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CHEMICAL EFFECTS

Characterization of titanium dioxide nanoparticles in confectionary products and estimation of dietary exposure level among the Chinese population

2022-10-26

Titanium dioxide (TiO₂) is widely used in the food industry. Recently, European Commission has banned TiO₂ as a food additive, raising public concern about its health risk, especially the nanoparticles (NPs) contained therein. This study aimed to reveal the existence of TiO₂ NPs in food and further estimate the dietary exposure level among Chinese population by characterizing particle size distribution, determining Ti content and micro-distribution in food products, and calculating food consumption from the China Health and Nutrition Survey (CHNS). The results showed that TiO₂ particle size in food additives and chewing gums was 53.5-230.3 nm and 56.8-267.7 nm respectively, where NPs accounted for 34.7% and 55.6% respectively. TiO₂ was firstly in situ presented on the surface of confectionary products with hard shells. The content of TiO₂ ranged from 3.2 to 3409.3 µg/g product. Besides, the mean dietary intake was 71.31 µg/kgbw/day for TiO₂ and 7.75 µg/kgbw/day for TiO₂ NPs among Chinese population, affected by people's dietary habits of different regions. Children's exposure levels was the highest due to their love of sweets. More attention should be paid to risk assessment and management of TiO₂ NPs for children in China.

Authors: Langzhi He, Hongbo Wang, Shumin Duan, Yanjun Gao, Lizhi Lyu, Xiaxian Ou, Nairui Yu, Yaoyun Zhang, Lingna Zheng, Yun Wang
Full Source: *NanoImpact* 2022 Oct 26;100435. doi: 10.1016/j.impact.2022.100435.

Co-exposure to phenols and phthalates during pregnancy with the difference of body size in twins at one month old

2022-10-25

Humans are simultaneously exposed to phenols and phthalates (PAEs). However, the mixture effect of phenols and PAEs on the body size of twins is lacking. From 2016 to 2018, we recruited 228 pregnant twins and collected up to three urine samples. A total of 8 PAE metabolites and 7 phenols were detected in urine by liquid chromatography-tandem mass spectrometry. Chemical individual and mixture effects were estimated. Multivariable linear regression results presented the percentage change in twins' growth differences at one month old with maternal PAE and

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phenol exposure. These chemicals were positively associated with weight differences during the entire trimester. Moreover, the quantile g-computed model showed that increased urinary concentrations of all chemicals by one quartile were associated with a 22.85% (95%CI: 11.21-35.72%), 22.60% (95%CI: 12.31-33.83%), and 24.05% (95%CI: 13.11-36.05%) larger weight difference within twins in each trimester, respectively. Increasing all PAE metabolites and phenols by one quantile across the entire trimester, weight differences increased by 26.61% (95% CI: 15.79%, 38.44%), and height differences increased by 15.84% (95%CI: 3.92%, 29.13%). Co-exposure to PAEs and phenols may primarily play a role in twins' growth.

Authors: Hong Mei, Langjing Deng, Jinying Xie, Xiaojie Li, Nanxin Wu, Liqin Hu, Guangtong Huang, Fanyu Mo, Da Chen, Han Xiao, Pan Yang
Full Source: *Chemosphere* 2022 Oct 25;136991. doi: 10.1016/j.chemosphere.2022.136991.

REACHing for solutions: Essential revisions to the EU chemicals regulation to modernise safety assessment

2022-10-21

The Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation was created to protect human health and the environment through the better and earlier identification of harmful intrinsic properties of chemical substances on the European market. One of its central aims was the promotion of alternatives to animal testing, yet it has instead become a long 'tick-box' list of in vivo experiments questionable relevance to human health outcomes despite a global trend towards new approach methods (NAMs) in chemical safety assessment. The Chemicals Strategy for Sustainability (CSS), proposed by the European Commission in 2020, is a golden opportunity to revise REACH in a significant and impactful way, yet proposals presented so far have significant negative animal welfare consequences. There is still time to correct the course of the ongoing REACH revision - proposals made herein offer a path towards the promising future intended by the CSS. These proposals are anchored in three vectors of action, varying in level of complexity -from changes that ECHA can implement to improve existing processes, through technical changes aimed at minimizing animal testing and increasing NAM acceptance, to deeper structural changes to establish non-animal testing strategies as the basis for risk assessment.

Authors: Marina Pereira, Donna S Macmillan, Catherine Willett, Troy Seidle
Full Source: *Regulatory toxicology and pharmacology* : RTP 2022 Oct 21;105278. doi: 10.1016/j.yrtph.2022.105278.

