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CHEMICAL EFFECTS

New Insights into Mechanisms of Endocrine-Disrupting Chemicals in Thyroid Diseases: The Epigenetic Way

2020-10-24

In recent years, the presence in the environment of chemical compounds with thyroid-disrupting effects is progressively increased. This phenomenon has risen concern for human health as the preservation of thyroid system homeostasis is essential for fetal development and for maintaining psychological and physiological wellbeing. An increasing number of studies explored the role of different classes of toxicants in the occurrence and severity of thyroid diseases, but large epidemiological studies are limited and only a few animal or in vitro studies have attempted to identify the mechanisms of chemical action. Recently, epigenetic changes such as alteration of methylation status or modification of non-coding RNAs have been suggested as correlated to possible deleterious effects leading to different thyroid disorders in susceptible individuals. This review aims to analyze the epigenetic alterations putatively induced by chemical exposures and involved in the onset of frequent thyroid diseases such as thyroid cancer, autoimmune thyroiditis and disruption of fetal thyroid homeostasis.

Authors: Letizia Pitto, Francesca Gorini, Fabrizio Bianchi, Elena Guzzolino
Full Source: International journal of environmental research and public health 2020 Oct 24;17(21):E7787. doi: 10.3390/ijerph17217787.

Chemicals of concern in plastic toys

2020-10-22

We present a list of Chemicals of Concern (CoCs) in plastic toys. We started from available studies reporting chemical composition of toys to group plastic materials, as well as to gather mass fractions and function of chemicals in these materials. Chemical emissions from plastic toys and subsequent human exposures were then estimated using a series of models and a coupled near-field and far-field exposure assessment framework. Comparing human doses with reference doses shows high Hazard Quotients of up to 387 and cancer risk calculated using cancer slope factors of up to 0.0005. Plasticizers in soft plastic materials show the highest risk, with 31 out of the 126 chemicals identified as CoCs, with sum of Hazard Quotients >1 or child cancer risk >10⁻⁶. Our results indicate that a relevant amount of chemicals used in plastic toy materials may pose a non-negligible health risk to children, calling for more refined investigations and more human- and eco-friendly alternatives. The 126 chemicals identified as CoCs were compared with other existing regulatory

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prioritization lists. While some of our chemicals appear in other lists, we also identified additional priority chemicals that are not yet covered elsewhere and thus require further attention. We finally derive for all considered chemicals the maximum Acceptable Chemical Content (ACC) in the grouped toy plastic materials as powerful green chemistry tool to check whether chemical alternatives could create substantial risks.

Authors: Nicolò Aurisano, Lei Huang, Llorenç Milà I Canals, Olivier Jolliet, Peter Fantke

Full Source: Environment international 2020 Oct 22;146:106194. doi: 10.1016/j.envint.2020.106194.

Bioconcentration and developmental neurotoxicity of novel brominated flame retardants, hexabromobenzene and pentabromobenzene in zebrafish

2020-10-21

The flame retardants hexabromobenzene (HBB) and pentabromobenzene (PBB) have been extensively used and become ubiquitous pollutants in the aquatic environment and biota, but their potential toxic effects on wildlife remained unknown. In this study, by using zebrafish (*Danio rerio*) as a model, the bioconcentration and developmental neurotoxicity were investigated. Zebrafish embryos were exposed to HBB and PBB (0, 30, 100 and 300 µg/L) from 2 until 144 h post-fertilization (hpf). Chemical analysis showed bioconcentrations of both chemicals, while HBB is readily metabolized to PBB in zebrafish larvae. Embryonic exposure to both chemicals did not cause developmental toxicity, but induced locomotor behavioral anomalies in larvae. Molecular docking results indicated that both chemicals could bind to zebrafish acetylcholinesterase (AChE). Furthermore, HBB and PBB significantly inhibited AChE activities, accompanied by increased contents of acetylcholine and decreased choline in larvae. Downregulation of the genes associated with central nervous system (CNS) development (e.g., *mbp*, β 1-tubulin, *gfap*, *shha*) as well as the corresponding proteins (e.g., *Mbp*, β 1-Tubulin) was observed, but *gap-43* was upregulated at both gene and protein levels. Together, our results indicate that both HBB and PBB exhibit developmental neurotoxicity by affecting various parameters related to CNS development and indications for future toxicological research and risk assessment of the novel brominated flame retardants.

Authors: Xiangping Chen, Wei Guo, Lei Lei, Yongyong Guo, Lihua Yang, Jian Han, Bingsheng Zhou

Full Source: Environmental pollution (Barking, Essex : 1987) 2020 Oct 21;268(Pt B):115895. doi: 10.1016/j.envpol.2020.115895.

