CHEMWATCH

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CHEMICAL EFFECTS

Time Trends of Acrylamide Exposure in Europe: Combined Analysis of Published Reports and Current HBM4EU Studies

2022-08-17

More than 20 years ago, acrylamide was added to the list of potential carcinogens found in many common dietary products and tobacco smoke. Consequently, human biomonitoring studies investigating exposure to acrylamide in the form of adducts in blood and metabolites in urine have been performed to obtain data on the actual burden in different populations of the world and in Europe. Recognizing the related health risk, the European Commission responded with measures to curb the acrylamide content in food products. In 2017, a trans-European human biomonitoring project (HBM4EU) was started with the aim to investigate exposure to several chemicals, including acrylamide. Here we set out to provide a combined analysis of previous and current European acrylamide biomonitoring study results by harmonizing and integrating different data sources, including HBM4EU aligned studies, with the aim to resolve overall and current time trends of acrylamide exposure in Europe. Data from 10 European countries were included in the analysis, comprising more than 5500 individual samples (3214 children and teenagers, 2293 adults). We utilized linear models as well as a non-linear fit and breakpoint analysis to investigate trends in temporal acrylamide exposure as well as descriptive statistics and statistical tests to validate findings. Our results indicate an overall increase in acrylamide exposure between the years 2001 and 2017. Studies with samples collected after 2018 focusing on adults do not indicate increasing exposure but show declining values. Regional differences appear to affect absolute values, but not the overall time-trend of exposure. As benchmark levels for acrylamide content in food have been adopted in Europe in 2018, our results may imply the effects of these measures, but only indicated for adults, as corresponding data are still missing for children.

Authors: Michael Poteser, Federica Laguzzi, Thomas Schettgen, Nina Vogel, Till Weber, Philipp Zimmermann, Domenica Hahn, Marike Kolossa-Gehring, Sónia Namorado, An Van Nieuwenhuyse, Brice Appenzeller, Thórhallur I Halldórsson, Ása Eiríksdóttir, Line Småstuen Haug, Cathrine Thomsen, Fabio Barbone, Valentina Rosolen, Loïc Rambaud, Margaux Riou, Thomas Göen, Stefanie Nübler, Moritz Schäfer, Karin Haji Abbas Zarrabi, Liese Gilles, Laura Rodriguez Martin, Greet Schoeters, Ovnair Sepai, Eva Govarts, Hanns Moshammer

Full Source: Toxics 2022 Aug 17;10(8):481. doi: 10.3390/toxics10080481.

More than 20 years ago, acrylamide was added to the list of potential carcinogens found in many common dietary products and tobacco smoke.

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Microbiome alterations from volatile organic compounds (VOC) exposures among workers in salons primarily serving women of color

2022-08-18

Salon workers, especially those serving an ethnically and racially diverse clientele (i.e., Black/Latina), may experience disparately high levels of workplace exposures to respiratory irritants, including volatile organic compounds (VOCs). Salon workers are also reported to have a greater risk of developing respiratory conditions compared to the general population. Emerging evidence suggests that occupational chemical exposures may alter the human microbiome and that these alterations may be an important mechanism by which workplace VOC exposures adversely impact respiratory health. This preliminary research investigated the potential effects of 28 VOC urinary biomarkers on the 16S rRNA nasal microbiome in 40 workers from salons primarily serving women of color (Black and Dominican salons) compared to office workers. Our exploratory analysis revealed significant differences in microbial composition by worker group; namely dissimilar levels of Staphylococcus species (S. epidermidis and S. aureus, specifically) in salon workers compared to office workers, and higher alpha diversity levels in workers in Dominican salons compared to workers in Black salons. Within-sample alpha diversity levels tended to be decreased with higher VOC urinary biomarker concentrations, significantly for carbon disulfide, acrolein, acrylonitrile, crotonaldehyde, and vinyl chloride biomarkers. Our research highlights that occupational exposures, particularly to chemicals like VOCs, can impact the respiratory microbiome in the vulnerable salon worker group. Further understanding of the potential effects of chemical mixtures on microbial composition may provide key insights to respiratory health and other adverse health outcomes, as well as direct prevention efforts in this largely historically understudied occupational population.