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Light pollution enhances ground-level exposure to airborne toxic chemicals for nocturnally migrating passerines

2022-10-25

Anthropogenic activities generate different forms of environmental pollution, including artificial light at night (ALAN) and airborne toxic chemicals (ATCs). Nocturnally migrating birds are attracted to ALAN during migration and if ALAN occurs in unison with ATC, the chances of ground-level ATC contamination occurring at stopover sites could increase. Here, we document the relationship between ALAN and ATC within the contiguous United States based on 479 toxic chemicals from 15,743 releasing facilities. Using weekly diurnal estimates of relative abundance for 165 nocturnally migrating passerine (NMP) bird species, we assess how the species richness and relative abundance of NMP species are correlated with ALAN and ATC across the annual cycle. The concentration of ATC increased with increasing ALAN levels, except at the highest ALAN levels. The species richness of NMP species was positively correlated with ATC during the non-breeding season and migration, and negatively correlated during the breeding season. The relative abundance of NMP species was negatively correlated with ATC during the breeding and non-breeding seasons and the correlation did not differ from zero during migration. Through the disorienting influence of ALAN, our findings suggest large numbers of NMP species are being exposed to higher ATC concentrations at stopover sites. Outside of migration, large numbers of NMP species that winter along the US Gulf Coast are being exposed for an extended period of time to higher ATC concentrations. Initiatives designed to decrease ALAN during migration have the potential to reduce the acute and chronic effects of ATC contamination, lower the maternal transfer of toxic chemicals to eggs, and decrease the biologically mediated transport of toxic chemicals across regions. However, these initiatives will not benefit species that experience prolonged ATC exposure during the non-breeding season along the US Gulf Coast, a region that could be a significant source of ATC contamination for North American birds.

Authors: Frank A La Sorte, Christopher A Lepczyk, Myla F J Aronson

Full Source: Global change biology 2022 Oct 25. doi: 10.1111/gcb.16443.

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ENVIRONMENTAL RESEARCH

The Effects of Single and Combined Stressors on Daphnids-Enzyme Markers of Physiology and Metabolomics Validate the Impact of Pollution

2022-10-12

The continuous global increase in population and consumption of resources due to human activities has had a significant impact on the environment. Therefore, assessment of environmental exposure to toxic chemicals as well as their impact on biological systems is of significant importance. Freshwater systems are currently under threat and monitored; however, current methods for pollution assessment can neither provide mechanistic insight nor predict adverse effects from complex pollution. Using daphnids as a bioindicator, we assessed the impact in acute exposures of eight individual chemicals and specifically two metals, four pharmaceuticals, a pesticide and a stimulant, and their composite mixture combining phenotypic, biochemical and metabolic markers of physiology. Toxicity levels were in the same order of magnitude and significantly enhanced in the composite mixture. Results from individual chemicals showed distinct biochemical responses for key enzyme activities such as phosphatases, lipase, peptidase, β -galactosidase and glutathione-S-transferase. Following this, a more realistic mixture scenario was assessed with the aforementioned enzyme markers and a metabolomic approach. A clear dose-dependent effect for the composite mixture was validated with enzyme markers of physiology, and the metabolomic analysis verified the effects observed, thus providing a sensitive metrics in metabolite perturbations. Our study highlights that sensitive enzyme markers can be used in advance on the design of metabolic and holistic assays to guide the selection of chemicals and the trajectory of the study, while providing mechanistic insight. In the future this could prove to become a useful tool for understanding and predicting freshwater pollution.

Authors: Anna Michalaki, Allan Robert McGivern, Gernot Poschet, Michael Büttner, Rolf Altenburger, Konstantinos Grintzalis

Full Source: Toxics 2022 Oct 12;10(10):604. doi: 10.3390/toxics10100604.

Aerosol physicochemical determinants of carbon black and ozone inhalation co-exposure induced pulmonary toxicity

2022-10-27

Air pollution accounts for more than 7 million premature deaths worldwide. Using ultrafine carbon black (CB) and ozone (O₃) as a model for