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ENVIRONMENTAL RESEARCH

Investigation of health risk assessment and odor pollution of volatile organic compounds from industrial activities in the Yangtze River Delta region, China

2020-10-28

To investigate composition characteristics and assess occupational health risks and odor pollution of volatile organic compounds (VOCs) from industrial activities in the Yangtze River Delta (YRD) region, China, one-year field measurements of VOCs were conducted simultaneously at an iron and steel industrial park (ISP), one chemical industrial park (CMP) and one petrochemical industrial park (PCP) from September, 2018 to August, 2019. The concentrations of VOCs were 80.2 ± 67.9 ppbv, 28.1 ± 27.2 ppbv and 144 ± 378 ppbv for ISP, CMP and PCP, respectively. Aromatics, alkanes and alkenes were the major components of VOCs at ISP, CMP and PCP, respectively. Moreover, the toluene to benzene ratios were 0.330 ± 0.302 , 4.31 ± 6.48 and 1.84 ± 3.34 , which generally showed the characteristics of combustion source for ISP, industrial activities for CMP and petrochemical industry for PCP, respectively. The hazard index values were 0.752 ± 0.438 , 0.108 ± 0.248 and 0.090 ± 0.260 at ISP, CMP and PCP, which were generally lower than threshold limit value, suggesting a low noncarcinogenic risk for workers. Meanwhile, the 95th percentile LCR values of VOCs were 8.76×10^{-5} , 1.15×10^{-5} and 1.00×10^{-5} at ISP, CMP and PCP, respectively, which were also under acceptable risk level, indicating a low carcinogenic risk. Benzene and 1,3-butadiene were main harmful substances for both noncarcinogenic and carcinogenic risks of VOCs. The odor levels of VOCs were 2.12 ± 4.21 , 12.5 ± 28.7 and 1.01 ± 7.84 at ISP, CMP and PCP, respectively. Aromatics for ISP and sulfide compounds for CMP and PCP were primary pollutants for odor pollution. This work could improve the understanding of risk levels and odor characteristics of VOCs and benefit policy development on alleviating odor complaints and health risks for workers in YRD region, China.

Authors: Haohao Jia, Song Gao, Yusen Duan, Qingyan Fu, Xiang Che, Hui Xu, Zhuo Wang, Jinping Cheng

Full Source: Ecotoxicology and environmental safety 2020 Oct 28;208:111474. doi: 10.1016/j.ecoenv.2020.111474.

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Detection of pollutants in water bodies: electrochemical detection or photo-electrochemical detection?

2020-10-29

The massive discharge of pollutants including endocrine-disrupting chemicals (EDCs), heavy metals, pharmaceuticals and personal care products (PPCPs) into water bodies is endangering the ecological environment and human health, and needs to be accurately detected. Both electrochemical and photo-electrochemical detection methods have been widely used for the detection of these pollutants, however, which one is better for the detection of different environmental pollutants? In this feature article, different electrochemical and photo-electrochemical detection methods are summarized, including the principles, classification, common catalysts, and applications. By summarizing the advantages and disadvantages of different detection methods, this review provides a guide for other researchers to detect pollutants in water bodies by using electrochemical and photo-electrochemical analysis.

Authors: Zhi Li, Mingshan Zhu

Full Source: Chemical communications [Cambridge, England] 2020 Oct 29. doi: 10.1039/d0cc05709f.

OCCUPATIONAL

Lifelong exposure to air pollution and greenness in relation to asthma, rhinitis and lung function in adulthood

2020-10-27

Objectives: To investigate if air pollution and greenness exposure from birth till adulthood affects adult asthma, rhinitis and lung function.

Methods: We analysed data from 3428 participants (mean age 28) in the RHINESSA study in Norway and Sweden. Individual mean annual residential exposures to nitrogen dioxide (NO₂), particulate matter (PM₁₀ and PM_{2.5}), black carbon (BC), ozone (O₃) and greenness (normalized difference vegetation index (NDVI)) were averaged across susceptibility windows (0-10 years, 10-18 years, lifetime, adulthood (year before study participation)) and analysed in relation to physician diagnosed asthma (ever/allergic/non-allergic), asthma attack last 12 months, current rhinitis and low lung function (lower limit of normal (LLN), z-scores of forced expiratory volume in one second (FEV₁), forced vital capacity (FVC) and FEV₁/FVC below 1.64). We performed logistic regression for asthma attack, rhinitis and LLN lung function (clustered with family and study centre), and conditional logistic regression with a matched case-control

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design for ever/allergic/non-allergic asthma. Multivariable models were adjusted for parental asthma and education.

