

# Bulletin Board

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## Bulletin Board

## Technical

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## CHEMICAL EFFECTS

## [A study of neurotoxicity of crotonaldehyde in male rats]

2021-01-20

Objective: To investigate the neurotoxicity of crotonaldehyde exposure in male rats and its possible mechanism of action. Methods: From July to October 2019, 24 specific pathogen-free male Wistar rats were randomly divided into control group and 2.5, 4.5, and 8.5 mg/kg exposure groups, with 6 rats in each group, and the rats in these groups were given oral administration of crotonaldehyde solution at doses of 0.0, 2.5, 4.5, and 8.5 mg/kg, respectively, 5 times a week for 90 consecutive days. Body weight was measured after exposure, and brain tissue and liver tissue were collected. The activity of acetylcholinesterase (AChE) in brain tissue and the level of acetylcholine (ACh) in liver tissue were measured; The activities of superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px) and the levels of malondialdehyde (MDA) and reduced glutathione (GSH) in brain tissue were measured; ELISA was used to measure the levels of interleukin-6 (IL-6), interleukin-1 $\beta$  (IL-1 $\beta$ ), and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) in brain tissue. Results: Compared with the control group, the 2.5, 4.5, and 8.5 mg/kg exposure groups had a significant reduction in the activity of AChE in brain tissue, and the 8.5 mg/kg exposure group had a significant increase in the level of ACh in liver tissue ( $P < 0.05$ ). Compared with the control group, the 4.5 and 8.5 mg/kg exposure groups had a significant increase in the level of MDA and significant reductions in the level of GSH and the activities of SOD and GSH-Px in brain tissue ( $P < 0.05$ ). Compared with the control group, the 2.5, 4.5, and 8.5 mg/kg exposure groups had significant increases in the levels of TNF- $\alpha$  and IL-6 in brain tissue, and the 4.5 and 8.5 mg/kg exposure groups had a significant increase in the level of IL-1 $\beta$  ( $P < 0.05$ ). Conclusion: Crotonaldehyde exposure can induce nervous system injury in rats, possibly by altering oxidative balance and upregulating the expression of inflammatory factors in brain tissue.

Authors: S M Zhang, Z H Zhang, B Zhang, Q Zhang

Full Source: Zhonghua lao dong wei sheng zhi ye bing za zhi = Zhonghua laodong weisheng zhiyebing zazhi = Chinese journal of industrial hygiene and occupational diseases 2021 Jan 20;39(1):1-4. doi: 10.3760/cma.j.cn121094-20200106-00015.

Objective: To investigate the neurotoxicity of crotonaldehyde exposure in male rats and its possible mechanism of action.

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## Degradation of Bisphenol A by ozonation in rotating packed bed: Effects of operational parameters and co-existing chemicals

2021-01-26

Bisphenol A (BPA), a typical endocrine disrupting chemical, widely exists in water and threatens human health. The degradation of BPA by ozone in water is limited by the gas-mass transfer due to the low solubility of ozone. In this study, a rotating packed bed (RPB) was employed to create a high gravity environment to intensify the ozone mass transfer and BPA degradation. The effects of operational parameters (rotation speed of RPB, pH of the solution, ozone concentration, BPA concentration, gas volumetric flow rate and liquid volumetric flow rate) on BPA degradation efficiency and overall volumetric mass transfer coefficient of ozone were investigated. The results show that RPB effectively promoted the ozone mass transfer and BPA degradation and can be used for the ozonation of micropollutants that have fast reaction rates with ozone. Quenching experiments suggest that both ozone and HO $\cdot$  participated in BPA degradation from acidic to alkaline environments. In addition, the effects of co-existing chemicals on BPA degradation efficiency were studied. The addition of H<sub>2</sub>O<sub>2</sub> or Cl<sup>-</sup> had no obvious impact on BPA degradation; the addition of HCO<sub>3</sub><sup>-</sup> is beneficial for BPA degradation while the addition of fulvic acid suppressed the degradation. These results indicate that the pH value, which affects the reaction rate between ozone and BPA, is a major factor to be considered during the ozonation of BPA in RPB.

Authors: Lei Wang, Jimmy Yun, Hanxiao Zhang, Jianmeng Si, Xihong Fang, Lei Shao

Full Source: Chemosphere 2021 Jan 26;274:129769. doi: 10.1016/j.chemosphere.2021.129769.