Authors: Kathryn R Dalton, Lydia M Louis, Magdalena Fandiño-Del-Rio, Ana M Rule, Walkiria Pool, Katrina Randolph, Stephen Thomas, Meghan F Davis, Lesliam Quirós-Alcalá

Full Source: Environmental research 2022 Aug 18;214(Pt 4):114125. doi: 10.1016/j.envres.2022.114125.

Salon workers, especially those serving an ethnically and racially diverse clientele (i.e., Black/Latina), may experience disparately high levels of workplace exposures to respiratory irritants, including volatile organic compounds (VOCs).

ENVIRONMENTAL RESEARCH

Is the impact of atmospheric microplastics on human health underestimated? Uncertainty in risk assessment: A case study of urban atmosphere in Xi'an, Northwest China

2022-08-20

Microplastic (MP) exposure in the environment has been commonly demonstrated to have adverse effects on human health. The majority of studies on MP were related to the aquatic and terrestrial systems, its potential risk for ecosystem and human health when exposed to the atmosphere is not well-understood. The presented study, taking Xi'an, a megacity in Northwest China, as an example, first estimated the possibility of local residents bearing MPs pollution. The results figured out an average abundance of MPs in TSP, PM10, and PM2.5 was 12.5, 3.5 and 0.8 particles/L, respectively. A total of 15 polymer types of MPs were identified in the atmosphere. Although a species sensitivity distribution (SSD) approach is acknowledged to be useful to estimate the potential risk of pollutants, the result of SSD when used to evaluate the risk of MPs is debatable. In this study, SSD-based risk assessment showed that the atmospheric MP pollution in Xi'an had not yet reached the level of threatening human. However, unlike chemicals, it is unreliable to assess risk using the relationship of dose-response for MPs because toxic effects of MPs can be influenced by not only the abundance but also the characteristics, e.g., morphological size, shape and oxidative potential. Since insufficient mechanistic understanding regarding the relative relationship between MP characteristics and their toxic effects and limitation of the quality and relevance of toxicity data, the uncertainty of risk assessment of the atmospheric MPs is inevitable and the risk of the atmospheric MPs was tended to be underestimated. This poses a challenge to manufacturers and public health authorities, as well as researchers alike, however, we are already being exposed to the atmospheric MPs.

Authors: Ze Liu, Qian'en Huang, Long Chen, Jiahui Li, Hanzhong Jia

Full Source: The Science of the total environment 2022 Aug 20;158167. doi: 10.1016/j.scitotenv.2022.158167.

Microplastic (MP) exposure in the environment has been commonly demonstrated to have adverse effects on human health.

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Occurrence of primary aromatic amines and nicotine in sediments collected from the United States

2022-08-17

Despite extensive use of primary aromatic amines (AAs) in consumer products, little is known about their occurrence in the environment. In this study, we investigated the occurrence of 14 AAs and nicotine in 75 sediment samples collected from seven estuarine and freshwater ecosystems in the Unites States. Additionally, risk quotients (RQs) were calculated to assess potential risks of these chemicals to aquatic organisms. Of the 14 AAs analyzed, seven of them were found in sediments. The sum concentrations of seven AAs in sediments were in the range of 10.2 to 1810 ng/g, dry wt (mean: 388 ng/g). Aniline was the most abundant compound, accounting for, on average, 53 % of the total concentrations. Nicotine was found in sediments at a concentration range of <LOQ to 1340 ng/g, dry wt (mean: 119 ng/g). Among the seven sampling locations studied, AAs and nicotine concentrations were the highest in sediment from Altavista wastewater lagoon in Virginia (AV, mean: 1700 ng/g) followed in descending order by Chicago Sanitary and Ship Canal (CSSC, mean: 807 ng/g), Indiana Harbor and Ship Canal (IHSC, mean: 698 ng/g) and New Bedford Harbor (NBH, mean: 482 ng/g). Sediments from the upper Mississippi River (MISS, mean: 63.4 ng/g) and Tittabawassee River (TBR, mean: 52.3 ng/g) contained the lowest concentrations. The RQ values for AAs in sediment ranged from 0 to 733 and that for nicotine ranged from 0 to 2060. Among AAs, the highest RQ value was found for 4-chloroaniline. Nicotine exhibited notable RQ values, which suggested risk from this chemical to aquatic organisms. This is the first study to report the occurrence of AAs in sediments and our results suggest the need for further investigations on the sources and ecological impacts of these chemicals in aquatic ecosystems.

