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CHEMICAL EFFECTS

Use of a Polymeric Implant System to Assess the Neurotoxicity of Subacute Exposure to 2,2′,5,5′-Tetrachlorobiphenyl-4-ol, a Human Metabolite of PCB 52, in Male Adolescent Rats

2023-11-21

Polychlorinated biphenyls (PCBs) are persistent organic pollutants (POPs) that ubiquitously exist in the environment. PCB exposure has been linked to cancer and multi-system toxicity, including endocrine disruption, immune inhibition, and reproductive and neurotoxicity. 2,2′,5,5′-Tetrachloro-biphenyl (PCB 52) is one of the most frequently detected congeners in the environment and human blood. The hydroxylated metabolites of PCB 52 may also be neurotoxic, especially for children whose brains are still developing. However, it is challenging to discern the contribution of these metabolites to PCB neurotoxicity because the metabolism of PCB is species-dependent. In this study, we evaluated the subacute neurotoxicity of a human-relevant metabolite, 2,2′,5,5′-tetrachlorobiphenyl-4-ol (4-52), on male adolescent Sprague Dawley rats, via a novel polymeric implant drug delivery system grafted subcutaneously, at total loading concentrations ranging from 0%, 1%, 5%, and 10% of the implant (w/w) for 28 days. Y-maze, hole board test, open field test, and elevated plus maze were performed on exposure days 24 to 28 to assess their locomotor activity, and exploratory and anxiety-like behavior. 4-52 and other possible hydroxylated metabolites in serum and vital tissues were quantified using gas chromatography with tandem mass spectrometry (GC-MS/MS). Our results demonstrate the sustained release of 4-52 from the polymeric implants into the systemic circulation in serum and tissues. Dihydroxylated and dechlorinated metabolites were detected in serum and tissues, depending on the dose and tissue type. No statistically significant changes were observed in the neurobehavioral tasks across all exposure groups. The results demonstrate that subcutaneous polymeric implants provide a straightforward method to expose rats to phenolic PCB metabolites to study neurotoxic outcomes, e.g., in memory, anxiety, and exploratory behaviors.

Authors: Hui Wang, Amanda J Bullert, Xueshu Li, Hanna Stevens, Aloysius J Klingelhutz, James A Ankrum, Andrea Adamcakova-Dodd, Peter S Thorne, Hans-Joachim Lehmler

Full Source: Toxicology 2023 Nov 21:153677. doi: 10.1016/j.tox.2023.153677.

Polychlorinated biphenyls (PCBs) are persistent organic pollutants (POPs) that ubiquitously exist in the environment.

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Coenzyme Q10-Loaded Albumin Nanoparticles Protect against Redox Imbalance and Inflammatory, Apoptotic, and Histopathological Alterations in Mercuric Chloride-Induced Hepatorenal Toxicity in Rats

2023-11-14

Exposure to mercuric chloride (HgCl2), either accidental or occupational, induces substantial liver and kidney damage. Coenzyme Q10 (CoQ10) is a natural antioxidant that also has anti-inflammatory and anti-apoptotic activities. Herein, our study aimed to investigate the possible protective effects of CoQ10 alone or loaded with albumin nanoparticles (CoQ10NPs) against HgCl2-induced hepatorenal toxicity in rats. Experimental animals received CoQ10 (10 mg/kg/oral) or CoQ10NPs (10 mg/kg/oral) and were injected intraperitoneally with HgCl2 (5 mg/kg; three times/week) for two weeks. The results indicated that CoQ10NP pretreatment caused a significant decrease in serum liver and kidney function markers. Moreover, lowered MDA and NO levels were associated with an increase in antioxidant enzyme activities (SOD, GPx, GR, and CAT), along with higher GSH contents, in both the liver and kidneys of intoxicated rats treated with CoQ10NPs. Moreover, HgCl2-intoxicated rats that received CoQ10NPs revealed a significant reduction in the hepatorenal levels of TNF-α, IL-1β, NF-κB, and TGF-β, as well as an increase in the hepatic level of the fibrotic marker (α-SMA). Notably, CoQ10NPs counteracted hepatorenal apoptosis by diminishing the levels of Bax and caspase-3 and boosting the level of Bcl-2. The hepatic and renal histopathological findings supported the abovementioned changes. In conclusion, these data suggest that CoQ10, alone or loaded with albumin nanoparticles, has great power in reversing the hepatic and renal tissue impairment induced by HgCl2 via the modulation of hepatorenal oxidative damage, inflammation, and apoptosis. Therefore, this study provides a valuable therapeutic agent (CoQ10NPs) for preventing and treating several HgCl2-induced hepatorenal disorders.

Authors: Shimaa S Ramadan, Farah A El Zaiat, Engy A Habashy, Mostafa M Montaser, Habeba E Hassan, Shahinaz S Tharwat, Manal El-Khadragy, Ahmed E Abdel Moneim, Gehad E Elshopakey, Ahmed M A Akabawy

Full Source: Biomedicines 2023 Nov 14;11(11):3054. doi: 10.3390/biomedicines11113054.

Exposure to mercuric chloride (HgCl2), either accidental or occupational, induces substantial liver and kidney damage.