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an environmental co-exposure scenario, the dose response relationships in acute pulmonary injury and inflammation were determined by generating, characterizing, and comparing stable concentrations of CB aerosols (2.5, 5.0, 10.0 mg/m³), O₃ (0.5, 1.0, 2.0 ppm) with mixture CB+O₃ (2.5 + 0.5, 5.0 + 1.0, 10.0 + 2.0). C57BL6 male mice were exposed for 3 hours by whole body inhalation and acute toxicity determined after 24 h. CB itself did not cause any alteration, however, a dose response in pulmonary injury/inflammation was observed with O₃ and CB+O₃. This increase in response with mixtures was not dependent on the uptake but due to enhanced reactivity of the particles. Benchmark dose modeling showed several-fold increase in potency with CB+O₃ compared to CB or O₃ alone. Principal component analysis provided insight into response relationships between various doses and treatments. There was a significant correlation in lung responses with charge-based size distribution, total/alveolar deposition, oxidant generation and antioxidant depletion potential. Lung tissue gene/protein response demonstrated distinct patterns that are better predicted by either particle dose/aerosol responses (IL-1 β , KC, TGF- β) or particle reactivity (TSLP, IL13, IL-6). Hierarchical clustering showed a distinct signature with high dose and a similarity in mRNA expression pattern of low and medium doses of CB+O₃. In conclusion, we demonstrate that the biological outcomes from CB+O₃ co-exposure are significantly greater than individual exposures over a range of aerosol concentrations and aerosol characteristics can predict biological outcome.

Authors: Nairriti Majumder, Vamsi Kodali, Murugesan Velayutham, Travis Goldsmith, Jessica Amedro, Valery V Khramtsov, Aaron Erdely, Timothy R Nurkiewicz, Jack R Harkema, Eric E Kelley, Salik Hussain

Full Source: Toxicological sciences : an official journal of the Society of Toxicology 2022 Oct 27;kfac113. doi: 10.1093/toxsci/kfac113.

PHARMACEUTICAL/TOXICOLOGY

A global burden assessment of lung cancer attributed to residential radon exposure during 1990-2019

2022-10

This study aimed to explore the spatial and temporal trends of lung cancer burden attributable to residential radon exposure at the global, regional, and national levels. Based on the Global Burden of Disease Study (GBD) 2019, we collected the age-standardized mortality rate (ASMR) and age-standardized disability-adjusted life rate (ASDR) of lung cancer attributable to residential radon exposure from 1990 to 2019. The Joinpoint model was used to calculate the annual average percentage change (AAPC)

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to evaluate the trend of ASMR and ASDR from 1990 to 2019. The locally weighted regression (LOESS) was used to estimate the relationship of the socio-demographic index (SDI) with ASMR and ASDR. In 2019, the global ASMR and ASDR for lung cancer attributable to residential radon exposure were 1.03 (95% CI: 0.20, 2.00) and 22.66 (95% CI: 4.49, 43.94) per 100 000 population, which were 15.6% and 23.0% lower than in 1990, respectively. According to the estimation, we found the lung cancer burden attributable to residential radon exposure declined significantly in high and high-middle SDI regions, but substantially increased in middle and low-middle SDI regions from 1990 to 2019. Across age and sex, the highest burden of lung cancer attributable to residential radon exposure was found in males and elderly groups. In conclusion, the global burden of lung cancer attributable to residential radon exposure showed a declining trend from 1990 to 2019, but a relatively large increase was found in the middle SDI regions. In 2019, the burden of lung cancer attributable to residential radon exposure remained high, particularly in males, the elderly, and high-middle SDI regions compared with other groups.

Authors: Xiaobing Shan, Xiaoyu Tian, Bo Wang, Li He, Ling Zhang, Baode Xue, Ce Liu, Ling Zheng, Yunhui Yu, Bin Luo

Full Source: Indoor air 2022 Oct;32(10):e13120. doi: 10.1111/ina.13120.

Exposure to Bisphenol A increases malignancy risk of thyroid nodules in overweight/obese patients

2022-10-25

Bisphenol A (BPA) is a widespread thyroid disruptor, but evidence about an association with thyroid cancer is weak. Excess body weight is a risk factor for thyroid cancer and affects activity of endocrine disruptors. Aim of the study was to investigate the association between BPA exposure and thyroid cancer, verifying the effect modification related to body weight. We performed a multicentre, cross-sectional study including consecutive patients referring for nodular goiter. The quantitative determination of BPA in serum samples was performed through high performance liquid chromatography system, coupled in tandem with ultraviolet and fluorescence detection. Ninety-six patients were included: 55 benign nodules, 41 thyroid cancers, 28 normal weight, and 68 overweight/obese. BPA was detected in 79 subjects. In the overall study population and in the group with BMI < 25 kg/m² BPA exposure was not significantly correlated to thyroid cancer ($p = 0.08$ and 0.759 , respectively). In the group with BMI ≥ 25 kg/m², BPA-exposed subjects showed significantly higher risk of malignancy (OR: 5.3, $p = 0.028$). At multivariate analysis, such association was independent of smoking, alcohol consumption,

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occupational exposure, and phthalates exposure ($p = 0.021$ and 0.016 , respectively), but was lost after adjustment for the presence of metabolic syndrome ($p = 0.089$). In overweight/obese subjects, BPA exposure was significantly associated with higher thyroid stimulating hormone levels. Our study suggests that BPA exposure is a risk factor for thyroid cancer in overweight/obese subjects.

