therefore health risk assessment of nanomaterials is of importance. The specific scope of this project is to develop and apply methodologies for nanoparticle recovery, detection of their chemical composition and determination of their size and surface area. The methods will be applied to particles in suspension or dosed to biological materials such as cell-lines or living animals. The project will test methods to extract or liberate nanosized matter from food contact materials or from cells. Techniques assisted by ultrasound or by enzymes will be in focus. Following sample preparation, methods for separation of mixtures of nanoparticles will be tested and compared. The separation techniques will be coupled on-line with detectors including inductively coupled plasma mass spectrometry (ICP-MS) for analysis of elemental composition, or with multi angle light scattering (MALS) for surface area measurement. In addition, organic mass spectrometry may become of importance for further characterisation of their exact mass or polymer structure.

Division of Food Chemistry  
National Food Institute  
Aalborg University  
University of Illinois  
Period: 01/01/2006 → 31/01/2013  
Number of participants: 5  
Project participant:  
Petersen, Steffen (Ekstern)  
Fojan, Peter (Ekstern)  
Gao, Xueyun (Ekstern)  
Sloth, Jens Jørgen (Intern)
Organotin compounds in food contact materials

Organotin compounds (mono-, di- and tri- substituted compounds) in food contact materials have several uses, such as heat stabilizers for PVC and as catalysts in polyurethanes and in silicons. Another possible use could be as biocide agents in both plastics and wood. During processing and storage, they can decompose into other known and unknown Sn containing substances. As they are loosely bound to the food contact material, they are at high risk of migrating upon contact with foods. Organotin compounds are generally very toxic and act as endocrine disruptors and exert immunotoxic effects.

Recently (2005), the European Food Safety Agency (EFSA) issued a toxicological evaluation of organotin compounds and suggested a tolerable daily intake (TDI) as low as 0.25 µg/kg bodyweight for the sum of four organotin compounds (TBT, DBT, TPT and DOT), corresponding to a specific migration limit (SML) of 6 µg/kg. Research at DFVF focus on developing the first organotin multimethod capable of meeting the new limits in plastics (PVC and aliphatic polyurethanes) and in silicone, which is performed by GC-ICPMS. The project includes a screening and identification of reaction and degradation products that have not formerly been reported. The data from enforcement surveys are used to assess human exposure via food contact materials and are compared with present recommendations for tolerable intake.

National Veterinary Institute
Division of Food Chemistry
Period: 01/01/2006 → 01/01/2008
Number of participants: 3
Project participant:
Sloth, Jens Jørgen (Intern)
Larsen, Erik Huusfeldt (Intern)
Project Manager, organisational:
Trier, Xenia (Intern)

Financing sources
Source: Other public support (public)
Name of research programme: the Danish Veterinary and Food Administration
Amount: 800,000.00 Danish Kroner
**Organotin speciation in seafood**

Organotin compounds in nature comprise mono-, di- and tri- (alkyl- or aryl-) substituted compounds and are used in a variety of different industrial applications (e.g. biocide agents and plastic stabilisers). Organotin compounds are introduced to the aquatic environment by the use of organotin compounds as antifouling agents, mainly tributyltin (TBT), on ships. Organotin compounds are generally very toxic and act as endocrine disruptors and exert immunotoxic effects. Recently (2005) the European Food Safety Agency (EFSA) issued a toxicological evaluation of organotin compounds and suggested a tolerable daily intake (TDI) as low as 0.25 µg/kg bodyweight for the sum of four organotin compounds occurring in nature. The research at The National Food Institute focus on the determination of organotin levels in seafood samples, which is performed using GC-ICPMS. The data are used to assess human exposure via seafood and compared with present recommendations for tolerable intake.

