

Bulletin Board

Contents

JUL. 29, 2022

(click on page numbers for links)

CHEMICAL EFFECTS

In vitro analysis of catalase and superoxide dismutase mimetic properties of blue tattoo ink.....	3
Developmental neurotoxicity induced by glutaraldehyde in neuron/astrocyte co-cultured cells and zebrafish.....	3
Phenols, Parabens, Phthalates and Puberty: a Systematic Review of Synthetic Chemicals Commonly Found in Personal Care Products and Girls' Pubertal Development.....	4
Nanotechnology in agriculture: Comparison of the toxicity between conventional and nano-based agrochemicals on non-target aquatic species.....	5

ENVIRONMENTAL RESEARCH

Long-term exposure to air pollution, coronary artery calcification, and carotid artery plaques in the population-based Swedish SCAPIS Gothenburg cohort.....	6
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PHARMACEUTICAL/TOXICOLOGY

Effects of Glyphosate and Roundup™ on the mammalian nervous system: A review.....	7
Urinary nitrate and sodium in a high-risk area for upper gastrointestinal cancers: Golestan Cohort Study.....	8

OCCUPATIONAL

Characteristics and health effects of particulate matter emitted from a waste sorting plant.....	9
Occupational exposure to rare earth elements: Assessment of external and internal exposure.....	10
Identification of substances with a carcinogenic potential in spray-formulated engine/brake cleaners and lubricating products, available in the European Union (EU) - based on IARC and EU-harmonised classifications and QSAR predictions.....	11

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Bulletin Board

Technical

JUL. 29, 2022

CHEMICAL EFFECTS

In vitro analysis of catalase and superoxide dismutase mimetic properties of blue tattoo ink

2022-07-18

Tattoo inks are comprised of different combinations of bioactive chemicals with combined biological effects that are insufficiently explored. Tattoos have been associated with oxidative stress; however, a recent N-of-1 study suggested that blue tattoos may be associated with suppressed local skin oxidative stress. The present study aimed to explore the attributes of the blue tattoo ink (BTI) that may explain its possible effects on redox homeostasis, namely the catalase (CAT) and superoxide dismutase (SOD)-mimetic properties that have been reported for copper(II) phthalocyanine (CuPC) - the main BTI constituent. Intenze™ Persian blue (PB) BTI has been used in the experiment. CAT and SOD-mimetic properties of PB and its pigment-enriched fractions were analyzed using the carbonato-cobaltate (III) formation-derived H₂O₂ dissociation and 1,2,3-trihydroxybenzene autoxidation rate assays utilizing simple buffers and biochemical matrix of normal skin tissue as chemical reaction environments. CuPC-based tattoo ink PB and both its blue and white pigment-enriched fractions demonstrate CAT and SOD-mimetic properties in vitro with effect sizes demonstrating a substantial dependence on the biochemical environment. PB constituents act as inhibitors of CAT but potentiate its activity in the biochemical matrix of the skin. CuPC-based BTI can mimic antioxidant enzymes, however chemical constituents other than CuPC (e.g. the photoreactive TiO₂) seem to be at least partially responsible for the BTI redox-modulating properties.

Authors: Jan Homolak

Full Source: Free radical research 2022 Jul 18;1-25. doi: 10.1080/10715762.2022.2102976.

Developmental neurotoxicity induced by glutaraldehyde in neuron/astrocyte co-cultured cells and zebrafish

2022-07-19

The genotoxicity, development toxicity, carcinogenicity, and acute or chronic toxic effects of glutaraldehyde (GA), particularly during occupational exposure through its use as a fixative, disinfectant, and preservative, are well-documented but its effects on neurotoxicity have not been investigated. We performed in vitro and in vivo studies to examine the developmental neurotoxicity (DNT) of GA. Neurite outgrowth

Bulletin Board

Technical

JUL. 29, 2022

was examined in an in vitro co-culture model consisting of SH-SY5Y human neuroblastoma cells and human astrocytes. Cell Counting Kit-8, lactate dehydrogenase assay, and high-content screening revealed that GA significantly inhibited neurite outgrowth at non-cytotoxic concentration. Further studies showed that GA upregulated the mRNA expression of the astrocyte markers GFAP and S100 β and downregulated the expression of the neurodevelopmental genes Nestin, β III-tubulin, GAP43, and MAP2. Furthermore, in vivo zebrafish embryo toxicity tests explored the effects of GA on neural morphogenesis. GA adversely affected the early development of zebrafish embryos, resulting in decreased survival, irregular hatching, and reduced heart rate in a time- and concentration-dependent manner. Furthermore, the width of the brain and spinal cord was reduced, and the myelination of Schwann cells and oligodendrocytes was decreased by GA in transgenic zebrafish lines. These data suggest that GAs have potential DNT in vitro and in vivo, highlighting the need for caution regarding the neurotoxicity of GA.