Results: Childhood, adolescence and adult exposure to NO₂, PM₁₀ and O₃ were associated with an increased risk of asthma attacks (ORs between 1.29 and 2.25), but not with physician diagnosed asthma. For rhinitis, adulthood exposures seemed to be most important. Childhood and adolescence exposures to PM_{2.5} and O₃ were associated with lower lung function, in particular FEV₁ (range ORs 2.65 to 4.21). No associations between NDVI and asthma or rhinitis were revealed, but increased NDVI was associated with lower FEV₁ and FVC in all susceptibility windows (range ORs 1.39 to 1.74).

Conclusions: Air pollution exposures in childhood, adolescence and adulthood were associated with increased risk of asthma attacks, rhinitis and low lung function in adulthood. Greenness was not associated with asthma or rhinitis, but was a risk factor for low lung function.

Authors: Ingrid Nordeide Kuiper, Cecilie Svanes, Iana Markevych, Simone Accordini, Randi J Bertelsen, Lennart Bråbäck, Jesper Heile Christensen, Bertil Forsberg, Thomas Halvorsen, Joachim Heinrich, Ole Hertel, Gerard Hoek, Mathias Holm, Kees de Hoogh, Christer Janson, Andrei Malinowski, Alessandro Marcon, Roy Miodini Nilsen, Torben Sigsgaard, Ane Johannessen

Full Source: Environment international 2020 Oct 27;146:106219. doi: 10.1016/j.envint.2020.106219.

Characteristics of Exposure of Reproductive-Age Farmworkers in Chiang Mai Province, Thailand, to Organophosphate and Neonicotinoid Insecticides: A Pilot Study

2020-10-27

Exposure to insecticides containing organophosphate (OP) and neonicotinoid (NEO) compounds has been associated with adverse reproductive health outcomes. This study characterized and identified predictors of exposure to OP and NEO among 100 reproductive-age farmworkers from two intensive farming areas in Chiang Mai Province, Thailand, including 50 each from the Fang (FA) and Chom Thong (CT) districts. OP exposure was determined by measuring the urinary concentrations of six dialkylphosphates (DAPs), whereas NEO exposure was determined by measuring the urinary concentrations of NEO compounds and their metabolites (NEO/m). The most frequently detected OPs were diethylphosphate (DEP) and diethylthiophosphate (DETP), with DETP having the highest geometric mean (GM) concentration, 8.9 µg/g-

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creatinine. The most frequently detected NEO/m were N-desmethyl-acetamiprid (N-dm-ACE), imidacloprid (IMI), and thiamethoxam (THX), with IMI having the highest GM concentration, 8.7 µg/g-creatinine. Consumption of well water was the predominant determinant of OP and NEO exposure in this population. In addition to encouraging workers to use personal protective equipment, exposure of farmworkers to these compounds may be reduced by nation-wide monitoring agricultural insecticides and other pesticides in community drinking water resources.

Authors: Neeranuch Suwannarin, Tippawan Prapamontol, Tomohiko Isobe, Yukiko Nishihama, Shoji F Nakayama

Full Source: International journal of environmental research and public health 2020 Oct 27;17(21):E7871. doi: 10.3390/ijerph17217871.

Respiratory symptoms of exposure to substances in the workplace among Bulgarian dentists

2020-10-26

Objectives: Dentists are exposed to a variety of airborne chemicals that can act as irritants and sensitizers and may give rise to work-related respiratory symptoms. The aim of this study was to estimate the prevalence of respiratory symptoms of exposure to substances in the workplace and associated risk factors in Bulgarian dentists. Methods: A cross-sectional study was performed among Bulgarian dentists by using a self-report questionnaire. A direct acyclic graph (DAG) was elaborated to illustrate the direct and indirect causal pathways between exposure to irritants and/or allergens from dental environment and work-related respiratory symptoms among dentists. Multiple logistic regression analysis was conducted in order to investigate the relationship between sex, work experience, daily exposure to chemicals from dental environment, history of atopic disorder and work-related respiratory symptoms.

Results: A total of 4675 dentists completed the questionnaire (response rate 48.1%). The prevalence of self-reported work-related respiratory symptoms was 20.7%. The most common repeated causes of respiratory reactions were disinfectants (65.7%) and materials based on acrylic resins (29.7%). Factors associated with work-related respiratory symptoms are personal history of asthma [odds ratio (OR) 2.50, 95% confidence interval (CI): 1.71-3.64], work experience >20 years (OR 2.17, 95% CI: 1.74-2.70) and female gender (OR 2.14, 95% CI: 1.81-2.56). Conclusion: Work-related respiratory symptoms are frequent among dentists and indicate a need for efforts to establish effective programmes

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and techniques of reducing or eliminating direct exposure to airborne chemicals in the dental environment.

