Can solubility be used to predict availability? The example of zinc, selenium and manganese in salmon diets

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Characterization of 17 elements in ten edible seaweed species from Greenland

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Corresponding author: Kreissig, K. J.
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Cytokine Profile in Patients with Aseptic Loosening of Total Hip Replacements and Its Relation to Metal Release and Metal Allergy

Metal release from total hip replacements (THRs) is associated with aseptic loosening (AL). It has been proposed that the underlying immunological response is caused by a delayed type IV hypersensitivity-like reaction to metals, i.e., metal allergy. The purpose of this study was to investigate the immunological response in patients with AL in relation to metal release and the prevalence of metal allergy. THR patients undergoing revision surgery due to AL or mechanical implant...
failures were included in the study along with a control group consisting of primary THR patients. Comprehensive cytokine analyses were performed on serum and periimplant tissue samples along with metal analysis using inductive coupled plasma mass spectrometry (ICP-MS). Patient patch testing was done with a series of metals related to orthopedic implant. A distinct cytokine profile was found in the periimplant tissue of patients with AL. Significantly increased levels of the proinflammatory cytokines IL-1β, IL-2, IL-8, IFN-γ and TNF-α, but also the anti-inflammatory IL-10 were detected. A general increase of metal concentrations in the periimplant tissue was observed in both revision groups, while Cr was significantly increased in patient serum with AL. No difference in the prevalence of metal sensitivity was established by patch testing. Increased levels of IL-1β, IL-8, and TNF-α point to an innate immune response. However, the presence of IL-2 and IFN-γ indicates additional involvement of T cell-mediated response in patients with AL, although this could not be detected by patch testing.

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Evaluation of lead, mercury, cadmium and arsenic accumulation, and fatty acids' profile in muscle and cephalothorax of Parapenaeus longirostris (Mediterranean shrimp) and of Pandalus borealis (northern shrimp)
The aim of the present work was to assess the nutritional value of shrimps in terms of the essential fatty acids versus the toxicological concern as regards elements' accumulation in their tissues. The concentrations of lead (Pb), mercury (Hg), cadmium (Cd) and arsenic (As), and the fatty acid (FA) profiles in the muscle and cephalothorax of Parapenaeus longirostris (Mediterranean shrimp) and Pandalus borealis (northern shrimp) were evaluated and comparatively studied. The results indicated a substantial association of the Cd, Pb and Hg concentrations with the shrimp fishing area and the tissue type. Moreover, Cd, Pb and Hg levels, found in the tissues of shrimps, were below EU maximum levels for human consumption. Total As concentration was highest (p < 0.05) in all tissues studied, mainly in the organic As form. Fatty acid patterns were found significantly different between shrimp species and tissues. Palmitic (C16:0), oleic (C18:1 omega-9), eicosapentaenoic (C20:5 omega-3, EPA) and docosahexaenoic (C22:6 omega-3, DHA) acids were found to be the major FA in all tissues. The highest DHA/EPA and omega-3/omega-6 ratios were found in Parapenaeus longirostris and Pandalus borealis tissues, respectively. A positive feature, arising from the FA comparison, was the low values for both the atherogenic and thrombogenic indices, related to the high unsaturated/saturated FA ratio. (C) All Rights Reserved

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Mice with epidermal filaggrin deficiency show increased immune reactivity to nickel
Nickel allergy and dermatitis have been associated with filaggrin gene mutations in epidemiological studies, but the mechanisms mediating these associations are unknown. To investigate whether filaggrin-deficient flaky tail (ft/ft) mice show increased immune reactivity to nickel and elucidate the mechanisms mediating this, the immune responses to nickel, 2,4-dinitrofluorobenzene (DNFB), cinnamal and p-phenylenediamine were assessed in ft/ft and wild-type (WT) mice. The amounts of nickel in the skin of ft/ft and WT mice were determined 20 hours after nickel exposure. The effect of blocking either the interleukin (IL)-17A pathway or the IL-1 pathway on the response to nickel in ft/ft mice was evaluated. Increased responsiveness to nickel, DNFB and cinnamal was observed in ft/ft mice as compared with controls. A reduced amount of nickel was found in the skin of ft/ft mice as compared with WT mice, suggesting increased nickel absorption by the skin of ft/ft mice. Blocking either the IL-17A pathway or the IL-1 pathway reduced nickel responsiveness in ft/ft mice. These findings suggest that the increased nickel responsiveness associated with epidermal filaggrin deficiency is mediated by a combination of increased nickel penetration and the steady-state inflammation found in the skin of filaggrin-deficient mice.

Occupational allergic contact dermatitis caused by cobalt in machine oil
Cobalt is used in the creation of hard metal alloys, because of its ability to bind tungsten and carbon.1 This allows for increased resistance to wear, which is essential for mechanical parts exposed to heavy strain.2 Occupational allergic
cobalt dermatitis has traditionally been observed in metal, construction and pottery workers following direct skin contact with cobalt ions from alloys, paint, porcelain, cement, and leather.3, 4 We present a case of severe allergic contact dermatitis caused by occupational exposure to machine oil that was contaminated with cobalt residues.

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**Report on collaborative trial Animal Feedingstuffs – Determination of inorganic arsenic in animal feed by anion-exchange HPLC-ICPMS**

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**Short-term effect of the New Nordic Renal Diet on phosphorus homoeostasis in chronic kidney disease Stages 3 and 4**
The New Nordic Diet is a food concept favouring organically produced food items, fruits, vegetables, whole grains and fish. We investigated the short-term effects of a modified phosphorus-reduced New Nordic Renal Diet (NNRD) in chronic kidney disease (CKD) patients on important parameters of phosphorus homoeostasis. The NNRD contained a total of 850 mg phosphorus/day. A total of 18 patients, CKD Stages 3 and 4 were studied in a randomized crossover trial comparing a 1-week control period of the habitual diet with a 1-week period of the NNRD. Data were obtained at baseline and during 1 week of dietary intervention (habitual diet versus NNRD) by collecting fasting blood samples and 24-h urine collections. The primary outcome was the difference in the change in 24-h urine phosphorus excretion from baseline to Day 7 between the NNRD and habitual diet periods. Secondary outcomes were changes in the fractional excretion of phosphorus, fibroblast growth factor 23 (FGF23) and plasma phosphate. As compared with the habitual diet, 24-h urine phosphorus excretion was reduced in the NNRD by 313 mg/day (P

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Speciation of zinc in fish feed by size exclusion chromatography coupled to inductively coupled plasma mass spectrometry – using fractional factorial design for method optimisation and mild extraction conditions

Zinc (Zn) is an element essential to all living organisms and it has an important role as a cofactor of several enzymes. In fish, Zn deficiency has been associated with impaired growth, cataracts, skeletal abnormalities and reduced activity of various Zn metalloenzymes. Fish meal and fish oil traditionally used in salmon feed preparation are being replaced by plant-based ingredients. Zinc additives are supplemented to salmon feed to ensure adequate Zn levels, promoting good health and welfare in Atlantic salmon (Salmo salar). The main objective of the present study was to evaluate Zn species found in an Atlantic salmon feed. This work describes a Zn extraction method that was optimized using a fractional factorial design (FFD), whereby the effect of six factors could be studied by performing only eight experiments. The effects of the type of extraction solution and its molar concentration, pH, presence of sodium dodecyl sulphate, temperature and extraction time on Zn extraction were investigated. Mild extraction conditions were chosen in order to keep the Zn species intact. Total Zn (soluble fractions and non-soluble fractions) was determined by inductively coupled plasma mass spectrometry (ICP-MS). The highest Zn recovery was obtained using 100mM Tris-HCl, pH8.5 at a temperature of 4°C for 24h where the total Zn in soluble fraction and non-soluble fraction was 9.9±0.2% and 98±6%, respectively. Zinc speciation analysis (on the soluble fractions) was further conducted by size exclusion inductively coupled plasma mass spectroscopy (SEC-ICP-MS). The SEC-ICP-MS method provided qualitative and semi-quantitative information regarding Zn species present in the soluble fractions of the feed. Four Zn-containing peaks were found, each with different molecular weights: Peak 1 (high molecular weight - ~600kDa), peak 2 and peak 3 (medium molecular weight – 32 to 17kDa) were the least abundant (1–6%), while peak 4 (low molecular weight – 17 to 1.36kDa) was the most abundant (84–95%).
Selenium and selenium species in feeds and muscle tissue of Atlantic salmon

Selenium (Se) is an essential element for animals, including fish. Due to changes in feed composition for Atlantic salmon (Salmo salar), it may be necessary to supplement feeds with Se. In the present work, the transfer of Se and Se species from feed to muscle of Atlantic salmon fed Se supplemented diets was studied. Salmon were fed basal fish feed (0.35 mg Se/kg and 0.89 mg Se/kg feed), or feed supplemented either with selenised yeast or sodium selenite, at low (1–2 mg Se/kg feed) and high (15 mg Se/kg feed) levels, for 12 weeks. For the extraction of Se species from fish muscle, enzymatic cleavage with protease type XIV was applied. The extraction methods for Se species from fish feed were optimised, and two separate extraction procedures were applied, 1) enzymatic cleavage for organic Se supplemented feeds and 2) weak alkaline solvent for inorganic Se supplemented feeds, respectively. For selenium speciation analysis in feed and muscle tissue anion-exchange HPLC-ICP-MS for analysis of inorganic Se species and cation-exchange HPLC-ICP-MS for analysis of organic Se species, were applied. In addition, reversed phase HPLC-ICP-MS was applied for analysis of selenocysteine (SeCys) in selected muscle samples. The results demonstrated that supplemented Se (organic and inorganic) accumulated in muscle of Atlantic salmon, and a higher retention of Se was seen in the muscle of salmon fed organic Se diets. Selenomethionine (SeMet) was the major Se species in salmon fed basal diets and diets supplemented with organic Se, accounting for 91–118% of the total Se. In contrast, for muscle of salmon fed high inorganic Se diet, SeMet accounted for 30% of the total Se peaks detected. Several unidentified Se peaks were detected, in the fish fed high inorganic diet, and analysis showed indicated SeCys is a minor Se species present in this fish muscle tissue.