## Iron toxicity in plants: Impacts and remediation

2021-02-06

Iron (Fe) is the fourth abundant element in the earth crust. Iron toxicity is not often discussed in plant science though it causes severe morphological and physiological disorders, including reduced germination percentage, interferes with enzymatic activities, nutritional imbalance, membrane damage, and chloroplast ultrastructure. It also causes severe toxicity to important biomolecules, which leads to ferroptotic cell death and induces structural changes in the photosynthetic apparatus, which results in retardation of carbon metabolism. However, some agronomic practices like soil remediation through chemicals, nutrients and organic

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amendments, and some breeding and genetic approaches can provide fruitful results in enhancing crop production in Fe contaminated soils. Some quantitative trait loci (QTL) have been reported for Fe tolerance in plants but the function of underlying genes are just emerging. Physiological and molecular mechanism of Fe uptake, translocation, toxicity and remediation techniques are still under experimentation. In this review, the toxic effects of Fe on seed germination, carbon assimilation, water relations, nutrient uptake, oxidative damages, enzymatic activities and overall plant growth and development have been discussed. The Fe dynamics in soil rhizosphere and role of remediation strategies, i.e., biological, physical, and chemical have also been described. Use of organic amendments, microbe, phytoremediation and biological strategies are considered to be both cost and environment friendly for the purification of Fe-contaminated soil, while to ensure better crop yield and quality the manipulation of agronomic practices are suggested. This article is protected by copyright. All rights reserved.

Authors: Noreen Zahra, Muhammad Bilal Hafeez, Kanval Shaukat, Abdul Wahid, Mirza Hasanuzzaman

Full Source: *Physiologia plantarum* 2021 Feb 6. doi: 10.1111/ppl.13361.

### Neurotoxicity of organic solvents with emphasis on the role of iron

2021-01-29

Background: Exposure to organic solvents (OS) adversely affects different body systems, the central and peripheral nervous systems being the most susceptible ones.

Objectives: This study investigated the role of iron in association with some neurotransmitters for diagnosis of neurotoxicity of OS.

Methods: The study included 90 workers, 50 occupationally exposed to OS and 40 representing control group. Blood samples were collected from the included subjects for determination of serum iron, total iron binding capacity (TIBC), serotonin and gamma-aminobutyric acid (GABA).

Results: Revealed reduction in serotonin level and serum iron. However, the elevation in GABA and TIBC was observed. The duration of exposure was significantly correlated with iron and serotonin while it was positively correlated with GABA and TIBC.

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Conclusions: Elevated GABA and TIBC with decreased serotonin and serum iron can be used as early diagnostic measures to detect the neurotoxic effects of OS.

Authors: Eman M Shahy, Khadiga S Ibrahim, Heba Mahdy-Abdallah, Mona M Taha, Amal Saad-Hussien, Salwa F Hafez

Full Source: *Journal of complementary & integrative medicine* 2021 Jan 29. doi: 10.1515/jcim-2019-0103.

### ENVIRONMENTAL RESEARCH

#### Employee green behaviour: How organizations can help the environment

2020-12-24

Organizations are intrinsically involved in climate change - both in its causes and its solutions - and there has been a growing interest in the microfactors and macrofactors that affect employee green behaviour. On an employee level, the literature stresses the importance of values and self-concordance. On an organizational level, in contrast, recent developments emphasize environmental dynamic capabilities, leadership and human resource management practices such as training. However, an interplay between such microfactors and macrofactors suggests that organizational initiatives do not work uniformly but depend on employees' environmentalism. We thus highlight the need for a dynamic systems perspective in researching all types of employee green behaviour in organizations.

Authors: Kerrie L Unsworth, Matthew C Davis, Sally V Russell, Christian Bretter

Full Source: *Current opinion in psychology* 2020 Dec 24;42:1-6. doi: 10.1016/j.copsyc.2020.12.006.

#### Persistence, bioaccumulation and vertical transfer of pollutants in long-finned pilot whales stranded in Chilean Patagonia

2021-01-21

Long-finned pilot whales (LFPW) are cetaceans with strong social groups often involved in mass strandings worldwide. However, these beachings occur for reasons that are not fully understood. In 2016, 124 LFPW were stranded on the Chilean Patagonian islands, offering a unique opportunity to obtain crucial information on the ecology, biology, and genetics of this population. In addition, we examined whether persistent organic

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pollutants (POPs) and trace elements (TEs) were responsible for this mass mortality. Stable isotopes ( $\delta^{13}\text{C}$  &  $\delta^{15}\text{N}$ ) and genetic analyses were used to reconstruct the trophic ecology, social structure, and kinship of LFPW and compared to POPs and TE levels found in LFPW. Mitochondrial DNA analyses on 71 individuals identified four maternal lineages within the stranded LFPW. Of these animals, 32 individuals were analyzed for a suite of POPs, TEs, and lipid content in blubber. The highest levels were found for  $\Sigma\text{DDXs}$  (6 isomers) ( $542.46 \pm 433.46 \text{ ng/g, lw}$ ) and for total Hg ( $2.79 \pm 1.91 \text{ mg/kg, dw}$ ). However, concentrations found in these LFPW were lower than toxicity thresholds and those reported for LFPW stranded in other regions. Evidence was found of  $\Sigma\text{DDX}$ ,  $\Sigma\text{PCBs}$ , and Cd bioaccumulation and maternal transfer of POPs in mother/offspring groups. Nevertheless, no clear relationship between contaminant concentrations and LFPW mortality was established. Further research is still needed to assess LFPW populations including conservation status and exposure to chemicals in remote areas such as Patagonia.