Authors: Iliyana Stoeva

Full Source: Community dentistry and oral epidemiology 2020 Oct 26. doi: 10.1111/cdoe.12584.

PHARMACEUTICAL/TOXICOLOGY

An overview of the uses of per- and polyfluoroalkyl substances (PFAS)

2020-10-30

Per- and polyfluoroalkyl substances (PFAS) are of concern because of their high persistence (or that of their degradation products) and their impacts on human and environmental health that are known or can be deduced from some well-studied PFAS. Currently, many different PFAS (on the order of several thousands) are used in a wide range of applications, and there is no comprehensive source of information on the many individual substances and their functions in different applications. Here we provide a broad overview of many use categories where PFAS have been employed and for which function; we also specify which PFAS have been used and discuss the magnitude of the uses. Despite being non-exhaustive, our study clearly demonstrates that PFAS are used in almost all industry branches and many consumer products. In total, more than 200 use categories and subcategories are identified for more than 1400 individual PFAS. In addition to well-known categories such as textile impregnation, fire-fighting foam, and electroplating, the identified use categories also include many categories not described in the scientific literature, including PFAS in ammunition, climbing ropes, guitar strings, artificial turf, and soil remediation. We further discuss several use categories that may be prioritised for finding PFAS-free alternatives. Besides the detailed description of use categories, the present study also provides a list of the identified PFAS per use category, including their exact masses for future analytical studies aiming to identify additional PFAS.

Authors: Juliane Glüge, Martin Scheringer, Ian T Cousins, Jamie C DeWitt, Gretta Goldenman, Dorte Herzke, Rainer Lohmann, Carla A Ng, Xenia Trier, Zhanyun Wang

Full Source: Environmental science. Processes & impacts 2020 Oct 30. doi: 10.1039/d0em00291g.

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Alkyl pyrrolidone solvents N-methyl-2-pyrrolidone (NMP) and N-ethyl-2-pyrrolidone (NEP) in urine of children and adolescents in Germany - human biomonitoring results of the German Environmental Survey 2014-2017 (GerESV)

2020-10-25

N-methyl-2-pyrrolidone (NMP) and its substitute N-ethyl-2-pyrrolidone (NEP) are aprotic solvents used in many technical applications, but also in carpets, and consumer products such as cleaning agents, and cosmetics. NMP and NEP are classified as reproductive toxicants. As a substance of very high concern (SVHC), NMP is included in the European REACH (Registration, Evaluation, Authorisation of Chemicals) candidate list for authorisation. NMP and NEP metabolites were measured in more than 2100 urine samples of 3- to 17-year-old children and adolescents, participating in the population-representative German Environmental Survey for Children and Adolescents 2014-2017 (GerESV). The two NMP metabolites 5-hydroxy-N-methyl-2-pyrrolidone (5-HNMP) and 2-hydroxy-N-methylsuccinimide (2-HMSI) could be detected and quantified in all urine samples, and the two NEP metabolites 5-hydroxy-N-ethylpyrrolidone (5-HNEP) and 2-hydroxy-N-ethylsuccinimide (2-HESI) in 32% and 87% of the urine samples. Geometric mean concentrations were 103.1 µg/L (88.21 µg/g creatinine) for the sum of NMP metabolites and 11.86 µg/L (10.15 µg/g creatinine) for the sum of NEP metabolites, thus remaining below the current health-based human biomonitoring values. For NMP, highest exposure was found in young children, but exposure pathways could not be revealed. Exposure to NEP was highest in adolescents and participants with low socio-economic status or migration background. Associations to usage of personal care products suggested the choice of products to have a distinct impact on NEP exposure. The presented data can be used by the German Human Biomonitoring Commission to derive new reference values (RV95) for NMP and NEP for children and adolescents in Germany. This will facilitate to recognise changing exposure levels in this population group in Germany.

Authors: Maria I H Schmied-Tobies, Aline Murawski, Enrico Rucic, Gerda Schwedler, Daniel Bury, Monika Kasper-Sonnenberg, Stephan Koslitz, Holger M Koch, Thomas Brüning, Marike Kolossa-Gehring
Full Source: Environment international 2020 Oct 25;146:106221. doi: 10.1016/j.envint.2020.106221.

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