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Web of Science (2018): Impact factor 2.895
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An electroplated copper–silver alloy as antibacterial coating on stainless steel

Transfer and growth of pathogenic microorganisms must be prevented in many areas such as the clinical sector. One element of transfer is the adhesion of pathogens to different surfaces and the purpose of the present study was to develop and investigate the antibacterial efficacy of stainless steel electroplated with a copper-silver alloy with the aim of developing antibacterial surfaces for the medical and health care sector. The microstructural characterization showed a porous microstructure of electroplated copper-silver coating and a homogeneous alloy with presence of interstitial silver. The copper-silver alloy coating showed active corrosion behavior in chloride-containing environments. ICP-MS measurements revealed a selective and localized dissolution of copper ions in wet conditions due to its galvanic coupling with silver. No live bacteria adhered to the copper-silver surfaces when exposed to suspensions of S. aureus and E. coli at a level of $10^8$ CFU/ml whereas $10^4$ CFU/cm² adhered after 24h on the stainless steel controls. In addition, the Cu-Ag alloy caused a significant reduction of bacteria in the suspensions. The coating was superior in its antibacterial activity as compared to pure copper and silver electroplated surfaces. Therefore, the results showed that the electroplated copper-silver coating represents an effective and potentially economically feasible way of limiting surface spreading of pathogens.
A study of selenoproteins in atlantic salmon (Salmo salar) using hyphenated mass spectrometry and bioinformatics

Selenium (Se) is an essential micronutrient for vertebrates and fish. Se is central to the function of selenoproteins, which play key roles in many biological functions including redox signaling, antioxidant defense, hormone metabolism, and immune responses. The number and expression levels of selenoproteins vary between different animal species with teleost fish featuring a much higher number of selenoproteins compared to vertebrates. While selenoproteomes have been well described for many species, a comprehensive analysis of selenoproteins in Atlantic salmon (Salmo salar) has yet to be performed. With recent advances in bioinformatics it has become possible to predict selenoproteins using computational tools; however, these in silico predictions description require validation through analytical data. In the present study we applied gel electrophoresis with subsequent use of laser ablation coupled to inductively coupled plasma mass spectrometry (LA-ICP-MS), and tryptic digestion with subsequent analysis with high performance liquid chromatography (HPLC) coupled to both ICPMS and high-resolution tandem electrospray mass spectrometry (HR-ESI-MS) for the analysis of selenoproteins. Furthermore, we set out to combine theoretical selenoprotein predictions with hyphenated analytical techniques to characterize the selenoproteome of salmon liver tissue. The results and challenges related to the analytical work will be presented and the presentation will show how bioinformatics data can be combined with analytical data to study selenoproteomes in fish.
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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Contributors: Löschner, K., Correia, M., López Chaves, C., Rokkjær, I., Sloth, J. J.
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Effects of steaming on contaminants of emerging concern levels in seafood

Seafood consumption is a major route for human exposure to environmental contaminants of emerging concern (CeCs). However, toxicological information about the presence of CeCs in seafood is still insufficient, especially considering the effect of cooking procedures on contaminant levels. This study is one among a few who evaluated the effect of steaming on the levels of different CeCs (toxic elements, PFCs, PAHs, musk fragrances and UV-filters) in commercially relevant seafood in Europe, and estimate the potential risks associated with its consumption for consumers. In most cases, an increase in contaminant levels was observed after steaming, though varying according to contaminant and seafood species (e.g. iAs, perfluorobutanoate, dibenz(ah)anthracene in Mytilus edulis, HHCB-Lactone in Solea sp., 2-Ethylhexyl salicylate in Lophius piscatorius). Furthermore, the increase in some CeCs, like Pb, MeHg, iAs, Cd and carcinogenic PAHs, in seafood after steaming reveals that adverse health effects can never be excluded, regardless contaminants concentration. However, the risk of adverse effects can vary. The drastic changes induced by steaming suggest that the effect of cooking should be integrated in food risk assessment, as well as accounted in CeCs regulations and recommendations issued by food safety authorities, in order to avoid over/underestimation of risks for consumer health.

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Corresponding author: Marques, A.
Iodine in seaweed - occurrence, speciation, bioavailability and risk assessment

Seaweed is the common term for marine macroalgae plants, which may be divided into green, red and brown algae types. There is an increased interest to increase the exploitation of marine macroalgae for commercial purposes including the use in relation to food and feed production. Certain seaweeds have a great potential to accumulate various trace elements and contain consequently relatively high levels of both essential and toxic elements. Seaweed can even be used for bioremediation purposes in order to remove trace elements from the environment. The concentrations of iodine in seaweeds vary highly between the different types of seaweed. In green and red algae concentrations in the lower mg/kg are typically reported, whereas in certain brown algae concentrations in the g/kg range (dry mass) can be found. These very high levels raise concern about food and feed safety when brown algae are used consumed by either humans or animals. No maximum levels for iodine in seaweeds (or other types of food and feed) have been established in the legislation in EU. For humans an upper tolerable level at 600 µg/day has been established (SCF, 2003), hence consumption of as low as 100 mg of certain seaweeds would lead to an exceeding of this guideline value. There is a need for a better documentation of the iodine levels in seaweeds and further knowledge on the biological and environmental factors that may influence the concentration levels (e.g. seaweed type, location and season). Furthermore, the speciation of iodine may also be an important parameter to take into account when assessing the safety of seaweed food and feed applications.

The present lecture will include:
- examples of the use of seaweeds in various food items
- examples of the determination of iodine and iodine compounds in seaweed samples by (HPLC-)ICP-MS discussion of the results obtained in relation to food and feed safety assessment.

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Macro and trace elements in Paracentrotus lividus gonads from South West Atlantic areas

Sea urchin represents one of the most valuable seafood product being harvested and explored for their edible part, the gonads or roe. This species is generally considered a sentinel organism for ecotoxicological studies being widely used in
monitoring programs to assess coastal aquatic environments quality, because is directly exposed to anthropogenic contaminants in their habitat. In this context, the aim of this study is to evaluate the concentrations of macro (Cl, K, P, Ca, S) and trace (Zn, Br, Fe, Sr, I, Se, Rb, Cu, Cr, Ni, As, iAs, Cd, Pb, Hg) elements in Paracentrotus lividus gonads from three South West Atlantic production areas subjected to distinct environmental and anthropogenic pressures. In all studied areas, the elements profile in sea urchin gonads was Cl > K > P > Ca > S > Zn > Br > Fe > Sr > I > Rb > Cu > Se > Cr > Ni, suggesting an element guide profile with special interest for sea urchin farming development. Concerning toxic elements, the profile was the following: As > Cd > Pb > Hg > iAs. The results evidenced higher levels of Pb and Hg in open areas. Distinct area characteristics and anthropogenic pressures of production areas evidence the importance of biomonitoring contaminants, particularly toxic elements. In general, the levels of these elements were below maximum levels in foodstuffs (MLs) which pose a minimal health risk to consumers.

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**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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Corresponding author: Alves, R. N.
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The influence of microplastics and halogenated contaminants in feed on toxicokinetics and gene expression in European seabass (Dicentrarchus labrax)

When microplastics pollute fish habitats, it may be ingested by fish, thereby contaminating fish with sorbed contaminants. The present study investigates how combinations of halogenated contaminants and microplastics associated with feed are able to alter toxicokinetics in European seabass and affect the fish. Microplastic particles (2%) were added to the feed either with sorbed contaminants or as a mixture of clean microplastics and chemical contaminants, and compared to feed containing contaminants without microplastics. For the contaminated microplastic diet, the accumulation of polychlorinated biphenyls (PCBs) and brominated flame retardants (BFRs) in fish was significantly higher, increasing up to 40 days of accumulation and then reversing to values comparable to the other diets at the end of accumulation. The significant gene expression results of liver (cyp1a, il1β, gstα) after 40 days of exposure indicate that microplastics might indeed exacerbate the toxic effects (liver metabolism, immune system, oxidative stress) of some chemical contaminants sorbed to microplastics. Seabass quickly metabolised BDE99 to BDE47 by debromination, probably mediated by deiodinase enzymes, and unlike other contaminants, this metabolism was unaffected by the presence of microplastics. For the other PCBs and BFRs, the elimination coefficients were significantly lower in fish fed the diet with contaminants sorbed to microplastic compared to the other diets. The results indicate that microplastics affects liver detoxification and lipid distribution, both of which affect the concentration of contaminants.
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.