Authors: Ha-Na Oh, Donggon Yoo, Seungmin Park, Sangwoo Lee, Woo-Keun Kim

Full Source: Ecotoxicology and environmental safety 2022 Jul 19;242:113891. doi: 10.1016/j.ecoenv.2022.113891.

Phenols, Parabens, Phthalates and Puberty: a Systematic Review of Synthetic Chemicals Commonly Found in Personal Care Products and Girls' Pubertal Development

2022-07-22

Purpose of review: Exposure to endocrine disrupting chemicals through personal care products (PCPs) is widespread and may disrupt hormone-sensitive endpoints, such as timing of puberty. Given the well-documented (and ongoing) decline in age at menarche in many populations, we conducted a systematic review of the epidemiological literature on exposure to chemicals commonly found in PCPs (including certain phthalates, phenols, and parabens) in relation to girls' pubertal development.

Recent findings: The preponderance of research on this topic has examined phthalate exposures with the strongest evidence indicating that prenatal monoethyl phthalate (MEP) concentrations may be associated with slightly earlier timing of puberty, including age at menarche. Findings examining peri-pubertal phthalate exposures and pubertal outcomes were less consistent as were studies of prenatal and peri-pubertal phenol exposures. Very few studies had examined parabens in relation to girls' pubertal development. Common study limitations included potential

Purpose of review: Exposure to endocrine disrupting chemicals through personal care products (PCPs) is widespread and may disrupt hormone-sensitive endpoints, such as timing of puberty.

Bulletin Board

Technical

JUL. 29, 2022

exposure misclassification related to use of spot samples and/or mistimed biomarker assessment with respect to the outcomes. The role of body size as a mediator in these relationships remains unresolved. Overall, evidence of associations between chemical exposures in PCPs and girls' pubertal development was conflicting. When associations were observed, effect sizes were small. Nevertheless, given the many environmental, social, and behavioral factors in the modern environment that may act synergistically to accelerate timing of puberty, even marginal changes may be cause for concern, with implications for cancer risk, mental health, and cardiometabolic disease in later life.

Authors: Zorimar Rivera-Núñez, Carolyn W Kinkade, Yingting Zhang, Amber Rockson, Elisa V Bandera, Adana A M Llanos, Emily S Barrett
Full Source: Current environmental health reports 2022 Jul 22. doi: 10.1007/s40572-022-00366-4.

Nanotechnology in agriculture: Comparison of the toxicity between conventional and nano-based agrochemicals on non-target aquatic species

2022-07-08

Increased crop production is necessary to keep up with rising food demand. However, conventional agricultural practices and agrochemicals are unable to sustain further increases without serious risk of adverse environmental consequences. The implementation of nanotechnology in agriculture practices has been increasing in recent years and has shown tremendous potential to boost crop production. The rapid growth in development and use of nano-agrochemicals in agriculture will inevitably result in more chemicals reaching water bodies. Some unique properties of nanoformulations may also alter the toxicity of the AI on aquatic organisms when compared to their conventional counterparts. Results from studies on conventional formulations may not properly represent the toxicity of new nanoformulations in the aquatic environment. As a result, current guidelines derived from conventional formulations may not be suitable to regulate those newly developed nanoformulations. Current knowledge on the toxicity of nano-agrochemicals on aquatic organisms is limited, especially in an ecologically relevant setting. This review compiles and analyzes 18 primary studies based on 7 criteria to provide a comprehensive analysis of the available toxicity information of nano-agrochemicals and their conventional counterparts on aquatic organisms. Our analysis demonstrates that the overall toxicity of nano-agrochemicals on non-target aquatic species is significantly lower as compared to conventional counterparts. However, further dividing

Increased crop production is necessary to keep up with rising food demand.

Bulletin Board

Technical

JUL. 29, 2022

formulations into three categories (organic, bulk and ionic) shows that some nanoformulations can be more toxic when compared to bulk materials but less toxic as compared to ionic formulations while organic nanopesticides do not show a general trend in overall toxicity. Moreover, our analysis reveals the limitations of current studies and provides recommendations for future toxicity studies to ensure the effective and sustainable application of nano-agrochemicals, which will be beneficial to both the agrochemical industry and regulatory agencies alike.