Authors: Ana M Garcia-Cegarra, Jean-Luc Jung, Rodrigo Orrego, Janeide de A Padilha, Olaf Malm, Bernardo Ferreira-Braz, Ricardo E Santelli, Karla Pozo, Petra Pribylova, Mario Alvarado-Rybak, Claudio Azat, Karen A Kidd, Winfred Espejo, Gustavo Chiang, Paulina Bahamonde

Full Source: The Science of the total environment 2021 Jan 21;770:145259. doi: 10.1016/j.scitotenv.2021.145259.

## OCCUPATIONAL

### Development of Korean CARcinogen EXposure: An Initiative of the Occupational Carcinogen Surveillance System in Korea

2021-02-02

Objective: To prevent occupational cancers, carcinogen exposure surveillance systems have been developed in many countries. This study aimed to develop a carcinogen exposure database specific to South Korea. Methods: Twenty known human carcinogens were selected for this study. The International Standard Classification of Industry was used for a classification scheme of industries. Three nationwide occupational exposure databases, the Work Environment Measurement Database, the Special Health Examination Database, and the Work Environment Condition Survey, were used to calculate reference exposure prevalence estimates by carcinogen and industry. Then, 37 professional industrial hygienists with at least 19 years of field experience provided their own

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exposure prevalence estimates, after reviewing the abovementioned reference estimates derived from three data sources. The median value of the experts' estimates was used as the final exposure prevalence. Finally, the number of exposed workers was computed by multiplying the final exposure prevalence by the number of workers extracted from the 2010 national census data by carcinogen and industry.

Results: The exposure prevalence and the number of exposed workers were calculated according to 20 carcinogen and 228 minor industrial groups, assuming year 2010 circumstances. The largest population was exposed to welding fumes (326 822 workers), followed by ultraviolet radiation (238 937 workers), ionizing radiation (168 712 workers), and mineral oil mist (146 798 workers).

Conclusions: Our results provide critical data on carcinogen exposure for the prevention of occupational cancers.

Authors: Dong-Hee Koh, Ju-Hyun Park, Sang-Gil Lee, Hwan-Cheol Kim, Sangjun Choi, Hyejung Jung, Inah Kim, Donguk Park

Full Source: Annals of work exposures and health 2021 Feb 2;wxaa135. doi: 10.1093/annweh/wxaa135.

### Smoking, occupational exposures, and idiopathic pulmonary fibrosis among Swedish construction workers

2021-02-05

Background: Cigarette smoking and occupational exposures each have been reported to increase the risk of idiopathic pulmonary fibrosis (IPF), a disease previously considered of unknown origin. We investigated the risk of IPF mortality associated with combined smoking and occupational exposures.

Methods: A registry study of Swedish construction workers (N = 389,132), linked baseline smoking and occupational data with registry data on cause of death and hospital care diagnoses. Occupation was classified by the likelihood of exposure to vapors, gases, dusts, or fumes using a job-exposure matrix. Those likely exposed to asbestos or silica were excluded from the analysis. Age-adjusted relative risks [RRs] were calculated using Poisson regression. Follow-up observation began at age 40 and ended at age 89.

Results: Heavy smokers at baseline who were exposed to inorganic dusts during their working life had an increased risk of IPF mortality (RR 1.70; 95% confidence interval [CI] 1.11-2.60), while there was no statistically increased risk in the other exposure groups. There were dose-response relationships between smoking at baseline and IPF mortality among both unexposed and dust exposed workers, with similar risk for dust exposed and unexposed, except among baseline heavy smokers, where workers

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exposed to inorganic dust manifested the highest risk (RR 4.22; 95% CI 2.69-6.60). Excluding workers with chronic obstructive pulmonary disease or emphysema did not affect the results substantively. Conclusion: A clear dose-response relationship was seen between smoking at baseline and IPF, supporting a causal relationship. Occupational exposure to inorganic dusts, excluding silica and asbestos, was associated with increased risk of IPF in baseline heavy current smokers.