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Bioaccessibility of contaminants of emerging concern in raw and cooked commercial seafood species: insights for food safety risk assessment

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Bioavailability of emerging contaminants in seafood

General information
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Can seafood safety be compromised in the ocean of tomorrow?

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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 seabass (Dicentrarchus labrax) produced in Southern Europe, where it is a highly consumed seafood product. 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.

Acknowledgments

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Source ID: 130181169
Research output: Contribution to conference » Poster – Annual report year: 2017 » Research
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.

Effects of industrial processing on regulated and emerging contaminant levels in seafood

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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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Web of Science (2017): Indexed yes
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Iodine in seaweed - occurrence, speciation, bioavailability and risk assessment

General information
Publication status: Published
Organisations: National Food Institute, Research group for Nano-Bio Science, Research group for Bioactives – Analysis and Application, Division of Risk Assessment and Nutrition
Contributors: Sloth, J. J., Rasmussen, R. R., Holdt, S. L., Hansen, M.
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Publisher: Helmholtz-Zentrum Geesthacht
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EWCPSS_2017_Book_of_Abstracts.pdf
Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report year: 2017 › Research › peer-review
Phycoremediation of diflubenzuron, lindane, copper and cadmium potential by Laminaria digitata

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Place of publication: Brussels, Belgium
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Phycoremediation potential of brown macroalgae species Saccharina latissimi and Laminaria digitata towards inorganic arsenic in a multitrophic pilot-scale experiment

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Research output: Chapter in Book/Report/Conference proceeding › Conference abstract in proceedings – Annual report
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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 practises towards this parameter.

Acknowledgments
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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Publication status: Published
Organisations: National Food Institute, Research group for Nano-Bio Science
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
Publication status: Published
Organisations: National Food Institute, Research group for Analytical Food Chemistry, Research group for Nano-Bio Science, National Institute of Aquatic Resources, Section for Aquaculture
Pages: 16-16
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Place of publication: Brussels, Belgium
Publisher: Royal Flemish Academy of Science and the Arts (KVAB)
Electronic versions:
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Research output: Chapter in Book/Report/Conference proceeding – Annual report year: 2017 › Research › peer-review

Toxic metals in European Ulva spp. – evaluation of potential use in food and feed applications

General information
Publication status: Published
Organisations: National Food Institute, Research group for Nano-Bio Science, Technical University of Denmark, Aarhus University
Contributors: Christiansen, E. R., Bruhn, A., Sloth, J. J.
Number of pages: 1
Publication date: 2017
Peer-reviewed: Yes
Event: Poster session presented at 7th Nordic seaweed conference, Grenaa, Denmark.
Electronic versions:
Poster_Ulva_TRYK.pdf
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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%.

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute, European Commission Joint Research Centre Institute , CSIC, University of Graz, University of Barcelona, National Institute of Health, University of Aberdeen
Number of pages: 11
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Peer-reviewed: Yes

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

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.

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.

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Scopus rating (2016): CiteScore 3.85 SJR 1.564 SNIP 0.901
Web of Science (2016): Impact factor 4.041
Web of Science (2016): Indexed yes
Original language: English
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Sahebekhtiari_et_al_2016_PROTEOMICS.pdf. Embargo ended: 30/04/2017
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Source: FindIt
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**There is a need for speciation analysis of selenium in fish feed and fish tissue**

**General information**
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Organisations: National Food Institute, Research group for Nano-Bio Science, National Institute of Nutrition and Seafood Research
Contributors: Sele, V., Sloth, J. J., Ørnsrud, R., Amlund, H.
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Sele_Sloth_Sele_se_speciation_fish_feed_poster_loen2016_final_Veronika.pdf
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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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Publication status: Published
Organisations: National Food Institute, Research group for Nano-Bio Science, Research group for Analytical Food Chemistry, Universiti Putra Malaysia
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 (r² = 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, C(19)H(39)AO(3), 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.

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Web of Science (2015): Indexed yes
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Source ID: 274635322
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**Correlations between arsenolipids, organic and inorganic forms of arsenic, mercury and selenium in muscles and cephalothoraxes of Aristaeomorpha foliacea shrimp**

**General information**
Publication status: Published
Organisations: National Food Institute, Research group for Nano-Bio Science, Technical University of Denmark, National and Kapodistrian University of Athens, National Institute of Nutrition and Seafood Research
Contributors: Soultani, G., Sele, V., Rasmussen, R. R., Pasias, I., Stathopoulou, E., Thomaidis, N. S., Scoullos, M., Sloth, J. J.
Number of pages: 1
Publication date: 2015
Peer-reviewed: Yes
Event: Poster session presented at CEMEPE - 5th international conference on environmental management, engineering, planning and economics, Athens, Greece.
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**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 and Kapodistrian University of Athens, National Institute of Nutrition and Seafood Research
Contributors: Soultani, G., Sele, V., Rasmussen, R. R., Pasias, I., Stathopoulou, E., Thomaidis, N. S., Scoullos, M., Sloth, J. J.
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Pages: 14-14
Publication date: 2015

**Host publication information**
Environmental contaminants of emerging concern in seafood - European database on contaminant levels

Marine pollution gives rise to concern not only about the environment itself but also about the impact on food safety and consequently on public health. European authorities and consumers have therefore become increasingly worried about the transfer of contaminants from the marine environment to seafood. So-called "contaminants of emerging concern" are chemical substances for which no maximum levels have been laid down in EU legislation, or substances for which maximum levels have been provided but which require revision. Adequate information on their presence in seafood is often lacking and thus potential risks cannot be excluded. Assessment of food safety issues related to these contaminants has thus become urgent and imperative. A database (www.ecsafeseafoodbase.eu), containing available information on the levels of contaminants of emerging concern in seafood and providing the most recent data to scientists and regulatory authorities, was developed. The present paper reviews a selection of contaminants of emerging concern in seafood including toxic elements, endocrine disruptors, brominated flame retardants, pharmaceuticals and personal care products, polycyclic aromatic hydrocarbons and derivatives, microplastics and marine toxins. Current status on the knowledge of human exposure, toxicity and legislation are briefly presented and the outcome from scientific publications reporting on the levels of these compounds in seafood is presented and discussed.

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Web of Science (2015): Impact factor 3.088
Web of Science (2015): Indexed yes
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Source ID: 2279576154
Research output: Contribution to journal › Journal article – Annual report year: 2015 › Research › peer-review

Evaluation of the Danish cultivated sugarkelp as possible future source of ingredients such as minerals and pigments

General information
Publication status: Published
Organisations: National Food Institute, Research group for Bioactives – Analysis and Application, Department of Environmental Engineering, Residual Resource Engineering, Research group for Nano-Bio Science
Number of pages: 1
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.

General information
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Organisations: National Food Institute, Division of Risk Assessment and Nutrition, Research group for Nano-Bio Science
Contributors: Hansen, M., Sloth, J. J., Rasmussen, R. R.
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Publication date: 2015

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

General information
Publication status: Published
Organisations: National Food Institute, Research group for Nano-Bio Science, Trace Element Speciation Laboratory, Matís ltd.
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L'Arsenico nei prodotti della pesca lagunare in un'area estrattivo-industriale

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Organisations: National Food Institute, Research group for Nano-Bio Science, Istituto Zooprofilattico Sperimentale Umbria, Servizio Veterinario IAOA USL 7 Carbonia
Contributors: Orletti, R., Sloth, J. J., Carloni, C., Griffoni, F., Palombo, P., Piras, P.
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Publisher: ISTISAN Congressi (Istituto Superiore di Sanità. Congressi).

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L'Arsenico nei prodotti della pesca lagunare in un'area estrattivo-industriale

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Contributors: Orletti, R., Sloth, J. J., Carloni, C., Griffoni, F., Palombo, P., Piras, P.
Number of pages: 1
Publication date: 2015
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Event: Poster session presented at Convegno nazionale Arsenico nelle catene alimentari (Arsenic in the food chain), Roma, Italy.
Electronic versions:
Poster_Arsenico_Boi_Cerbus_rev.1.pdf
Research output: Contribution to conference – Poster – Annual report year: 2015 › Research › peer-review

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 (0.86mgkg(-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.
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. 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 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 in 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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Contributors: Hansen, M., Rasmussen, R. R., Sloth, J. J.
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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, monoiodotyrosine (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 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 2862) to 78 μg/l (n 2041) (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.
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.