Authors: Yueyang Zhang, Greg G Goss

Full Source: Journal of hazardous materials 2022 Jul 8;439:129559. doi: 10.1016/j.jhazmat.2022.129559.

ENVIRONMENTAL RESEARCH

Long-term exposure to air pollution, coronary artery calcification, and carotid artery plaques in the population-based Swedish SCAPIS Gothenburg cohort

2022-07-19

Long-term exposure to air pollution is associated with cardiovascular events. A main suggested mechanism is that air pollution accelerates the progression of atherosclerosis, yet current evidence is inconsistent regarding the association between air pollution and coronary artery and carotid artery atherosclerosis, which are well-established causes of myocardial infarction and stroke. We studied associations between low levels of long-term air pollution, coronary artery calcium (CAC) score, and the prevalence and area of carotid artery plaques, in a middle-aged population-based cohort. The Swedish CARDioPulmonary bioImage Study (SCAPIS) Gothenburg cohort was recruited during 2013-2017 and thoroughly examined for cardiovascular risk factors, including computed tomography of the heart and ultrasonography of the carotid arteries. In 5070 participants (age 50-64 years), yearly residential exposures to air pollution (PM_{2.5}, PM₁₀, PM_{coarse}, NO_x, and exhaust-specific PM_{2.5} 1990-2015) were estimated using high-resolution dispersion models. We used Poisson regression to examine associations between long-term (26 years' mean) exposure to air pollutants and CAC score, and prevalence of carotid artery plaques, adjusted for potential confounders. Among participants with carotid artery plaques, we also examined the association with plaque area using linear regression. Mean exposure to PM_{2.5} was low by international standards (8.5 µg/m³). There were no consistent associations between long-term total PM_{2.5} exposure and CAC score or presence of

Long-term exposure to air pollution is associated with cardiovascular events.

Bulletin Board

Technical

JUL. 29, 2022

carotid artery plaques, but an association between total PM2.5 and larger plaque area in participants with carotid plaques. Associations with traffic-related air pollutants were consistently positive for both a high CAC score and bilateral carotid artery plaques. These associations were independent of road traffic noise. We found stronger associations among men and participants with cardiovascular risk factors. The results lend some support to atherosclerosis as a main modifiable pathway between low levels of traffic-related ambient air pollution and cardiovascular disease, especially in vulnerable individuals.

Authors: Karl Kilbo Edlund, Gerd Sallsten, Peter Molnár, Eva M Andersson, Mikael Ögren, David Segersson, Erika Fagman, Björn Fagerberg, Lars Barregard, Göran Bergström, Leo Stockfelt
Full Source: Environmental research 2022 Jul 19;113926. doi: 10.1016/j.envres.2022.113926.

PHARMACEUTICAL/TOXICOLOGY

Effects of Glyphosate and Roundup™ on the mammalian nervous system: A review

2022-07-19

Glyphosate is the active ingredient in Roundup™, the most widely used herbicide in the world. Glyphosate targets an essential enzyme in plants that is not found in animals. However, both glyphosate and Roundup™ are rated as Group 2 A, probably human carcinogens, and also have documented effects on reproduction, acting as endocrine disruptive chemicals. We have reviewed reports of the effects of glyphosate and Roundup™ on the mammalian nervous system function. As with several other herbicides, Roundup™ exposure has been associated with an increased risk of Parkinson's Disease and death of neurons in the substantia nigra. There is also some evidence implicating Roundup™ in elevated risk of autism. Other studies have shown the effects of Roundup™ on synaptic transmission in animal and cellular studies. The major mechanism of action appears to be oxidative stress, accompanied by mitochondrial dysfunction. In addition, some gut bacteria utilize the enzyme used by plants, and glyphosate and Roundup™ use has been shown to alter the gut microbiome. There is a large and growing body of evidence that the gut microbiome alters susceptibility to great number of human diseases, including nervous system function. The weight of the evidence indicates that in addition to cancer and reproductive effects, glyphosate and Roundup™ have significant adverse effects on the brain

Glyphosate is the active ingredient in Roundup™, the most widely used herbicide in the world.

Bulletin Board

Technical

JUL. 29, 2022

and behavior and increase the risk of at least some serious neurological diseases.

Authors: Najm Alsatat Madani, David O Carpenter
Full Source: Environmental research 2022 Jul 19;113933. doi: 10.1016/j.envres.2022.113933.