Authors: Magdalena Urbaniak, Sridhar Chinthakindi, Andres Martinez, Keri C Hornbuckle, Kurunthachalam Kannan

Full Source: The Science of the total environment 2022 Aug 17;851(Pt 1):158102. doi: 10.1016/j.scitotenv.2022.158102.

Despite extensive use of primary aromatic amines (AAs) in consumer products, little is known about their occurrence in the environment.

A decade of monitoring micropollutants in urban wet-weather flows: What did we learn?

2022-08-09

Urban wet-weather discharges from combined sewer overflows (CSO) and stormwater outlets (SWO) are a potential pathway for micropollutants (trace contaminants) to surface waters, posing a threat to the environment

and possible water reuse applications. Despite large efforts to monitor micropollutants in the last decade, the gained information is still limited and scattered. In a metastudy we performed a data-driven analysis of measurements collected at 77 sites (683 events, 297 detected micropollutants) over the last decade to investigate which micropollutants are most relevant in terms of 1) occurrence and 2) potential risk for the aquatic environment, 3) estimate the minimum number of data to be collected in monitoring studies to reliably obtain concentration estimates, and 4) provide recommendations for future monitoring campaigns. We highlight micropollutants to be prioritized due to their high occurrence and critical concentration levels compared to environmental quality standards. These top-listed micropollutants include contaminants from all chemical classes (pesticides, heavy metals, polycyclic aromatic hydrocarbons, personal care products, pharmaceuticals, and industrial and household chemicals). Analysis of over 30,000 event mean concentrations shows a large fraction of measurements (> 50%) were below the limit of quantification, stressing the need for reliable, standard monitoring procedures. High variability was observed among events and sites, with differences between micropollutant classes. The number of events required for a reliable estimate of site mean concentrations (error bandwidth of 1 around the "true" value) depends on the individual micropollutant. The median minimum number of events is 7 for CSO (2 to 31, 80%-interquantile) and 6 for SWO (1 to 25 events, 80%-interquantile). Our analysis indicates the minimum number of sites needed to assess global pollution levels and our data collection and analysis can be used to estimate the required number of sites for an urban catchment. Our data-driven analysis demonstrates how future wet-weather monitoring programs will be more effective if the consequences of high variability inherent in urban wet-weather discharges are considered.

Authors: Lena Mutzner, Viviane Furrer, Hélène Castebrunet, Ulrich Dittmer, Stephan Fuchs, Wolfgang Gernjak, Marie-Christine Gromaire, Andreas Matzinger, Peter Steen Mikkelsen, William R Selbig, Luca Vezzaro
Full Source: Water research 2022 Aug 9;223:118968. doi: 10.1016/j.watres.2022.118968.

Urban wet-weather discharges from combined sewer overflows (CSO) and stormwater outlets (SWO) are a potential pathway for micropollutants (trace contaminants) to surface waters.