**Division of Food Chemistry**

National Food Institute

**Period:** 01/01/2004 → 31/12/2009

**Number of participants:** 2

**Project participant:**

Larsen, Erik Huusfeldt (Intern)

**Project Manager, organisational:**

Sloth, Jens Jørgen (Intern)

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**Metal Release by Corrosion and Wear in the Food Industry**

The objectives of this project are to identify the sources of metal contamination from stainless steel equipment in food industry, analyse the impact of the contamination and finally to suggest solutions for the problem. Metal release can cause a health risk for consumers with nickel allergy and the acquisition of data on metal content in not only raw products but also in manufactured food and ready-to-eat dishes will be an improvement of the present status. The role of the National Food Institute is to analyse trace elements in processed raw materials and foodstuffs sampled at various sites along the process line in the food industry. The trace element content is determined by Inductively Coupled Plasma Mass Spectrometry (ICPMS) equipped with a collision/reaction cell for interference reduction/removal. The obtained data on food products will be analysed and the health risk evaluated by comparison with the estimated daily intake. By materials selection and development of more wear and corrosion resistant surfaces the general food quality can be improved, metal release reduced and longer lifetime of process equipment obtained – all leading to better products. So by technological solutions safe and high quality food production can be made possible.

**Department of Management Engineering**

Division of Food Chemistry

National Food Institute

**University of Copenhagen**

**Period:** 01/01/2003 → 31/07/2007

**Number of participants:** 4

**Project participant:**

Møller, Per (Ekstern)

Poulsen, Lars K. (Ekstern)

Larsen, Erik Huusfeldt (Intern)

**Project Manager, organisational:**

Sloth, Jens Jørgen (Intern)

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**Metal Release by Corrosion and Wear in the Food Industry**

The objectives of this project are to identify the sources of metal contamination from stainless steel equipment in food industry, analyse the impact of the contamination and finally to suggest solutions for the problem. Metal release can cause a health risk for consumers with nickel allergy and the acquisition of data on metal content in not only raw products but also in manufactured food and ready-to-eat dishes will be an improvement of the present status.

The role of the National Food Institute is to analyse trace elements in processed raw materials and foodstuffs sampled at various sites along the process line in the food industry. The trace element content is determined by Inductively Coupled Plasma Mass Spectrometry (ICPMS) equipped with a collision/reaction cell for interference reduction/removal. The obtained data on food products will be analysed and the health risk evaluated by comparison with the estimated daily intake.
By materials selection and development of more wear and corrosion resistant surfaces the general food quality can be improved, metal release reduced and longer lifetime of process equipment obtained – all leading to better products. So by technological solutions safe and high quality food production can be made possible.

Project financing:
The project is funded by The Directorate for Food, Fisheries and Agri Business, DFFE and has a total budget of 6.1 mill kroner. The National Food Institute has a budget of 0.9 mill kr.

National Food Institute
Division of Food Chemistry
Department of Mechanical Engineering
Materials and Surface Engineering
Rigshospitalet
Period: 01/01/2003 → 01/01/2007
Number of participants: 4
Project participant:
Larsen, Erik Huusfeldt (Intern)
Møller, Per (Intern)
Poulsen, Lars Kærgaard (Intern)

Project Manager, organisational:
Sloth, Jens Jørgen (Intern)

Prevention of Cancer by Intervention with Selenium (PRECISE)
In order to test the possible role of selenium in cancer prevention, a group of researchers from Denmark, Sweden and the UK have designed the Prevention of Cancer by Intervention with Selenium (PRECISE) study. Over a period of 8 years a planned total of 42000 Europeans will be randomised to supplementation with yeast-selenium at 100, 200 and 300 µg/day or placebo. Pilot studies have been conducted in Denmark and in the UK from 1999-2004, and the biomarkers of selenium intake show good response and compliance to the supplements. No adverse effects were recorded. The task of the National Food Institute is to aid in the study design and assure quality of the selenium supplementation tablets to be used. In case of a positive outcome of the PRECISE trial, the National Food Institute will devise ways to raise the selenium intake in the general population.