**General information**

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Web of Science (2014): Impact factor 2.268  
Web of Science (2014): Indexed yes  
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Keywords: Arsenic, Chemical contamination, Developing countries, Groundwater, Rural areas, Surface waters, Thermal processing (foods), Water treatment  
DOIs: 10.1016/j.apgeochem.2013.11.012

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**Total and inorganic As in seafood products caught in an environment facing a mining and industrial area in Sardinia (Italy)**

**General information**

Publication status: Published  
Organisations: National Food Institute, Division of Food Chemistry, Istituto Zooprofilattico Sperimentale Umbria, Servizio Veterinario IAOA USL 7 Carbonia  
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Research output: Contribution to conference › Poster – Annual report year: 2014 › Research › peer-review

**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.
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.

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BFI (2014): BFI-level 1
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.
Arsen i fiskeoljer
Fiskeoljer kan inneholde relativt høye konsentrasjoner av grunnstoffet arsen. I fiskeoljer finnes arsen i form av fettløselige arsenforbindelser; arsenolipider. Dette er en forholdsvis ny gruppe arsenholdige forbindelser som en i dag har begrenset kunnskap om. Hvilke kjemiske forbindelser av arsenolipider finnes? Hvor mye er til stede i fiskeoljer? Og er forbindelsene giftige? Dette er spørsmål som først kan besvares når det analytiske grunnlaget er på plass.

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ISI indexed (2013): ISI indexed no
Original language: Norwegian
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Chemical Contaminants. Food monitoring 2004-2011

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Electronic versions:
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Source ID: u::8131
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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.

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Scopus rating (2013): CiteScore 1.87 SJR 0.822 SNIP 1.42
Web of Science (2013): Impact factor 3.624
Web of Science (2013): Indexed yes
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**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 (Ammodytes 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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BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.55 SJR 1.236 SNIP 1.279
Web of Science (2013): Impact factor 3.578
ISI indexed (2013): ISI indexed yes
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.

Inorganic arsenic – spe hg–aas method for rice tested in-house and collaboratively

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Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2013 › Research › peer-review
Inorganic arsenic - SPE HG-AAS method for RICE tested in-house and collaboratively

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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.

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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.

Methylmercury determined by HPLC-ICP-MS in marine food and feed: in-house method validation and inter-laboratory comparison

Methylmercury determined by hplc–icpms in marine food and feed; in-house method validation and interlaboratory comparison

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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 >70 m 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.

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Web of Science (2013): Indexed yes
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Source: dtu
Source ID: n:oai:DTIC-ART:springer/386068406::28342
Research output: Contribution to journal › Journal article – Annual report year: 2013 › Research › peer-review

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 for Standardization).

General information
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.

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Organisations: National Food Institute, Division of Food Chemistry
Contributors: Rasmussen, R. R., Qian, Y., Sloth, J. J.
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Publication information
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Scopus rating (2013): CiteScore 3.55 SJR 1.236 SNIP 1.279
Web of Science (2013): Impact factor 3.578
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Original language: English
Keywords: Inorganic arsenic, Rice samples, SPE-HG-AAS, Water bath extraction, Food control, Speciation
DOIs:
10.1007/s00216-013-6936-8
Source: dtu
Source ID: n:oai:DTIC-ART:springer/391959941::31874
Research output: Contribution to journal › Journal article – Annual report year: 2013 › Research › peer-review

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.
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⁻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.

**General information**

Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry, Danish Veterinary and Food Administration
Contributors: Hedegaard, R. S. V., Rokkjær, I., Sloth, J. J.
Pages: 4429-4435
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Peer-reviewed: Yes

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Web of Science (2013): Impact factor 3.578
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Original language: English
Keywords: Dietary supplements, Inorganic arsenic, Speciation analysis, HPLC-ICP-MS, Dietary exposure
DOI:
10.1007/s00216-013-6835-z
Source: dtu
Source ID: n::oai:DTIC-ART:springer/385589211::28082
Research output: Contribution to journal › Journal article – Annual report year: 2013 › Research › peer-review

**Arsenolipids in fish oil determined by GC-ICPMS**

**General information**

Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry, National Institute of Nutrition and Seafood Research, University of Bergen
Contributors: Sele, V., Amlund, H., Julshamn, K., Sloth, J. J.
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Publication date: 2012
Peer-reviewed: Yes
Electronic versions:
prod11341828899300.2012_NordicPlasma_AsLip_by_GC_ICPMS_Sele_JJSL.pdf

**Bibliographical note**

Poster presentation
Research output: Contribution to conference › Poster – Annual report year: 2012 › Research › peer-review

**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.
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.

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Organisations: National Food Institute, Division of Food Chemistry
Contributors: Rasmussen, R. R., Hedegaard, R. S. V., Larsen, E. H., Sloth, J. J.
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Peer-reviewed: Yes

Publication information
Journal: Analytical and Bioanalytical Chemistry
Volume: 403
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ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Original language: English
DOIs: 10.1007/s00216-012-6006-7
Source: dtu
Source ID: n:oai:DTIC-ART:pubmed/366066877::17385
Research output: Contribution to journal › Journal article – Annual report year: 2012 › Research › peer-review

Humans seem to produce arsenobetaine and dimethyarsinate 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 organoarsonicals 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), dimethyarsinate
(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 organoarsonicals. 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 organoarsenicals. 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.

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute, Oslo and Akershus University College of Applied
Sciences, National Institute of Nutrition and Seafood Research, Institute for Chemistry-Analytical Chemistry, Norwegian
Institute of Public Health, Statistics Norway
Goessler, W., Oshaug, A., Alexander, J., Fliegel, D., Ydersbond, T., Meltzer, H.
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Publication date: 2012
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Journal: Environmental Research
Volume: 112
ICP-MS and HPLC-ICP-MS for large scale monitoring of total arsenic and inorganic arsenic in Norwegian seafood

General information
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Organisations: National Food Institute, Division of Food Chemistry, National Institute of Nutrition and Seafood Research, Institute of Marine Research
Contributors: Julshamn, K., Nilsen, B. M., Frantzen, S., Valdersnes, S., Måge, A., Nedreaas, K., Fliegel, D., Sloth, J. J.
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Peer-reviewed: Yes
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2012 NordicPlasma iAs in norwegian fish Fliegel-JJSL.pdf

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Research output: Contribution to conference → Poster → Annual report year: 2012 → Research → peer-review

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
Publication date: 2012

Event information
Event: Danish Society for Mass Spectrometry Meeting 2012
Location: Svendborg, Denmark
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JJSL DSMS møde Svendborg Jan2012.pdf
URLs:
http://www.dsms.dk/
Source: orbit
Source ID: 318480
Research output: Non-textual form → Sound/Visual production (digital) → Annual report year: 2012 → Research

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 $\zeta$ 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.

**General information**

Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry, European Commission Joint Research Centre Institute , Fera Science Ltd., Karl-Franzens Universität Graz, CSIC, University of Barcelona, University of Aberdeen, Istituto Superiore di Sanità
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- Web of Science (2012): Impact factor 3.659
- ISI indexed (2012): ISI indexed yes

Keywords: Wheat, Vegetables, Algae, Inorganic arsenic

DOI: 10.1007/s00216-012-6398-4
Source: dtu
Source ID: n:oai:DTIC-ART:springer/372460346::20575
Research output: Contribution to journal › Journal article – Annual report year: 2012 › Research › peer-review

**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.

**General information**

Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry, Oslo and Akershus University College of Applied Sciences, Statistics Norway, National Institute of Nutrition and Seafood Research, Institute for Chemistry-Analytical Chemistry, Norwegian Institute of Public Health
Pages: 2462-2472
Publication date: 2012
Peer-reviewed: Yes
The CONfiDENCE project - The outcome of WP3 on heavy metals

General information
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Organisations: National Food Institute, Division of Food Chemistry
Contributors: Sloth, J. J.
Publication date: 2012

Event information
Event: 7th EU-RL workshop on heavy metals in food and feed
Location: Brussels, Belgium

Bibliographical note
Oral presentation
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Source ID: u::5029
Research output: Non-textual form – Sound/Visual production (digital) – Annual report year: 2012 – Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Rasmussen, R. R., Hedegaard, R. S. V., Herbst, M. B. K., Sloth, J. J.
Publication date: 2011
Peer-reviewed: No
Electronic versions:
Poster-1.pdf
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https://www.was.org/WasMeetings/meetings/Default.aspx?code=WA2011
Source: orbit
Source ID: 278441
Research output: Contribution to conference → Poster – Annual report year: 2011 → Research

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.

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Arsenic Exposure from Seafood Consumption

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Contributors: Amlund, H., Sloth, J. J.
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Editor: Nriagu, J.
ISBN (Print): 978-0-444-52273-3

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.

General information
Publication status: Published
Organisations: Analytical Chemistry, Department of Chemistry, Organic Chemistry, Center for Microbial Biotechnology, Department of Systems Biology, Enzyme and Protein Chemistry, Division of Food Chemistry, National Food Institute, The Danish Polymer Centre, Department of Chemical and Biochemical Engineering
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.
Heavy metals in feed - Current regulation, risk assessment, methods of analysis, examples and future trends

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Sloth, J. J.
Publication date: 2011

Event information
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Electronic versions: prod21323176963981.JJSL.pdf
URLs: http://www.akademie-fresenius.de/konferenz/output.php?kurs=278
Source: orbit
Source ID: 313975
Research output: Non-textual form > Sound/Visual production (digital) – Annual report year: 2011 > Research

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 (unspiked and spiked), fish meal (unspiked and spiked), fish fillet (spiked) and a lobster hepatopancreas (unspiked). 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.