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PHARMACEUTICAL/TOXICOLOGY

Ecotoxicological and health implications of microplastic-associated biofilms: a recent review and prospect for turning the hazards into benefits

2022-08-22

Microplastics (MPs), over the years, have been regarded as a severe environmental nuisance with adverse effects on our ecosystem as well as human health globally. In recent times, microplastics have been reported to support biofouling by genetically diverse organisms resulting in the formation of biofilms. Biofilms, however, could result in changes in the physicochemical properties of microplastics, such as their buoyancy and roughness. Many scholars perceived the microplastic-biofilm association as having more severe consequences, providing evidence of its effects on the environment, aquatic life, and nutrient cycles. Furthermore, other researchers have shown that microplastic-associated biofilms have severe consequences on human health as they serve as vectors of heavy metals, toxic chemicals, and antibiotic resistance genes. Despite what is already known about their adverse effects, other interesting avenues are yet to be fully explored or developed to turn the perceived negative microplastic-biofilm association to our advantage. The major inclusion criteria for relevant literature were that it must focus on microplastic association biofilms, while we excluded papers solely on biofilms or microplastics. A total of 242 scientific records were obtained. More than 90% focused on explaining the environmental and health impacts of microplastic-biofilm association, whereas only very few studies have reported the possibilities and opportunities in turning the microplastic biofilms association into benefits. In summary, this paper concisely reviews the current knowledge of microplastic-associated biofilms and their adverse consequences and further proposes some approaches that can be developed to turn the negative association into positive.

Authors: Emmanuel Sunday Okeke, Timothy Prince Chidike Ezeorba, Yao Chen, Guanghua Mao, Weiwei Feng, Xiangyang Wu
Full Source: Environmental science and pollution research international 2022 Aug 22. doi: 10.1007/s11356-022-22612-w.

Microplastics (MPs), over the years, have been regarded as a severe environmental nuisance with adverse effects on our ecosystem as well as human health globally.

Methylmercury Risk Assessment Based on European Human Biomonitoring Data

2022-07-28

A risk assessment (RA) was conducted to estimate the risk associated with methylmercury (MeHg) exposure of vulnerable European populations, using Human Biomonitoring (HBM) data. This RA was performed integrating published data from European HBM surveys and earlier EFSA approaches (EFSA 2012). Children/adolescents (3 to 17 years old) and women of childbearing age (18 to 50 years old) were selected as relevant study population groups for this RA. Two types of HBM datasets were selected: HBM studies (n = 18) with mercury (Hg) levels (blood and hair, total Hg and/or MeHg) in the general population in different EU countries and the DEMOCOPHES harmonized study in child-mother pairs (hair, total Hg) in 17 EU countries as a reference. Two approaches were included in the RA strategy: the first one was based on estimations of the fraction of children/adolescents and women of childbearing age, respectively, from the EU general population exceeding the HBM-I value established by the German Human Biomonitoring Commission, measured as Hazard Quotients (HQ); and the second approach was based on estimations of the fraction of the two population groups exceeding the Tolerable Weekly Intake (TWI) (or their equivalent to Tolerable Daily Intake (TDI)) defined by EFSA in 2012. The HQ approach showed that for both groups, the risk varies across EU countries and that some EU areas are close to or exceeding the exposure guidance values. This is the case of Spain and Portugal, which showed the highest HQ (GM and/or P95), probably due to their higher fish consumption. Results from the EFSA approach show that hair values of children/adolescents and women of childbearing age (both in selected HBM studies and in DEMOCOPHES study) are below the TDI of 1.9 µg/g; therefore, in general, the European population does not exceed the daily average/intake dose for MeHg and/or Hg. A possible risk underestimation was identified in our assessment since for many studies no data on P95 were available, causing loss of relevant information for risk characterization on the upper bound. In addition, data from other European countries also with high seafood consumption, such as France, Greece or Iceland, were not available. For this reason, further RA refinement is needed with harmonized and more widespread HBM data to account for differences in European exposure and associated risks, so that interventions to protect vulnerable citizens, can be applied.

Authors: Noelia Domínguez-Morueco, Susana Pedraza-Díaz, María Del Carmen González-Caballero, Marta Esteban-López, Mercedes de Alba-González, Andromachi Katsonouri, Tiina Santonen, Ana Cañas-Portilla, Argelia Castaño

Full Source: Toxics 2022 Jul 28;10(8):427. doi: 10.3390/toxics10080427.