Division of Food Chemistry
National Food Institute
Aalborg University Hospital
Odense University Hospital
Karolinska Institutet
University of Surrey
Period: 01/01/2002 → 01/01/2015
Number of participants: 6
Project participant:
Overvad, Kim (Ekstern)
Cold, Søren (Ekstern)
Adami, Hans Olav (Ekstern)
Rayman, Margaret (Ekstern)
Sloth, Jens Jørgen (Intern)

Project Manager, organisational:
Larsen, Erik Huusfeldt (Intern)

Arsenic speciation in seafood
Arsenic is introduced into the environment via both anthropogenic and natural sources. Biotransformation processes in nature are responsible for the existence of a large number of naturally occurring arsenic compounds. Especially samples of marine origin may contain high concentrations of arsenic (up to several hundred mg/kg). A large variation in toxicity among the various arsenic species is found. Inorganic arsenic is the most toxic form, whereas organic bound arsenic is considered less toxic and some compounds even innocuous. Dietary exposure to arsenic comes mainly from seafood. In
order to carry out a correct assessment of possible health risks associated with the ingestion of arsenic in food, the dramatic variation in toxicity must be taken into account. Consequently speciation analysis is needed. Methodologies for arsenic speciation analysis is based on various forms of liquid chromatography coupled to ICPMS as an arsenic-specific detector (HPLC-ICPMS) and the use of solid phase extraction for selective extraction of inorganic arsenic followed by determination by atomic absorption spectrometry (SPE-AAS). Electrospray Ionisation Mass spectrometry is used for the structural identification of arsenic compounds and for the structural elucidation of novel arsenic species.

Division of Food Chemistry
National Food Institute

National Institute for Nutrition and Seafood Research
National Food Administration

RIKILT
Period: 01/01/2001 → 31/12/2011
Number of participants: 5
Project participant:
Haldorsen, Anne-Katrine (Ekstern)
Jorhem, Lars (Ekstern)
de Jong, Jacob (Ekstern)
Larsen, Erik Huusfeldt (Intern)
Project Manager, organisational:
Sloth, Jens Jørgen (Intern)

Project

Selenium speciation and bioavailability
The aim of the project is to characterise molecular forms (species) of selenium in food of plant and animal origin. Furthermore, the research aims at assessing the bioavailability in humans of selenium. The selenium contained in plants from the onion family (e.g. garlic and onion) and in selenium-enriched yeast was extracted using aqueous solvents or proteolytic enzymes. The selenium species (ppt-file) were identified by liquid chromatography coupled with the selenium-selective ICP-MS detector. For assessment of the selenium bioavailability (ppt-file) in humans, yeast enriched by the stable selenium isotope 77Se was used as the intervention substance. The bioavailability was estimated by time-resolved appearance of 77Se in blood, urine and faecal samples.

Division of Food Chemistry
National Food Institute
Institute for Plant Research
Centre National de la Recherche Scientifique
Pharma Nord Aps.
Period: 01/01/2001 → 31/12/2007
Number of participants: 2
Project participant:
Sloth, Jens Jørgen (Intern)
Project Manager, organisational:
Larsen, Erik Huusfeldt (Intern)

Activities:

Application of seaweeds in food and feed - analysis of toxic elements and implications for food/feed safety
Period: 9 Nov 2017
Jens Jørgen Sloth (Speaker)
Susan Løvstad Holdt (Other)
Max Hansen (Other)
Arne Duinker (Other)
National Food Institute
Research Group for Nano-Bio Science
Research Group for Bioactives – Analysis and Application
Division of Risk Assessment and Nutrition
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: Talks and presentations › Conference presentations

Fractional factorial design to assess zinc speciation in Atlantic salmon (Salmo salar) feeds
Period: 19 Jun 2017 → 22 Jun 2017
Jens Jørgen Sloth (Other)
National Food Institute
Research Group for Nano-Bio Science

Description
Poster
Degree of recognition: International

Related event

15th Scandinavian Symposium on Chemometrics
19/06/2017 → 22/06/2017
Naantali, Finland
Activity: Talks and presentations › Conference presentations