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry, European Commission Joint Research Centre Institute , Technical University of Munich
Number of pages: 41
Publication date: 2011
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 202Hg, 198Hg, 35Cl (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 inter-laboratory 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.
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.
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.

**General information**
- Publication status: Published
- Organisations: Division of Food Chemistry, National Food Institute, Division of Toxicology and Risk Assessment, University of Copenhagen
- Pages: 2461-2468
- Publication date: 2011
- Peer-reviewed: Yes

**Publication information**
- Journal: Analytical Chemistry
- Volume: 83
- Issue number: 7
- ISSN (Print): 0003-2700
- Ratings:
  - BFI (2011): BFI-level 2
  - Scopus rating (2011): CiteScore 5.86
  - Web of Science (2011): Impact factor 5.856
  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2011): Indexed yes
- Original language: English
- Electronic versions:
  - 9A35F929d01.pdf
  - DOIs: 10.1021/ac102545e
  - Source: orbit
  - Source ID: 276623

**Speciation analysis of trace elements in food and feed - status and future developments**

**General information**
- Publication status: Published
- Organisations: National Food Institute, Division of Food Chemistry
- Contributors: Sloth, J. J.
- Publication date: 2011
- Peer-reviewed: No
- Event: Poster session presented at AOAC 125th Annual Meeting & Exposition, New Orleans, USA
- Electronic versions:
  - JJSL.pdf
  - Source: orbit
  - Source ID: 284279

**Speciation analysis of trace elements in relation to food and feed control - status and future developments**

**General information**
- Publication status: Published
- Organisations: National Food Institute, Division of Food Chemistry
- Contributors: Sloth, J. J.
- Publication date: 2011

**Event information**
- Event: AOAC 125th Annual Meeting & Exposition
- Location: New Orleans, USA
Speciation of arsenic and mercury in feed: why and how?
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.

Speciation of Heavy Metals - an important parameter for risk assessment of feed and food safety in aquaculture
Arsenic speciation in marine samples – focus on shellfish and seafood safety

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Sloth, J. J.
Publication date: 2010
Peer-reviewed: No
Source: orbit
Source ID: 262418
Research output: Contribution to conference › Paper – Annual report year: 2010 › Research

Arsenolipids in fish oils

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Sele, V., Amlund, H., Lundebye, A., Herbst, M. B. K., Sloth, J. J.
Publication date: 2010
Peer-reviewed: No
Source: orbit
Source ID: 264752
Research output: Contribution to conference › Poster – Annual report year: 2010 › Research

Arsenolipids in seafood

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute, National Institute of Nutrition and Seafood Research
Contributors: Sele, V., Lundebye, A., Sloth, J. J., Amlund, H.
Publication date: 2010
Peer-reviewed: No
Source: orbit
Source ID: 270689
Research output: Contribution to conference › Poster – Annual report year: 2010 › Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Hedegaard, R. S. V., Sloth, J. J.
Publication date: 2010
Peer-reviewed: No
Source: orbit
Source ID: 257359
Research output: Contribution to conference › Poster – Annual report year: 2010 › Research

Determination of inorganic arsenic - food and feed

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J.
Publication date: 2010
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/6BomTac) 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
Publication status: 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 Centre for the Working Environment
Pages: 16
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Particle and Fibre Toxicology
Volume: 7
ISSN (Print): 1743-8977
Ratings:
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.097 SNIP 1.431
Web of Science (2010): Impact factor 4.906
Original language: English
Electronic versions:
5C181d01.pdf
DOIs:
10.1186/1743-8977-7-16

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Source: orbit
Source ID: 264747
Research output: Contribution to journal › Journal article – Annual report year: 2010 › Research › peer-review

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
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Jensen, B. H., Sloth, J. J., Petersen, A.
Publication date: 2010

Metal accumulation and food safety in wastewater-fed aquatic production systems in Hanoi, Vietnam. Risk assessment of the human dietary intake of different elements
Rapid Methods for Metal Speciation

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J.
Publication date: 2010
Peer-reviewed: No

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 tetramethylarsonium 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 arsobilane content was reduced significantly, but only in the samples of blue mussels.

The role of GC-ICPMS in food analysis applications

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Sloth, J. J.
Publication date: 2010
AFFF-MALS-ICP-MS and electron microscopy for the characterization of nanoparticles in biological studies

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute, National Research Centre for the Working Environment, Chinese Academy of Sciences
Publication date: 2009
Peer-reviewed: No
Event: Poster session presented at 4th International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic.
Source: orbit
Source ID: 252220
Research output: Contribution to conference › Poster – Annual report year: 2009 › Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Publication date: 2009
Peer-reviewed: No
Event: Poster session presented at 2009 European Winter Conference on Plasma Spectrochemistry, Graz, Austria.
Source: orbit
Source ID: 240308
Research output: Contribution to conference › Poster – Annual report year: 2009 › Research

Detection and characterisation of nanoparticles by field flow fractionation (FFF) using multi-angle light scattering (MALS) and ICPMS

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Larsen, E. H., Schmidt, B., Löschner, K., Sloth, J. J.
Publication date: 2009
Peer-reviewed: No
Event: Abstract from 2009 European Winter Conference on Plasma Spectrochemistry, Graz, Austria.
Source: orbit
Source ID: 246718
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2009 › Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Hedegaard, R. S. V., Larsen, E. H., Sloth, J. J., Hansen, M.
Publication date: 2009

Event information
Event: Thermo Scientific usermeeting
Keywords: speciation of arsenic
Source: orbit
Determination of inorganic arsenic in food and feed by MAE-SPE-HG-AAS-A simple, inexpensive and fast speciation alternative

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Publication date: 2009
Peer-reviewed: No
Event: Poster session presented at 2009 European Winter Conference on Plasma Spectrochemistry, Graz, Austria.
Source: orbit
Source ID: 246723
Research output: Contribution to conference › Poster – Annual report year: 2009 › Research

Heavy metal speciation. How and why?

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Hedegaard, R. S. V., Larsen, E. H., Sloth, J. J., Hansen, M.
Publication date: 2009

Event information
Event: 3th Feed Safety conference
Location: Wageningen, Holland
Keywords: Speciation of arsenic and mercury, Feed
Source: orbit
Source ID: 251726
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2009 › Research

Seafood og kemisk fødevarestikkerhed - classics og newcomers

General information
Publication status: Published
Organisations: National Food Institute
Contributors: Sloth, J. J., Duedahl-Olesen, L., Cederberg, T. L., Andersen, J. H., Petersen, J. H.
Publication date: 2009

Event information
Event: SeafoodCircle temadag : Seafood og kemisk fødevarestikkerhed – classics og newcomers, SeafoodCircle temadag, Klimaforandringernes betydning for den danske fiske industri &amp; Udfordringer omkring import af eksotiske fisk
Location: Horsens, Denmark
Source: orbit
Source ID: 250725
Research output: Non-textual form › Sound/Visual production (digital) – Annual report year: 2009 › Communication

Speciation issues in food control - are we ready?

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Sloth, J. J., Hedegaard, R. S. V., Trier, X. T., Julshamn, K., Larsen, E. H.
Publication date: 2009
Peer-reviewed: No
Event: Abstract from 2009 European Winter Conference on Plasma Spectrochemistry, Graz, Austria.
Source: orbit
Source ID: 246713
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2009 › Research
Trace Element Speciation Analysis - recent and future trends in food analysis

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Hedegaard, R. S. V., Julshamn, K., Larsen, E. H.
Publication date: 2009
Peer-reviewed: No
Event: Paper presented at 4th International Symposium on Recent Advances in Food Analysis, Prague, Czech Republic.
Keywords: Speciation, inorganic arsenic, organotin
Source: orbit
Source ID: 252218
Research output: Contribution to conference → Paper – Annual report year: 2009 → Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Publication date: 2008
Peer-reviewed: Yes
Publication information
Journal: Food & Nutrition Research
Volume: 52
ISSN (Print): 1654-6628
Ratings:
BFI (2008): BFI-level 1
Original language: English
DOIs:
10.3402/fnr.v52i0.1642
Source: orbit
Source ID: 233205
Research output: Contribution to journal → Journal article – Annual report year: 2008 → Research → peer-review

Arsen-grænseværdier i fiskeolie skal undersøges

General information
Publication status: Published
Organisations: Division of Food Production Engineering, National Food Institute, Division of Food Chemistry
Contributors: Jørgensen, S. B. (ed.), Sloth, J. J.
Publication date: 2008
Peer-reviewed: Unknown
Publication information
Journal: FoodDTU Midt i Ugen
Original language: Danish
Source: orbit
Source ID: 258486
Research output: Contribution to journal → Journal article – Annual report year: 2008 → Communication

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

General information
Publication status: Published
Organisations: Materials and Surface Engineering, Department of Mechanical Engineering, Division of Food Chemistry, National Food Institute
Publication date: 2008
Source: orbit
Source ID: 245790
Research output: Non-textual form → Sound/Visual production (digital) – Annual report year: 2008 → Research
Migration of organotin compounds from food contact materials – selective determination using GC-ICPMS

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Sloth, J. J.
Publication date: 2008
Peer-reviewed: No
Source: orbit
Source ID: 235060
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2008 › Research

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.