Urinary nitrate and sodium in a high-risk area for upper gastrointestinal cancers: Golestan Cohort Study

2022-07-18

Background: The epidemiological evidence regarding the carcinogenicity of nitrate and sodium in drinking water is limited, partly because measuring the exposure at the individual level is complex. Most studies have used nitrate in water supplies as a proxy for individual exposure, but dietary intakes and other factors may contribute to the exposure. The present study investigates the factors associated with urinary nitrate and sodium in a high-risk area for esophageal and gastric cancers.
Methods: For this cross-sectional study, we used data and samples collected in 2004-2008 during the enrollment phase of the Golestan Cohort Study from a random sample of 349 participants (300 individuals from 24 rural villages and 49 from the city of Gonbad), stratified by average water nitrate in their district, the source of drinking water, and the usual dietary intake of nitrate and sodium. Nitrate, sodium, and creatinine were measured in a spot urine sample collected at the time of interview. We used the provincial cancer registry data to calculate the cumulative incidence rates of esophageal and gastric cancers for each location through June 1, 2020, and used weighted partial Pearson correlation to compare the incidence rates with median urinary nitrate and sodium in each village or the city.

Results: Among 349 participants (mean age±SD: 50.7 ± 8.6 years), about half (n = 170) used groundwater for drinking, and the use of ground water was significantly more common in high-elevation locations (75.8%). The geometric mean of the creatinine-corrected urinary nitrate concentration was 68.3 mg/g cr (95%CI: 64.6,72.3), and the corresponding geometric mean for urinary sodium was 150.0 mmol/g cr (95%CI: 139.6161.1). After adjusting for confounders, urinary nitrate was associated with being a woman, drinking groundwater, and living in high-elevation locations, but not with estimated dietary intake. Urinary sodium concentration was significantly associated with monthly precipitation at the time of sampling but not with elevation or drinking water source. There were significant positive correlations between both median urinary nitrate and sodium in each location and esophageal cancer incidence rates adjusted for sex

Background: The epidemiological evidence regarding the carcinogenicity of nitrate and sodium in drinking water is limited, partly because measuring the exposure at the individual level is complex.

Bulletin Board

Technical

JUL. 29, 2022

and age ($r = 0.65$ and $r = 0.58$, respectively, $p < 0.01$), but not with gastric cancer incidence.

Conclusion: In a rural population at high risk for esophageal and gastric cancers, nitrate excretion was associated with living at a higher elevation and using groundwater for drinking. The associations between nitrate and sodium excretion with esophageal cancer incidence warrant future investigation.

Authors: Arash Etemadi, Ian D Buller, Maryam Hashemian, Gholamreza Roshandel, Hossein Poustchi, Maria Morel Espinosa, Benjamin C Blount, Christine M Pfeiffer, Behnam Keshavarzi, Abigail R Flory, Siavosh Nasseri-Moghaddam, Sanford M Dawsey, Neal D Freedman, Christian C Abnet, Reza Malekzadeh, Mary H Ward

Full Source: Environmental research 2022 Jul 18;113906. doi: 10.1016/j.envres.2022.113906.

OCCUPATIONAL

Characteristics and health effects of particulate matter emitted from a waste sorting plant

2022-07-19

Solid waste components can be recycled in waste paper and cardboard sorting plants (WPCSP) through a multistep process. This work collected 15 samples every six days from each of the 9 points selected to study the processes taking place in a WPCSP (135 particulate matter samples total). Examining the concentration and size fraction of particulate matter (i.e., PM₁, PM_{2.5} and PM₁₀) in WPCSP is an essential issue to notify policy makers about the health impacts on exposed workers. The major activities for increasing of the concentration of PM in various processing units in the WPCSP, especially in hand-picking routes I and II were related to manual dismantling, mechanical grinding, mechanical agitation, and separation and movement of waste. The results of this work showed that a negative correlation between temperature and particulate matter size followed the order PM₁₀ > PM_{2.5} > PM₁. Exposure to PM_{2.5} and PM₁₀ in the WPCSP lead to possible risk (HI = 5.561 and LTCRs = 3.41×10^{-6} to 9.43×10^{-5} for PM_{2.5} and HI = 7.454 for PM₁₀). The exposure duration and the previous concentrations had the most effect on the ILCRs and HQs for PM_{2.5} and PM₁₀ in all sampling sites. Hence, because WPCSP are infected indoor environments (I/O ratio > 1), the use of control methods such as isolation of units, misting systems, blower systems equipped with bag houses, protective equipment, a mechanical ventilation system, and additional

Solid waste components can be recycled in waste paper and cardboard sorting plants (WPCSP) through a multistep process.

Bulletin Board

Technical

JUL. 29, 2022

natural ventilation can reduce the amount of suspended PM, enhance worker safety, and increase the recycling rate.