Arsenic compounds in foodstuffs – the importance of speciation analysis for food safety assessment
Period: 24 Oct 2016
Jens Jørgen Sloth (Speaker)
National Food Institute
Research Group for Nano-Bio Science

Related event

Temadag: Miljøets betydning for sundheden
24/10/2016 → 24/10/2016
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Determination of iodine and inorganic arsenic in feed: analytical methods and risk assessment
Period: 19 Oct 2016
Jens Jørgen Sloth (Speaker)
National Food Institute
Research Group for Nano-Bio Science

Related event

International Feed Conference: Present and future challenges
19/10/2016 → 20/10/2016
Geel, Belgium
Activity: Talks and presentations › Conference presentations

International Feed Conference
Jens Jørgen Sloth (Organizer)
National Food Institute
Research Group for Nano-Bio Science

**Description**
Member of scientific committee and poster award committee

**Related event**

**International Feed Conference: Present and future challenges**
19/10/2016 → 20/10/2016
Geel, Belgium
Activity: Attending an event › Participating in or organising a conference

**Inorganic arsenic in food and feed – the journey from research to legislation and standardization of methods**
Period: 6 Oct 2016
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Research Group for Nano-Bio Science

**Related event**

**Science day of the Contaminants EURLs**
06/10/2016 → 07/10/2016
Geel, Belgium
Activity: Talks and presentations › Conference presentations

**Toxic trace elements in seaweed – occurrence, analysis and food safety assessment**
Period: 21 Jun 2016
Jens Jørgen Sloth (Speaker)
National Food Institute
Research Group for Nano-Bio Science

**Related event**

**22nd International Seaweed Symposium**
19/06/2016 → 24/06/2016
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**The complex natural chemistry of arsenic – analytical challenges and implications on food safety**
Period: 9 Jun 2016
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Research Group for Nano-Bio Science

**Related event**

**The Danish Chemical Society Annual Meeting 2016**
09/06/2016 → 09/06/2016
Odense, Denmark
Activity: Talks and presentations › Conference presentations

**Use of seaweed in food and feed – implications for food/feed safety**
Period: 6 Jun 2016
Jens Jørgen Sloth (Speaker)
Related event

8th Nordic Conference on Plasma Spectrochemistry
05/06/2016 → 08/06/2016
Loen, Norway
Activity: Talks and presentations › Conference presentations

Nordic conference on plasmaspectrochemistry
Period: 5 Jun 2016 → 8 Jun 2016
Jens Jørgen Sloth (Organizer)
National Food Institute
Research Group for Nano-Bio Science

Description
Member of organizing committee

Related event

8th Nordic Conference on Plasma Spectrochemistry
05/06/2016 → 08/06/2016
Loen, Norway
Activity: Attending an event › Participating in or organising a conference

Examples of use of Agilent 8800 ICP-QQQ in food research - speciation analysis and nanoparticle characterisation
Period: 11 Mar 2016
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Research Group for Nano-Bio Science

Related event

Agilent Nordic Scientific Forum
10/03/2016 → 11/03/2016
Gothenburg, Sweden
Activity: Talks and presentations › Conference presentations

Food Analysis Congress
Period: 15 Sep 2015 → 16 Sep 2015
Jens Jørgen Sloth (Organizer)
National Food Institute
Research Group for Nano-Bio Science

Description
Chairman of conference
Links:

Related event

Food Analysis Congress 2015 : Safety, Quality, Novel Technologies
15/09/2015 → 16/09/2015
Cambridge, United Kingdom
Activity: Attending an event › Participating in or organising a conference
Arising compounds in foodstuffs – recent developments in speciation analysis and food safety assessment
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Division of Food Chemistry

Description
Tutorial on As compounds in food and their analysis
Links:

Related event
Food Analysis Congress 2014
29/10/2014 → 30/10/2014
Barcelona, Spain
Activity: Talks and presentations › Conference presentations

An update on the analysis of lipid-soluble arsenic compounds in marine oils – new compounds and new challenges
Period: 17 Oct 2014
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Division of Food Chemistry