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Marckmann, P., Nielsen, A., Sloth, J. J.
Pages: 3280-3282
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: Nephrology, Dialysis, Transplantation
Volume: 23
Issue number: 10
ISSN (Print): 0931-0509
Ratings:
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.181 SNIP 1.158
Web of Science (2008): Indexed yes
Original language: English
DOIs:
10.1093/ndt/gfn217
Source: orbit
Source ID: 232996
Research output: Contribution to journal › Journal article – Annual report year: 2008 › Research › peer-review

Speciation analysis of arsenic and tin by LC- or GC-ICPMS – food safety aspects

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J.
Publication date: 2008
Peer-reviewed: No
Event: Abstract from Danish Symposium on Analytical Chemistry : DanSAK9, Lyngby, Denmark.
Source: orbit
Source ID: 235059
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2008 › Research
Stability of Arsenic Compounds in Seafood Samples During Storage by Freezing

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Publication date: 2008
Peer-reviewed: No
Source: orbit
Source ID: 235061
Research output: Contribution to conference → Poster – Annual report year: 2008 → Research

Strategy for in vivo and in vitro toxicity testing of engineered nanoparticles in the Nanotest project

General information
Publication status: Published
Organisations: Division of Toxicology and Risk Assessment, National Food Institute, Division of Food Chemistry
Publication date: 2008
Peer-reviewed: No
Event: Poster session presented at Nanodag på DTU, Kgs. Lyngby, Denmark.
Source: orbit
Source ID: 236791
Research output: Contribution to conference → Poster – Annual report year: 2008 → Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Julshamn, K.
Pages: 1269-1273
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: Journal of Agricultural and Food Chemistry
Volume: 56
Issue number: 4
ISSN (Print): 0021-8561
Ratings:
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.327 SNIP 1.327
Web of Science (2008): Indexed yes
Original language: English
DOIs:
10.1021/jf073174+
Source: orbit
Source ID: 233180
Research output: Contribution to journal → Journal article – Annual report year: 2008 → Research → peer-review
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
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute, Division of Toxicology and Risk Assessment
Publication date: 2007
Peer-reviewed: No
Event: Poster session presented at International Symposium on Nanotechnology in Environmental Protection and Pollution, Fort Lauderdale, USA.
Source: orbit
Source ID: 245655
Research output: Contribution to conference

Arsen i før og mat - analyse og toksikogisk vurdering

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Publication date: 2007
Peer-reviewed: No
Source: orbit
Source ID: 245673
Research output: Contribution to conference

Arsen – på den fede måde

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Pages: 26-28
Publication date: 2007
Peer-reviewed: Unknown

Publications information
Journal: Dansk Kemi
Volume: 88
Issue number: 8
ISSN (Print): 0011-6335
Ratings:
Web of Science (2007): Indexed yes
Original language: Danish
Source: orbit
Source ID: 245643
Research output: Contribution to journal

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Julshamn, K., Larsen, E. H.
Publication date: 2007
Determination of trace element species using ICPMS coupled with GC and HPLC

General information
Publication status: Published
Organisations: National Food Institute, Division of Food Chemistry
Contributors: Sloth, J. J.
Publication date: 2007
Peer-reviewed: No
Event: Abstract from The 11th Nordic Seminar on ICP/MS, ICP/OES and AAS, Knivsta, Sweden.
Source: orbit
Source ID: 245666
Research output: Contribution to conference » Conference abstract for conference – Annual report year: 2007 » Research

Kilder og niveauer af kemiske fødevareforureninger

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Granby, K., Cederberg, T. L., Duedahl-Olesen, L., Petersen, J. H., Poulsen, M. E., Sloth, J. J.
Publication date: 2007
Peer-reviewed: No
Source: orbit
Source ID: 245177
Research output: Contribution to conference » Conference abstract for conference – Annual report year: 2007 » Research

Produktion af blødskaliede strandkrabber i Danmark - en ny marin akvakulturproduktion

General information
Publication status: Published
Organisations: Section for Aquatic Process and Product Technology, National Institute of Aquatic Resources, Division of Food Chemistry, National Food Institute
Contributors: Fischer, K., Cold, U., Jørgensen, K., Larsen, E., Rasmussen, O., Sloth, J. J.
Number of pages: 111
Publication date: 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, procymidone 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 g day⁻¹ for pesticides and 21 μg g day⁻¹ for copper. Correspondingly, the intakes from South African grapes were 2.6 and 5.7 μg g 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.
Arsen i fiskeolje som fôringrediens til oppdrettsfisk – en ny utfordring?

General information
Publication status: Published
Organisations: National Food Institute
Pages: 55-56
Publication date: 2006
Peer-reviewed: Unknown

Publication information
Journal: Norsk Fiskeoppdrett
Volume: 4
ISSN (Print): 0332-7132
Original language: English
Source: orbit
Source ID: 245646
Research output: Contribution to journal › Journal article – Annual report year: 2006 › Research

of inorganic arsenic in blue mussel (Mytilus edulis L) from the Norwegian coastline – impact on seafood safety

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Sele, V., Julshamn, K.
Publication date: 2006
Peer-reviewed: No
Event: Poster session presented at ISSEBETS, International Symposium on Speciation of Elements in Biological, Environmental and Toxicological Sciences, Białowieza, Poland, .
Source: orbit
Source ID: 245660
Research output: Contribution to conference › Poster – Annual report year: 2006 › Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Larsen, E. H., Overvad, K., Cold, S., Moesgaard, S., Dragsted, L. O., Sloth, J. J.
Publication date: 2006
Peer-reviewed: No
Source: orbit
Source ID: 247603
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2006 › Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Publication date: 2006
Peer-reviewed: No
Event: Abstract from Quasimeme workshop – Organotin in Marine Materials, NERI, Roskilde, Denmark, .
Source: orbit
Source ID: 245676
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2006 › Research
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
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Pages: 1098-1108
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Analytical and Bioanalytical Chemistry
Volume: 385
Issue number: 6
ISSN (Print): 1618-2642
Ratings:
Scopus rating (2006): SJR 0.981 SNIP 1.046
Web of Science (2006): Indexed yes
Original language: English
Keywords: selenium enrichment, garlic, HPLC-mass spectrometry, mycorrhiza, selenium speciation
Determination of inorganic arsenic in white fish using microwave-assisted alkaline alcoholic sample dissolution and HPLC-ICP-MS

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
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Pages: 339-346
Publication date: 2005
Peer-reviewed: Yes

Publication information
Journal: Analytical and Bioanalytical Chemistry
Volume: 381
Issue number: 2
ISSN (Print): 1618-2642
Ratings:
Scopus rating (2005): SJR 0.971 SNIP 1.123
Web of Science (2005): Indexed yes
Original language: English
Keywords: inorganic arsenic, seafood, microwave-assisted alkaline dissolution, anion-exchange HPLC-ICP-MS
DOIs:
10.1007/s00216-004-2815-7
Source: orbit
Source ID: 230313
Research output: Contribution to journal › Journal article – Annual report year: 2005 › Research › peer-review

Is seawater a reliable source of iodine for Atlantic halibut (Hippoglossus hippoglossus L.)?

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Moren, M., Sloth, J. J., Hamre, K.
Publication date: 2005
Peer-reviewed: No
Event: Poster session presented at Larvi 05 : Fish and Shellfish Larviculture Symposium, Gent, Belgium.
Source: orbit
Source ID: 245663
Research output: Contribution to conference › Poster – Annual report year: 2005 › Research

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 (DMEA), 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.

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Larsen, E. H., Julshamn, K.
Pages: 227-235
Publication date: 2005
Peer-reviewed: Yes

Publication information
Journal: Rapid Communications in Mass Spectrometry
Volume: 19
Issue number: 2
ISSN (Print): 0951-4198
Ratings:
Scopus rating (2005): SJR 1.39 SNIP 1.144
Web of Science (2005): Indexed yes
Original language: English
Source: orbit
Source ID: 230318
Research output: Contribution to journal › Journal article – Annual report year: 2005 › Research › peer-review

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
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Larsen, E. H., Julshamn, K.
Publication date: 2005

Publication information
Publisher: Danmarks Tekniske Universitet, Fødevareinstituttet
Original language: English
Source: orbit
Source ID: 245639
Research output: Book/Report › Report – Annual report year: 2005 › Research

Speciation analysis of arsenic – Development of selective methodologies for assessment of seafood safety

General information
Publication status: Published
Organisations: Unknown
Contributors: Sloth, J. J.
Publication date: 2005

Publication information
ISBN (Print): 82-7744-128-2
Original language: English
Source: orbit
Source ID: 245649
Research output: Book/Report › Doctoral thesis – Annual report year: 2005 › Research

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.
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, dimethylarsinioylacetic acid, trimethylarsioniopropionate and dimethylarsinoylethanol, were determined in the urines. Additionally, several unknown arsenicals were detected. This is the first time that dimethylarsinoylacetate acid and trimethylarsioniopropionate 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