A risk assessment (RA) was conducted to estimate the risk associated with methylmercury (MeHg) exposure of vulnerable European populations, using Human Biomonitoring (HBM) data.

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Maternal urinary organophosphate ester metabolite concentrations and glucose tolerance during pregnancy: The HOME Study

2022-08-24

Background: Endocrine-disrupting chemicals may alter glucose homeostasis, especially during pregnancy. Biomonitoring studies suggest ubiquitous human exposure to organophosphate esters (OPEs), chemicals with endocrine-disrupting capabilities. Few studies have examined the association between maternal exposure to OPEs and blood glucose during pregnancy. Methods: With data from 301 pregnant women in the Health Outcomes and Measures of the Environment (HOME) Study, a prospective pregnancy and birth cohort in Cincinnati, Ohio, USA, we examined whether OPE concentrations were associated with changes in blood glucose. We quantified four OPE metabolites in maternal spot urine samples collected at 16- and 26-weeks pregnancy. We extracted results from the glucose challenge test (GCT) and oral glucose tolerance test (OGTT) via medical chart review. Women with GCT ≥ 140 mg/dL or any abnormal values in OGTT (≥ 95 mg/dL fasting glucose, ≥ 180 mg/dL 1-h glucose, ≥ 155 mg/dL 2-h glucose, ≥ 140 mg/dL 3-h glucose) were defined as having elevated glucose levels. We used linear regression and Bayesian Kernel Machine Regression (BKMR) to estimate the associations of individual OPE metabolites and OPE mixtures with blood glucose levels during pregnancy. We used modified Poisson regression to estimate the associations of OPE metabolite concentrations with elevated glucose levels. We further examined effect measure modification by maternal characteristics (age, pre-pregnancy body mass index [BMI], and race/ethnicity).

Results:Diphenyl phosphate (DPHP) had the highest geometric mean concentration of the urinary OPE metabolites (1.83 µg/L at 16 weeks, 1.24 µg/L at 26 weeks). Thirty women (10.0%) had elevated glucose levels. Individual OPE metabolites or their mixtures were not significantly associated with continuous GCT results. We did not observe effect measure modification by maternal age, pre-pregnancy BMI categories, or race/ethnicity. Compared with women in the 1st tertile of average DPHP of 16- and 26 weeks of pregnancy, women in the 3rd tertile tended to have a reduced risk of elevated glucose levels (RR = 0.41, 95% CI = 0.16-1.06, p for trend = 0.06).

Background: Endocrine-disrupting chemicals may alter glucose homeostasis, especially during pregnancy.

Conclusion: In this cohort, maternal urinary OPE metabolite concentrations were weakly associated with blood glucose levels during pregnancy.
Authors: Weili Yang, Joseph M Braun, Ann M Vuong, Zana Percy, Yingying Xu, Changchun Xie, Ranjan Deka, Antonia M Calafat, Maria Ospina, Kimberly Yolton, Kim M Cecil, Bruce P Lanphear, Aimin Chen
Full Source: International journal of hygiene and environmental health 2022 Aug 24;245:114026. doi: 10.1016/j.ijheh.2022.114026.

OCCUPATIONAL

Occupational exposure and risk assessment for agricultural workers of thiamethoxam in vineyards