Related event
EU-RL Workshop on Trace Elements in Food of Animal Origin
17/10/2014 → …
Rom, Italy
Activity: Talks and presentations › Conference presentations

Speciation analysis of lipid-soluble arsenic compounds (arsenolipids) in marine oils – new compounds and new challenges
Period: 7 Sep 2014 → 10 Sep 2014
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Division of Food Chemistry

Related event
128th AOAC International 2014 Annual Meeting
07/09/2014 → 10/09/2014
Boca Raton, United States
Activity: Talks and presentations › Conference presentations

7th Nordic Conference on Plasma Spectrochemistry
Period: 1 Jun 2014 → 4 Jun 2014
Jens Jørgen Sloth (Organizer)
Division of Food Chemistry
National Food Institute
Research Group for Nano-Bio Science
Degree of recognition: International

Related event
7th Nordic Conference on Plasma Spectrochemistry
01/06/2014 → 04/06/2014
Loen, Norway
5th International IUPAC Symposium for Trace Elements in Food
Period: 6 May 2014 → 9 May 2014
Jens Jørgen Sloth (Organizer)
Division of Food Chemistry
National Food Institute

Description
Arranger af konferencen sammen med Prof Søren Husted fra KU (PLEN)

Related event
5th International IUPAC Symposium for Trace Elements in Food
06/05/2014 → 09/05/2014
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

Iodine in seaweed
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Division of Food Chemistry

Related event
Nordic Iodine Meeting
25/03/2014 → 26/03/2014
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Arsenic speciation in food – current status on standardization of methods for specific determination of inorganic arsenic
Period: 7 Oct 2013
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Division of Food Chemistry
Documents:
JJSL_EURL_meeting_Roma2013.pdf

Related event
Annual NRL - EURL Workshop EURL - CEFAO
07/10/2013 → 08/10/2013
Rome, Italy
Activity: Talks and presentations › Conference presentations

Determination of inorganic arsenic in food and feed – European initiatives in research and standardization of methods
Period: 28 Aug 2013
Jens Jørgen Sloth (Invited speaker)
National Food Institute
Division of Food Chemistry
Documents:
JJSL_AOAC_meeting_Chicago2013final.pdf

Related event
AOAC International 2013 Annual Meeting
Arsenic speciation in food – emphasis on inorganic arsenic

Period: 5 Oct 2012

Jens Jørgen Sloth (Invited speaker)

National Food Institute
Division of Food Chemistry

Documents:
Report_Workshop_2012_EURL_CEFAO.pdf

Related event

Annual Workshop of the EU-RL on Chemical Elements in Food of Animal Origin
05/10/2012 → 05/10/2012

Rome, Italy
Activity: Talks and presentations › Conference presentations

5th International Symposium on Recent Advances in Food Analysis (RAFA): Inorganic arsenic determined by SPE separation and AAS detection - a novel speciation approach

Period: 3 Nov 2011

Jens Jørgen Sloth (Speaker)