Selenium From a High Se Yeast Supplement Is Well Absorbed and Retained in Humans
Arsenic speciation analysis using HPLC coupled to ICPMS

General information
Publication status: Published
Organisations: University of Bergen
Contributors: Sloth, J. J.
Publication date: 2003
Peer-reviewed: Yes
Source: orbit
Source ID: 245690
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2003 › Research › peer-review

Arsenic species in marine samples

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Larsen, E. H., Julshamn, K.
Publication date: 2003
Peer-reviewed: No
Event: Abstract from 5th International Symposium on Speciation of Elements in Biological, Environmental and Toxicological Sciences, Almuñécar, Spain.
Source: orbit
Source ID: 245688
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 2003 › Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Julshamn, K., Larsen, E. H.
Publication date: 2003
Peer-reviewed: No
Event: Poster session presented at Winter Plasma Conference on Plasmaspectrochemistry, Garmisch-Partenkirchen, Germany.
Source: orbit
Source ID: 245681
Research output: Contribution to conference › Poster – Annual report year: 2003 › Research

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 dimethylarsinoylacetic acid, whereas the cationic arsenuocholine 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 mug 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**
- Publication status: Published
- Organisations: Division of Food Chemistry, National Food Institute
- Contributors: Sloth, J. J., Larsen, E. H., Julshamn, K.
- Pages: 452-459
- Publication date: 2003
- Peer-reviewed: Yes

**Publication information**
- Journal: Journal of analytical atomic spectrometry
- Volume: 18
- Issue number: 5
- ISSN (Print): 0267-9477
- Ratings:
  - Scopus rating (2003): SJR 1.433 SNIP 1.225
  - Web of Science (2003): Indexed yes
- Original language: English
- DOIs: 10.1039/b300508a
- Source: orbit
- Source ID: 229814
- Research output: Contribution to journal → Journal article – Annual report year: 2003 → Research → peer-review

**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**
- Publication status: Published
- Organisations: Division of Food Chemistry, National Food Institute, Pharma Nord ApS
- Pages: 317-322
- Publication date: 2003
- Peer-reviewed: Yes

**Publication information**
- Journal: Journal of analytical atomic spectrometry
- Volume: 18
- Issue number: 4
- ISSN (Print): 0267-9477
- Ratings:
  - Scopus rating (2003): SJR 1.433 SNIP 1.225
  - Web of Science (2003): Indexed yes
Investigation on the arsenic content in processed seafood

General information
Publication status: Published
Organisations: University of Bergen
Contributors: Sloth, J. J., Julshamn, K.
Publication date: 2003
Peer-reviewed: No
Event: Poster session presented at Colloquium Spectroscopicum Internationale XXXIII, Granada, Spain.

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 mug 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
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Larsen, E. H., Sloth, J. J., Hansen, M., Moesgaard, S.
Pages: 310-316
Publication date: 2003
Peer-reviewed: Yes

Publication information
Journal: Journal of analytical atomic spectrometry
Volume: 18
Issue number: 4
ISSN (Print): 0267-9477
Ratings:
Scopus rating (2003): SJR 1.433 SNIP 1.225
Web of Science (2003): Indexed yes
Original language: English
Source: orbit
Source ID: 229834
Research output: Contribution to journal › Journal article – Annual report year: 2003 › Research › peer-review

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

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Julshamn, K., Larsen, E. H.
Publication date: 2002
Peer-reviewed: No
Event: Abstract from Workshop on Arsenic Speciation, Ghent, Belgium.
Source: orbit
Source ID: 245682
Research output: Contribution to conference » Conference abstract for conference – Annual report year: 2002 » Research

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

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Larsen, E. H.
Publication date: 2002
Peer-reviewed: No
Event: Abstract from Winter Plasma Conference on Plasmaspectrochemistry, Scottsdale, United States.
Source: orbit
Source ID: 245678
Research output: Contribution to conference » Conference abstract for conference – Annual report year: 2002 » Research

Analyse af sporelementer i levnedsmidler ved ICP-DRC-MS

General information
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Larsen, E. H.
Pages: 34-40
Publication date: 2000
Peer-reviewed: Unknown

Publication information
Journal: Dansk Kemi
Volume: 81
Issue number: 9
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.

**General information**
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J., Larsen, E. H.
Pages: 669-672
Publication date: 2000
Peer-reviewed: Yes

**Publication information**
Journal: Journal of analytical atomic spectrometry
Volume: 15
Issue number: 6
ISSN (Print): 0267-9477
Ratings:
Scopus rating (2000): SJR 2.141 SNIP 1.502
Web of Science (2000): Indexed yes
Original language: English
DOIs:
10.1021/jf073030v
Source: orbit
Source ID: 245637
Research output: Contribution to journal › Journal article – Annual report year: 2000 › Research › peer-review

**Multielementbestemmelse ved HR-ICP-MS**

**General information**
Publication status: Published
Organisations: Division of Food Chemistry, National Food Institute
Contributors: Sloth, J. J.
Publication date: 1997
Peer-reviewed: No
Event: Abstract from ScanLab, København, Danmark,.
Source: orbit
Source ID: 245680
Research output: Contribution to conference › Conference abstract for conference – Annual report year: 1997 › Research

**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**
Publication status: Published
Organisations: Department of Chemistry, Division of Food Chemistry, National Food Institute, Department of Chemistry
Contributors: Nielsen, S., Sloth, J. J., Hansen, E. H.
Pages: 867-880
Publication date: 1996
Peer-reviewed: Yes

**Publication information**
Volume: 43
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.

General information
Publication status: Published
Organisations: Department of Chemistry, Division of Food Chemistry, National Food Institute, Department of Chemistry
Contributors: Nielsen, S., Sloth, J. J., Hansen, E. H.
Pages: 31-35
Publication date: 1996
Peer-reviewed: Yes

Publication information
Journal: Analyst
Volume: 121
Issue number: 1
ISSN (Print): 0003-2654
Original language: English
Source: orbit
Source ID: 164942
Research output: Contribution to journal › Journal article – Annual report year: 1996 › Research › peer-review

Projects:

Thermal Processing of Seaweeds and the Effects on Quality and Safety
Nielsen, C. W., PhD Student, National Food Institute
Holdt, S. L., Main Supervisor
Feyissa, A. H., Supervisor
Hansen, L. T., Supervisor
Hyldig, G., Supervisor
Sloth, J. J., Supervisor
Rustad, T., Supervisor
01/09/2019 → 31/08/2022
Project: PhD

Metals, arsenic and arsenic species in novel marine feed resources
Tibon, J. S., PhD Student, National Food Institute
Sloth, J. J., Main Supervisor
Amlund, H., Supervisor
Sele, V., Supervisor
01/04/2019 → 31/03/2022
Project: PhD
SEAFOOD-TOMORROW: Nutritious, safe and sustainable seafood for consumers of tomorrow. EU-H2020-project with 35 participants

SEAFOODTOMORROW – Nutritious, safe and sustainable seafood for consumers of tomorrow. EU-H2020-project with 35 participants.

Granby, K., Project Participant, National Food Institute, Research group for Analytical Food Chemistry
Dalgaard, P., Project Participant, National Food Institute, Research Group for Analytical and Predictive Microbiology
Sloth, J. J., Project Participant, National Food Institute, Research group for Nano-Bio Science
Larsen, B. K., Project Participant, National Institute of Aquatic Resources, Section for Aquaculture

FP7 Contract ID: 773400
01/11/2017 → 31/10/2020
Project: Research

Ultra-trace speciation analysis of chromium in foodstuff by high performance liquid chromatography coupled to inductively coupled plasma mass spectrometry using species specific isotope dilution (CHROSPID)

Saraiva, M. A., PhD Student, National Food Institute
Sloth, J. J., Main Supervisor
Jitaru, P., Supervisor
Samfinansieret - Andet
01/02/2018 → 31/01/2021
Award relations: Ultra-Trace speciation analysis of chromium in foodstuff by high performance liquid chromatography coupled to inductively coupled plasma mass spectrometry using species specific isotope dilution
Project: PhD

Extraction and characterisation of highly biocative ingredients from Nordic marine algae

Hermund, D. B., PhD Student, National Food Institute
Jacobsen, C., Main Supervisor
Nielsen, K. F., Supervisor
Sloth, J. J., Examiner
Andersen, M. L., Examiner
Hotchkiss, S., Examiner
Technical University of Denmark
01/06/2012 → 21/04/2016
Award relations: Extraction and characterisation of highly biocative ingredients from Nordic marine algae
Project: PhD

Toksikologiske effekter af akkumulering af nanopartikler i leveren

Modrzynska, J., PhD Student, National Food Institute
Ravn-Haren, G., Main Supervisor
Löschner, K., Supervisor
Jørgensen, A. T., Supervisor
Vogel, U. B., Supervisor
Sloth, J. J., Examiner
Larsen, A., Examiner
Stöger, T. J., Examiner
Technical University of Denmark
01/09/2012 → 15/01/2019
Award relations: Toksikologiske effekter af akkumulering af nanopartikler i leveren
Project: PhD

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

Boutrup Stephansen, K., PhD Student, National Food Institute
Jessen, F., Main Supervisor
Chronakis, I. S., Supervisor
Sloth, J. J., Examiner
Fojan, P., Examiner
Sarmento, B., Examiner
Forskningsrådsfinansiering
01/10/2011 → 02/09/2015
Award relations: Development and characterization of nano-microstructures as carrier for bioactive compounds
Project: PhD
**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.