Authors: Martin Andersson, Paul D Blanc, Kjell Torén, Bengt Järvholm  
Full Source: American journal of industrial medicine 2021 Feb 5. doi: 10.1002/ajim.23231.

## PHARMACEUTICAL/TOXICOLOGY

### The Oxygen-Generating Calcium Peroxide-Modified Magnetic Nanoparticles Attenuate Hypoxia-Induced Chemoresistance in Triple-Negative Breast Cancer

2021-02-03

Cancer response to chemotherapy is regulated not only by intrinsic sensitivity of cancer cells but also by tumor microenvironment. Tumor hypoxia, a condition of low oxygen level in solid tumors, is known to increase the resistance of cancer cells to chemotherapy. Triple-negative breast cancer (TNBC) is the most aggressive subtype of breast cancer. Due to lack of target in TNBC, chemotherapy is the only approved systemic treatment. We evaluated the effect of hypoxia on chemotherapy resistance in TNBC in a series of in vitro and in vivo experiments. Furthermore, we synthesized the calcium peroxide-modified magnetic nanoparticles (CaO<sub>2</sub>-MNPs) with the function of oxygen generation to improve and enhance the therapeutic efficiency of doxorubicin treatment in the hypoxia microenvironment of TNBC. The results of gene set enrichment analysis (GSEA) software showed that the hypoxia and autophagy gene sets are significantly enriched in TNBC patients. We found that the chemical hypoxia stabilized the expression of hypoxia-inducible factor 1 $\alpha$  (HIF-1 $\alpha$ ) protein and increased doxorubicin resistance in TNBC cells. Moreover, hypoxia inhibited the induction of apoptosis and autophagy by doxorubicin. In addition, CaO<sub>2</sub>-MNPs promoted ubiquitination and protein degradation of HIF-1 $\alpha$ . Furthermore, CaO<sub>2</sub>-MNPs inhibited autophagy and induced apoptosis in TNBC cells. Our animal studies with an orthotopic mouse model showed that CaO<sub>2</sub>-MNPs in combination with doxorubicin exhibited a stronger tumor-suppressive effect on TNBC, compared to the doxorubicin treatment alone. Our findings suggest that combined with

Cancer response to chemotherapy is regulated not only by intrinsic sensitivity of cancer cells but also by tumor microenvironment.

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CaO<sub>2</sub>-MNPs and doxorubicin attenuates HIF-1 $\alpha$  expression to improve the efficiency of chemotherapy in TNBC.

Authors: Fong-Yu Cheng, Chia-Hsin Chan, Bour-Jr Wang, Ya-Ling Yeh, Ying-Jan Wang, Hui-Wen Chiu

Full Source: Cancers 2021 Feb 3;13(4):606. doi: 10.3390/cancers13040606.

### Per- and polyfluoroalkyl substances (PFAS) and total fluorine in fire station dust

2021-02-05

Per- and polyfluoroalkyl substances (PFAS) are a class of over 4700 fluorinated compounds used in industry and consumer products. Studies have highlighted the use of aqueous film-forming foams (AFFFs) as an exposure source for firefighters, but little is known about PFAS occurrence inside fire stations, where firefighters spend most of their shifts. In this study, we aimed to characterize PFAS concentrations and sources inside fire stations. We measured 24 PFAS (using LC-MS/MS) and total fluorine (using particle-induced gamma ray emission) in dust from multiple rooms of 15 Massachusetts stations, many of which (60%) no longer use PFAS-containing AFFF at all and the rest of which only use it very rarely. Compared to station living rooms, turnout gear locker rooms had higher dust levels of total fluorine ( $p < 0.0001$ ) and three PFAS: perfluorohexanoate (PFHxA), perfluoroheptanoate (PFHpA), and perfluorodecanoate (PFDoDA) ( $p < 0.05$ ). These PFAS were also found on six wipes of station turnout gear. By contrast, the dominant PFAS in living rooms was N-ethyl perfluorooctane sulfonamidoacetic acid (N-MeFOSAA), a precursor to perfluorooctane sulfonate (PFOS) that still persists despite phase-outs almost two decades ago. The  $\Sigma 24$  PFAS accounted for less than 2% of fluorine in dust ( $n = 39$ ), suggesting the potential presence of unknown PFAS. Turnout gear may be an important PFAS source in stations due to intentional additives and/or contamination from firefighting activities.

Authors: Anna S Young, Emily H Sparer-Fine, Heidi M Pickard, Elsie M Sunderland, Graham F Peaslee, Joseph G Allen

Full Source: Journal of exposure science & environmental epidemiology 2021 Feb 5. doi: 10.1038/s41370-021-00288-7.

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