2022-08-24

Dermal & inhalation exposure was examined and according to these results, risk assessment of agricultural workers to thiamethoxam was performed during pesticide mixing/loading and hand-held sprayer application (11 replicates, each of about 1000 L of spray suspension) in vineyards. For the whole body dosimetry (WBD), clothing (Outer and inner), gauze, and nitrile gloves were analyzed to determine dermal exposure using whole-body dosimetry exposure protocol. The inhalation exposure was measured using a glass fiber filter with an IOM sampler. Analytical method validation of exposure matrices was evaluated including the field recovery and breakthrough test. The dermal exposure amount during mixing/loading was 0.163 mg (0.0004% of the total mixed/loaded active ingredient [a.i.]), whereas there was no inhalation exposure. The gloves (0.154 mg, 94.5%) were the most exposed body parts followed by the chest and stomach (0.009 mg, 5.5%). During application, the dermal and inhalation exposure amounts were 32.3 mg (0.07% of the total applied a.i.) and 10.8 µg (2.4 × 10-6% of the total applied a.i), respectively. The shin (35.1%) had the highest exposure to pesticides, followed by the chest & stomach (15.6%) and pelvis (12.6%). In case of mixing/loading, the amounts of actual dermal exposure (ADE) and actual inhalation exposure (AIE) were 0.0 and 0.0 µg/day, while those of ADE and AIE were 4707.6 and 15.8 µg/day for application. In risk assessment of the two different scenarios, the risk index was much lower than 1 (mixing/loading:0.000, application:0.014), indicating that vineyard workers are at low risk of thiamethoxam exposure. To determine the validity of the risk assessment using WBD method, the urinary metabolite was analyzed. Comparison of biomonitoring data and WBD exposure data show a reliable correlation

Dermal & inhalation exposure was examined and according to these results, risk assessment of agricultural workers to thiamethoxam was performed during pesticide mixing/loading and hand-held sprayer application (11 replicates, each of about 1000 L of spray suspension) in vineyards.

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(r = 0.885, p = 0.0003), suggesting that these are suitable methods to estimate exposure.
Authors: Jiho Lee, JiWoo Kim, Yongho Shin, Eunyoung Park, Junghak Lee, Young-Soo Keum, Jeong-Han Kim
Full Source: Ecotoxicology and environmental safety 2022 Aug 24;243:113988. doi: 10.1016/j.ecoenv.2022.113988.

Microbiome alterations associated with phthalate exposures in a US-based sample of Latino workers

2022-08-23

Low-wage service sector jobs are largely occupied by racial/ethnic minority workers who often experience an increased risk of elevated chemical exposures, including chemicals like phthalates, compared to the general public. Phthalates have been linked with adverse health effects, including increased risk of atopy and asthma. An important etiological component in respiratory disease, including asthma, is the role of the upper respiratory microbiota in atopic disease development. However, it is unclear how the upper respiratory microbiome is affected by chemical exposures, and how this may impact respiratory outcomes. As Latino workers are often disproportionately exposed to increased concentrations of chemicals and Hispanics have higher rates of adverse respiratory health conditions such as asthma, the aim of this pilot study was to evaluate the effects of 10 unique phthalate urinary biomarkers on the 16S rRNA nasal microbiome. Nasal and urinary samples were collected from 20 facility workers (plumbers, landscapers, electricians) and 20 custodial workers. Our analysis revealed altered microbial composition and diversity according to phthalate urinary biomarker concentration within the two worker groups. Higher urinary biomarker concentrations of select phthalates (MBP, MBIP, and ∑DEHP) were associated with increased Moraxella relative abundance, which has been positively associated with asthma. Within-sample alpha diversity levels were decreased in facility workers and were generally inversely associated with most phthalate urinary biomarker concentrations. Our research suggests that exposure to chemicals in this vulnerable worker group may impact the respiratory microbiome, which may increase risk of development of adverse health conditions. Further research is warranted to refine the mechanistic pathways that underpin the relationships between phthalate exposures and respiratory microbial communities to provide key insights on respiratory pathologies and, most importantly, to identify modifiable risk factors that can be used to direct

Low-wage service sector jobs are largely occupied by racial/ethnic minority workers who often experience an increased risk of elevated chemical exposures, including chemicals like phthalates, compared to the general public.

mitigation efforts aimed at ameliorating the harmful effects of chemical exposures in this understudied occupational population.
Authors: Kathryn R Dalton, Magdalena Fandiño-Del-Rio, Lydia M Louis, Mary A Garza, Lesliam Quirós-Alcalá, Meghan F Davis
Full Source: Environmental research 2022 Aug 23;114126. doi: 10.1016/j.envres.2022.114126.