Authors: Vincenzo Marotta, Lucia Grumetto, Ilaria Neri, Giacomo Russo, Anna Tortora, Giulia Izzo, Ilaria Panariello, Domenico Rocco, Luciano Pezzullo, Mario Vitale

Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Oct 25;120478. doi: 10.1016/j.envpol.2022.120478.

OCCUPATIONAL

Assessment of multi-chemical exposure using human biomonitoring data from the French Esteban study using exposure load method

2022-10-25

Exposure to chemical substances is common and comes from several sources (environmental, food, and occupational). It is often studied using a substance-by-substance approach. Although this method helps identify the determinants of exposure to a single chemical, it cannot accurately reflect exposure to multiple chemicals. In this study, we used the concept of exposure load (EL) to evaluate multi-chemical exposure in a representative sample of the general French population. EL corresponds to the number of substances (or metabolites) measured in body fluids above a defined concentration threshold. EL was calculated for adults and children separately for two groups of substances: those currently found in domestic environments (Group A) and pesticides (Group B). Although the EL does not assess the health impact linked to multi-chemical exposure, it does aid in the identification of particularly vulnerable populations. Accordingly, preventive actions specifically aimed at these subgroups could be useful. In Group A, we found that multi-chemical exposure was generalized since all the adults and children had an EL greater than or equal to 13 (out of 22 substances studied) when the LOQ (limit of quantification) was considered as the discretization threshold. In adults, men, smokers and people of working age (i.e., people under 60 years old) had a higher EL. In Group B, multi-chemical exposure was also generalized, since all the adults (15 substances studied) and children (13 substances studied) had a mean EL almost equal to 6 when the LOQ was considered

Exposure to chemical substances is common and comes from several sources (environmental, food, and occupational).

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as the discretization threshold. In adults, persons with occupational exposure to pesticide dust had a higher EL when the P90 was considered as the discretization threshold. This study highlights widespread multi-chemical exposure in adults and children in France, and the major impact of occupational exposure (Group B) and tobacco smoking (Group A) on EL. Authors: Marie Pécheux, Abdessatar Saoudi, Abdelkrim Zeghnoun, Amivi Oleko, Clémence Filloi

Full Source: International journal of hygiene and environmental health 2022 Oct 25;246:114054. doi: 10.1016/j.ijheh.2022.114054.

Occupational hazards and the onset of natural menopause

2022-09-05

Objective: To identify occupational hazards associated with earlier onset of natural menopause.

Study design: A national cross-sectional study was conducted to explore the reproductive health of Chinese female workers. The final sample size was 17,948.

Main outcome measures: Participants completed a self-report instrument that recorded working conditions, chemical and physical agents in the occupational environment, socioeconomic factors, lifestyle, reproductive history, and occupational information. A Cox regression model was used to examine the association between each occupational hazard and onset of menopause.

Results: Abnormal workload (19.31 %), aromatic compounds (7.95 %), and noise (24.94 %) were the three most frequently self-reported occupational hazards in the three categories of working conditions, chemical agents, and physical agents, respectively. Abnormal workload (HR = 1.133, $p = 0.038$), noise (HR = 1.233, $p < 0.001$), and heat stress (HR = 1.178, $p = 0.041$) were associated with earlier age at natural menopause in the analyses of each hazard, after adjustment. Only noise (HR = 1.187, $p = 0.003$) remained statistically significant after including all possible occupational hazards. Conclusions: In a national survey of 17,948 female workers, this study investigated the association of age at natural menopause with multiple occupational hazards, some of which have not been addressed. Occupational noise was identified as a risk factor for reproductive

Objective: To identify occupational hazards associated with earlier onset of natural menopause.

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senescence for the first time. However, further research is needed to confirm our findings.

Authors: Linjuan Ma, Tongyun Qi, Yue Zhang, Yizhou Huang, Saisai Li, Qian Ying, Zhaoqiang Jiang, Chunming Li, Peiqiong Chen, Wenxian Xu, Yibing Lan, Ketan Chu, Jianlin Lou, Wenlan Yu, Jianhong Zhou

Full Source: Maturitas 2022 Sep 5;167:46-52. doi: 10.1016/j.maturitas.2022.08.012.