National Food Institute
Division of Food Chemistry

Description
Arsenic (As) is a naturally occurring element, which is found at concentrations in the mg/kg range in marine animals. The element is bioaccumulated from seawater. It has a very complex chemistry and more than 50 naturally-occurring arsenic containing species, both inorganic and organic forms, have been identified in marine animals. The organic forms are mainly considered to be non-toxic, whereas inorganic arsenic is highly toxic and exposure may lead to severe adverse effects including cancer. An accurate estimation of inorganic arsenic exposure is therefore highly relevant for evaluation of food safety. However, so far most of the occurrence data collected in the official EU food control are still reported as total arsenic. A simple and inexpensive method for determination of inorganic arsenic in marine based food and feed by hydride generation atomic absorption spectrometry (HG-AAS) after microwave extraction and separation by solid phase extraction (SPE) has been developed and validated. The SPE separation is based on the different charges (pKa values) of the arsenic species at specific pH, which allow selective elution of organic arsenic compounds (e.g. MA, DMA and AB) and inorganic arsenic in the form of As(V). The sample is heated with a hydrochloric acid and hydrogen peroxide solution (20 minutes at 90 °C with 0.06 M HCl, 3 % H2O2). Hereby the sample is solubilised and As(III) is oxidised to As(V). Inorganic arsenic is selectively separated from other arsenic compounds using strong anion exchange SPE. The procedure include first pre-condition of the column, then loading of the buffered samples (pH 5.0-7.5), washing with 0.5 M acetic acid and finally elution of the sample from the column by 0.5 M HCl. The concentration of arsenic is determined by HG-AAS using external standards. SPE method development and sample extraction was evaluated using a selective HPLC-ICP-MS detection method. No degradation or conversion of organic arsenic species such as AB, MA or DMA were observed under the chosen extraction conditions. The results obtained by SPE-HG-AAS and HPLC-ICP-MS were not significantly different (95% confidence). The method was validated by spiked and naturally incurred marine samples. The limit of detection was 0.08 mg/kg and the in-house reproducibility standard deviations were less than ±13% for samples containing 0.2 to 1.5 mg/kg inorganic arsenic. The method has furthermore been tested in a collaborative trial on marine feed and food with a satisfactory result and is now in the process for CEN approval as a future European standard method. Acknowledgement: Funding from the European Community’s Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 211326.

Documents:
L38 RAFA2011 Rie Romme Rasmussen_online.pdf

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations
Arsenic speciation in food and feed, CRL Speciation training course
Period: 1 Jan 2008 → …
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Lipid-soluble contaminants
Period: 1 Jan 2008 → …
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Description
Place: DTU, Lyngby, Denmark

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Speciation analysis of trace elements by HPLC- and GC-ICPMS, Danish Society for Analytical Chemistry
Period: 1 Jan 2008 → …
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Description
Place: Copenhagen, Denmark

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Arsen i marine prøver
Period: 1 Jan 2007 → …
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Description
Place: Bergen, Norway

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Metalpartikler i fødevaren – hvordan kan det måles?
Period: 1 Jan 2007 → …
Jens Jørgen Sloth (Speaker)
**Tungmetaller i fødevarer**
Period: 1 Jan 2007 → …
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

**Prevention of Cancer by Intervention With Selenium (PRECISE) pilot trial: selenium in nails, plasma and whole blood as biomarkers of yeast-selenium intake. Co-author.**
Jens Jørgen Sloth (Other)
Division of Food Chemistry
National Food Institute

**Specieringsanalyser av arsen i sjømat ved HPLC-ICPMS**
Period: 4 May 2006 → 5 May 2006
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

**Fødevaresikkerhed for blødskallede krabber**
Period: 1 Jan 2006 → …
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Description
Place: Kontaktforum for Projekt Strandkrabber, Danmarks Fiskeriundersøgelser, Ingeniørhuset, København, Danmark

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

CEN TC275 WG10 Foodstuffs - Expert group on Elements and their chemical Species (External organisation)
Period: 20 Mar 2005 → …
Jens Jørgen Sloth (Participant)
National Food Institute
Research Group for Nano-Bio Science

Description
CEN TC275 WG10 Expert Group on Elements and their Chemical species
Degree of recognition: International

Related external organisation
CEN TC275 WG10 Foodstuffs - Expert group on Elements and their chemical Species
Brussels, Belgium
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

CEN TC327 Animal Feedingstuffs - Expert group on Elements and their chemical species (External organisation)
Period: 20 Mar 2005 → …
Jens Jørgen Sloth (Participant)
National Food Institute
Research Group for Nano-Bio Science
Degree of recognition: International

Related external organisation
CEN TC327 Animal Feedingstuffs - Expert group on Elements and their chemical species
Brussels, Belgium
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Fra råstof til færdigvare – hvordan analyseres for spormængder af metal i fødevarer
Period: 1 Jan 2005 → …
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Description
Place: DTU, Lyngby, Danmark