Authors: Abdullah Barkhordari, Marcelo I Guzman, Gholamreza Ebrahimzadeh, Armin Sorooshian, Mahdiah Delikhoon, Mehdi Jamshidi Rastani, Somayeh Golbaz, Mehdi Fazlzadeh, Ramin Nabizadeh, Abbas Norouzian Baghani

Full Source: Waste management (New York, N.Y.) 2022 Jul 19;150:244-256. doi: 10.1016/j.wasman.2022.07.012.

Occupational exposure to rare earth elements: Assessment of external and internal exposure

2022-07-18

Our study investigated occupational exposure to rare earth elements (REEs) in a major REE processing plant from North China by assessing both external exposure and internal exposure in the workers. An exposure group, including 50 workers in the processing plant, and a control group, including 50 workers from a liquor factory located 150 km away from the exposure group, were recruited in the study. Portable air sampler was employed to accurately measure individual exposure to the external environment, and the data demonstrating significantly higher contamination in the REE processing plant compared with the control group (i.e., 87.5 versus 0.49 $\mu\text{g}/\text{m}^3$ of ΣREEs). Blood concentrations were also significantly higher in the exposure group (3.47 versus 2.24 $\mu\text{g}/\text{L}$ of ΣREEs). However, the compositional profiles of REEs resembled between the exposure and control group in blood or air particles, indicating the influence of mining/processing activities on the surrounding regions. External exposure in the occupational environment appeared to significantly influence internal REE exposure in the REE processing workers. Some other sociodemographic and occupational factors, including the residence time and the type of work, could also influence occupational exposure to selected REEs. Our data clearly demonstrated the highly elevated REE contamination in both working environment and human bodies compared with the control subjects, raising the critical need for better assessing the health risks from occupational REE exposure and efficient management for occupational hazards.

Authors: Xinhang Qiao, Wenxuan Cui, Sheng Gao, Qiang Zhi, Bin Li, Yaochun Fan, Li Liu, Jianqiong Gao, Hongli Tan

Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Jul 18;119801. doi: 10.1016/j.envpol.2022.119801.

Our study investigated occupational exposure to rare earth elements (REEs) in a major REE processing plant from North China by assessing both external exposure and internal exposure in the workers.

Bulletin Board

Technical

JUL. 29, 2022

Identification of substances with a carcinogenic potential in spray-formulated engine/brake cleaners and lubricating products, available in the European Union (EU) - based on IARC and EU-harmonised classifications and QSAR predictions

2022-07-18

Spray-formulated engine/brake cleaners and lubricating agents are widely used to maintain machines. The occupational exposure to their aerosols is evident. To assess the carcinogenic potential of these products, we identified such products available in the European Union (EU). We built a database with CAS numbers of 1) mono-constituent substances, and 2) multi-constituent-substances, and unknown-or-variable-composition,-complex-reaction-products-and-biological-materials (multi-constituent/UVCBs). The compositions of multi-constituent/UVCBs were unravelled with European Chemicals Agency (ECHA) registration dossiers. To identify carcinogenic potentials, we searched for 1) International Agency for Research on Cancer (IARC) classification; 2) Harmonised classifications in Annex VI to the EU classification, labelling and packaging (CLP) Regulation; and 3) whether they had a Danish Environmental Protection Agency advisory CLP self-classification based on quantitative structure-activity relationships (QSARs) for genotoxicity and carcinogenicity in the Danish (Q)SAR Database. In 82 products, we identified 332 mono-constituent substances and 44 multi-constituent/UVCBs. Six substances were either IARC 1 or 2B classified. Twelve mono-constituent substances and 22 multi-constituent/UVCBs had harmonised classifications as Carcinogenic Category 1A, 1B or 2, while nine substances fulfilled the QSAR-based advisory self-classification algorithms for mutagenicity or carcinogenicity. At the product level, 39 products contained substances of carcinogenic concern by either IARC, harmonised classification or QSAR. We conclude that in the investigated EU marketed spray-formulated engine/brake cleaners and lubricants, 24 of 332 mono-constituent substances and 28 of 44 multi-constituent/UVCBs had a carcinogenic potential. At the product level, 39 of 82 contained substances with an identified carcinogenic potential. Regulators and manufacturers can use this determination of carcinogenic potential to decrease occupational risk.

Authors: Jorid B Sørli, Marie Frederiksen, Nikolai G Nikolov, Eva B Wedebye, Niels Hadrup

Full Source: Toxicology 2022 Jul 18;153261. doi: 10.1016/j.tox.2022.153261.

Spray-formulated engine/brake cleaners and lubricating agents are widely used to maintain machines.