Sloth, J. J., Project Manager, National Food Institute, Division of Food Chemistry
Larsen, E. H., Project Participant, National Food Institute, Division of Food Chemistry
Møller, P., Project Participant, Department of Mechanical Engineering, Materials and Surface Engineering
Poulsen, L. K., Project Participant

01/01/2003 → 01/01/2007

Collaborators: Righospitalet

Project: Research

**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 silicones. 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.

Trier, X., Project Manager, National Food Institute, Division of Food Chemistry
Sloth, J. J., Project Participant, National Food Institute, Division of Food Chemistry
Larsen, E. H., Project Participant, National Food Institute, Division of Food Chemistry

Danish Veterinary and Food Administration: DKK800,000.00

01/01/2006 → 01/01/2008

Award relations: Organotin compounds in food contact materials

Project: Research
**DANFomega: Udvikling af bæredygtige innovative fødevareingredienser på basis af ørredrestprodukter**

Jacobsen, C., Project Manager, National Food Institute, Division of Industrial Food Research  
Nouard, M., Project Participant, National Food Institute, Division of Industrial Food Research  
Nielsen, H. H., Project Participant, National Food Institute, Division of Industrial Food Research  
Sloth, J. J., Project Participant, National Food Institute, Division of Food Chemistry  
Rasmussen, R. R., Project Participant, National Food Institute, Division of Food Chemistry  
Vu, T. T. T., Project Participant, National Food Institute, Division of Industrial Food Research  
Hansen, E. D., Project Participant, Danforel A/S  
Ørum, P., Project Participant, Danforel A/S  
Honoré, L., Project Manager, inOmega-3 ApS  
Barlach, A., Project Participant, inOmega-3 ApS  
Mølje- og Fødevareministeriet: DKK10,940,907.00  
01/01/2014 → 31/12/2015  
Collaborators: inOmega-3 ApS, Danforel A/S  
Award relations: Udvikling af bæredygtige innovative fødevareingredienser på basis af ørredrestprodukter  
Project: Research

**ECsafeSEAFOOD: 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  
Granby, K., Project Participant, National Food Institute, Division of Food Chemistry  
Sloth, J. J., Project Participant, National Food Institute, Division of Food Chemistry  
Larsen, B. K., Project Participant, National Institute of Aquatic Resources, Section for Aquaculture  
Rasmussen, R. R., Project Participant, National Food Institute, Division of Food Chemistry  
FP7 Contract ID: 31180  
Project ID: 31180  
15/02/2013 → 15/02/2017  
Project: Research

**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 be the various strain modifications of yeasts will be characterised by advanced mass spectrometric methods, such as HPLC-ICP-MS and Q-TOF-MS.

Oslo, L., Project Participant, Department of Systems Biology  
Smidsgaard, J., Project Participant, Department of Systems Biology  
Lobinski, R., Project Participant, Centre National de la Recherche Scientifique  
Krath, B., Project Participant, University of Copenhagen  
Dragsted, L. Ø., Project Participant, University of Copenhagen  
Vanelli, V., Project Participant, Technical University of Denmark  
Paulin, H., Project Participant, Pharma Nord ApS  
Moesgaard, S., Project Participant, Pharma Nord ApS  
Larsen, E. H., Project Manager, National Food Institute, Division of Food Chemistry
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.

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.

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.

Sloth, J. J., Project Manager, National Food Institute, Division of Food Chemistry
Karp, M., Project Participant, Tampere University of Technology
Hedegaard, R. S. V., Project Participant, National Food Institute, Division of Food Chemistry
Rasmussen, R. R., Project Participant, National Food Institute, Division of Food Chemistry
01/05/2008 → 30/04/2012

Collaborators: Tampere University of Technology
Project: Research

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.

Amlund, H., Project Participant, Institute of Marine Research
Sele, V., Project Participant, Institute of Marine Research
Sloth, J. J., Project Manager, National Food Institute, Division of Food Chemistry
01/01/2010 → 31/12/2012

Collaborators: Institute of Marine Research, National Institute of Nutrition and Seafood Research
Project: Research

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 silicones. 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.

Trier, X., Project Manager, National Food Institute, Division of Food Chemistry
Sloth, J. J., Project Participant, National Food Institute, Division of Food Chemistry
Larsen, E. H., Project Participant, National Food Institute, Division of Food Chemistry
01/01/2006 → 31/12/2008

Project: Research

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.

Sloth, J. J., Project Manager, National Food Institute, Division of Food Chemistry
Larsen, E. H., Project Participant, National Food Institute, Division of Food Chemistry
01/01/2004 → 31/12/2009
**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.

Haldorsen, A., Project Participant, National Institute of Nutrition and Seafood Research
Jorhem, L., Project Participant, National Food Agency
de Jong, J., Project Participant, Institute of Food Safety
Sloth, J. J., Project Manager, National Food Institute, Division of Food Chemistry
Larsen, E. H., Project Participant, National Food Institute, Division of Food Chemistry
01/01/2001 → 31/12/2011
Collaborators: National Institute of Nutrition and Seafood Research, Institute of Food Safety, National Food Agency

**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.

Husted, S., Project Participant, University of Copenhagen
Larsen, E. H., Project Participant, National Food Institute, Division of Food Chemistry
Knuthsen, P., Project Participant, National Food Institute, Division of Food Chemistry
Jakobsen, J., Project Participant, National Food Institute, Division of Food Chemistry
Sloth, J. J., Project Participant, National Food Institute, Division of Food Chemistry
Kápolna, E., Project Participant, National Food Institute, Division of Food Chemistry
Saltoft, M., Project Participant, National Food Institute, Division of Food Chemistry
07/01/2007 → 31/12/2010
Collaborators: Aarhus University, University of Copenhagen

**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,
In order to test the possible role of selenium in cancer prevention, a group of researchers from Denmark, Sweden and from 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.

Keywords: Iodine analysis, Seaweed

Activities:

**Iodine in seaweed**

**Period:** 2019

Ana Jerse (Speaker)
Jens Jørgen Sloth (Other)

Research group for Nano-Bio Science
National Food Institute

**Description**

Presentation about iodine in seaweed and analytical challenges related to determination of iodine and its species

**Related event**

**Advances in elemental and isotopic analysis seminar**

02/04/2019 → 03/04/2019
Uppsala, Sweden

Keywords: Iodine analysis, Seaweed

Activity: Talks and presentations › Conference presentations

**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
Keywords: seaweed, Food safety, Toxic elements
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)
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)
National Food Institute
Research group for Nano-Bio Science

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

Arsenic 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 → …
Rome, Italy
Keywords: Arsenolipids, arsenic speciation
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
Activity: Attending an event › Participating in or organising a conference
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  
Keywords: Iodine, Seaweed  
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 Organization
Keywords: Inorganic arsenic, speciation, solid phase extraction, atomic absorption spectroscopy, validation
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 Organization
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 Organization
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 Organization
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 Organization
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

Description
Place: Ingeniørhuset, Danmark

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

Jens Jørgen Sloth (Other)
Division of Food Chemistry
National Food Institute

Related event
8th International Symposium on Selenium in Biology and Medicine
25/07/2006 → 30/07/2006
Madison, United States
Activity: Talks and presentations › Conference presentations

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

Description
Place: Sundvollen, Norway

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

Fødevaresikkerhed for blødskaliede 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 Organization
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

European Committee for Standardization (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
European Committee for Standardization
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 Organization
Activity: Talks and presentations › Conference presentations

Toxiske 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 Organization
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 event
2nd International Symposium on Trace Elements in Food
07/10/2004 → 08/10/2004
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 event
8. Danske Symposium i Analytisk Kemi
25/08/2004 → 26/08/2004
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 event
11th Biennial National Atomic Spectroscopy Symposium
08/07/2002 → 10/07/2002
Longborough, United Kingdom
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
Description
Selenium and tellurium speciation in yeast and algae
Degree of recognition: International

Related event
2002 Winter Conference on Plasma Spectrochemistry
06/01/2002 → 12/01/2002
Scottsdale, United States
Activity: Talks and presentations › Conference presentations

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 event
2001 European Winter Conference on Plasma Spectrochemistry
04/02/2001 → 08/02/2001
Lillehammer, 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
feendnavigator.com, Web
Jane Byrne
http://www.feendnavigator.com/Regulation/Arsenic-iodine-tracking-future-feed-controls
Jens Jørgen Sloth
National Food Institute, Research group for Nano-Bio Science
Press/Media: Press / Media
CEN standard for arsenik
Jens Jørgen Sloth
19/12/2016
National Food Institute, Research group for Nano-Bio Science

Media contribution (1)

Europæisk 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)

Nanopartikler i fødevarer
Jens Jørgen Sloth
07/01/2016
National Food Institute, Research group for Nano-Bio Science

Media contribution (1)