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Toksiske stoffer i fisk, DIFRES seminar
Period: 1 Jan 2005 → …
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Description
Place: Danish Institute for Fisheries Research, Lyngby, Danmark

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Speciation and bioavailability of inorganic arsenic, selenium and iodine in food. Co-author.
Jens Jørgen Sloth (Other)
Division of Food Chemistry
National Food Institute

Related external organisation

The 2nd International Symposium – Trace Elements in Food, Brussels, Belgium
Activity: Talks and presentations › Conference presentations

Speciation analysis by HPLC-ICP-MS
Jens Jørgen Sloth (Participant)
Division of Food Chemistry
National Food Institute

Related external organisation

DanSAK 8, Copenhagen, Denmark
Activity: Other

Selenium speciation and isotope abundance measurements in intrinsically 77Se-labelled yeast and human samples by HPLC with detection by ICP-DRC-MS and ES-MS. Co-author.
Period: 8 Jul 2002 → 10 Jul 2002
Jens Jørgen Sloth (Other)
Division of Food Chemistry
National Food Institute

Related external organisation

Activity: Talks and presentations › Conference presentations

2002 Winter Conference on Plasma Spectrochemistry
Period: 6 Jan 2002 → 12 Jan 2002
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Description
Selenium and tellurium speciation in yeast and algae
Degree of recognition: International

Related event

2002 Winter Conference on Plasma Spectrochemistry
The use of dynamic reaction cell ICP-MS and ES-MS for selenium isotope analysis and speciation in biological materials
Period: 4 Feb 2001 → 8 Feb 2001
Jens Jørgen Sloth (Other)
Division of Food Chemistry
National Food Institute

Related external organisation
The European Winter Conference on Plasma Spectrochemistry, Hafjell, Norway
Activity: Talks and presentations › Conference presentations

2000 Winter Conference on Plasma Spectrochemistry
Period: 10 Jan 2000 → 15 Jan 2000
Jens Jørgen Sloth (Speaker)
National Food Institute
Division of Food Chemistry

Description
Use of ICP-DRC-MS for elemental analysis and selenium speciation in biological samples
Degree of recognition: International

Related event
2000 Winter Conference on Plasma Spectrochemistry
10/01/2000 → 15/01/2000
Fort Lauderdale, United States
Activity: Talks and presentations › Conference presentations

Press clippings:

Inorganic arsenic, arsenolipids, iodine – tracking future feed controls
Jens Jørgen Sloth
19/12/2016
National Food Institute, Research Group for Nano-Bio Science

Media contribution (1)

Inorganic arsenic, arsenolipids, iodine – tracking future feed controls
19/12/2016
feednavigator.com, Web
Jane Byrne
http://www.feednavigator.com/Regulation/Arsenic-iodine-tracking-future-feed-controls
Jens Jørgen Sloth
National Food Institute, Research Group for Nano-Bio Science
Press / Media

CEN standard for arsenik
Jens Jørgen Sloth
19/12/2016
National Food Institute, Research Group for Nano-Bio Science

Media contribution (1)

CEN standard for arsenik
19/12/2016
Europeisk standard metode (CEN) Uorganisk arsen i fødevarer
Jens Jørgen Sloth
12/04/2016
National Food Institute, Research Group for Nano-Bio Science

Media contribution (1)

Europeisk standard metode (CEN) Uorganisk arsen i fødevarer
12/04/2016
FoodNavigator.com, Web
Niamh Michail
Jens Jørgen Sloth
National Food Institute, Research Group for Nano-Bio Science
Press / Media

Nanopartikler i fødevarer
Jens Jørgen Sloth
07/01/2016

Subject
Nanopartikler i fødevarer
National Food Institute, Research Group for Nano-Bio Science

Media contribution (1)

Nanopartikler i fødevarer
07/01/2016
Politiken, Web
Adam Hannestad
Jens Jørgen Sloth
National Food Institute, Research Group for Nano-Bio Science
Press / Media