Evaluating Manganese, Zinc, and Copper Metal Toxicity on SH-SY5Y Cells in Establishing an Idiopathic Parkinson's Disease Model

2023-11-09

Parkinson's disease (PD) is a neurodegenerative condition marked by loss of motor coordination and cognitive impairment. According to global estimates, the worldwide prevalence of PD will likely exceed 12 million cases by 2040. PD is primarily associated with genetic factors, while clinically, cases are attributed to idiopathic factors such as environmental or occupational exposure. The heavy metals linked to PD and other neurodegenerative disorders include copper, manganese, and zinc. Chronic exposure to metals induces elevated oxidative stress and disrupts homeostasis, resulting in neuronal death. These metals are suggested to induce idiopathic PD in the literature. This study measures the effects of lethal concentration at 10% cell death (LC10) and lethal concentration at 50% cell death (LC50) concentrations of copper, manganese, and zinc chlorides on SH-SY5Y cells via markers for dopamine, reactive oxygen species (ROS) generation, DNA damage, and mitochondrial dysfunction after a 24 h exposure. These measurements were compared to a known neurotoxin to induce PD, 100 µM 6-hydroxydopamine (6-ODHA). Between the three metal chlorides, zinc was statistically different in all parameters from all other treatments and induced significant dopaminergic loss, DNA damage, and mitochondrial dysfunction. The LC50 of manganese and copper had the most similar response to 6-ODHA in all parameters, while LC10 of manganese and copper responded most like untreated cells. This study suggests that these metal chlorides respond differently from 6-ODHA and each other, suggesting that idiopathic PD utilizes a different mechanism from the classic PD model.

Authors: Sahar H Pradhan, James Y Liu, Christie M Sayes

Full Source: International journal of molecular sciences 2023 Nov 9;24(22):16129. doi: 10.3390/ijms242216129.

Parkinson's disease (PD) is a neurodegenerative condition marked by loss of motor coordination and cognitive impairment.

ENVIRONMENTAL RESEARCH

Leaching and transformation of chemical additives from weathered plastic deployed in the marine environment

2023-11-24

Plastic pollution causes detrimental environmental impacts, which are increasingly attributed to chemical additives. However, the behaviour of plastic additives in the marine environment is poorly

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understood. We used a marine deployment experiment to examine the impact of weathering on the extractables profile, analysed by liquid chromatography-mass spectrometry, of four plastics at two locations over nine months in Aotearoa/New Zealand. The concentration of additives in polyethylene and oxo-degradable polyethylene were strongly influenced by artificial weathering, with deployment location and time less influential. By comparison, polyamide 6 and polyethylene terephthalate were comparatively inert with minimal change in response to artificial weathering or deployment time. Non-target analysis revealed extensive differentiation between non-aged and aged polyethylene after deployment, concordant with the targeted analysis. These observations highlight the need to consider the impact of leaching and weathering on plastic composition when quantifying the potential impact and risk of plastic pollution within receiving environments.

Authors: James H Bridson, Hayden Masterton, Beatrix Theobald, Regis Risani, Fraser Doake, Jessica A Wallbank, Stefan D M Maday, Gavin Lear, Robert Abbel, Dawn A Smith, Joanne M Kingsbury, Olga Pantos, Grant L Northcott, Sally Gaw

Full Source: Marine pollution bulletin 2023 Nov 24:198:115810. doi: 10.1016/j.marpolbul.2023.115810.

Air pollutants contribute to epithelial barrier dysfunction and allergic diseases

2023-11-23

Air pollution is a global problem associated with various health conditions, resulting in elevated rates of morbidity and mortality. Major sources of air pollutants include industrial emissions, traffic-related pollutants, and household biomass combustion, as well as indoor pollutants from chemicals and tobacco. Various types of air pollutants originate from both human activities and natural sources. This includes particulate matter (PM), pollen, greenhouse gases, and other harmful gases. Air pollution is linked to allergic diseases, including atopic dermatitis (AD), allergic rhinitis, allergic conjunctivitis, food allergy, and bronchial asthma. These pollutants lead to epithelial barrier dysfunction, dysbiosis, and immune dysregulation. Additionally, climate change and global warming may contribute to the exacerbation and the development of allergic diseases related to air pollutants. Epigenetic changes associated with air pollutants have also been connected to the onset of allergic diseases. Furthermore, these changes can be passed down through subsequent generations, resulting in a higher prevalence of allergic diseases in offspring. Modulation of the aryl hydrocarbon receptor (AHR) could be a

Air pollution is a global problem associated with various health conditions, resulting in elevated rates of morbidity and mortality.

valuable strategy for alleviating air pollutant-induced epidermal barrier dysfunction and AD. A more effective approach to preventing allergic diseases triggered by air pollutants is to reduce exposure to them. Implementing public policies aimed at safeguarding individuals from air pollutant exposure may prove to be the most efficient solution. A pressing need exists for global policy initiatives that prioritize efforts to reduce the production of air pollutants.
Authors: Byung Eui Kim, Jessica W Hui-Beckman, Michael Zev Nevid, Elena Goleva, Donald Y M Leung
Full Source: Annals of allergy, asthma & immunology : official publication of the American College of Allergy, Asthma, & Immunology 2023 Nov 23:S1081-1206(23)01462-X. doi: 10.1016/j.anai.2023.11.014.

Environmental Causes of Idiopathic Pulmonary Fibrosis

2023-11-18
Idiopathic pulmonary fibrosis (IPF), the most common and severe of the idiopathic interstitial pneumonias, is a chronic and relentlessly progressive disease, which occurs mostly in middle-aged and elderly males. Although IPF is by definition "idiopathic", multiple factors have been reported to increase disease risk, aging being the most prominent one. Several occupational and environmental exposures, including metal dust, wood dust and air pollution, as well as various lifestyle variables, including smoking and diet, have also been associated with an increased risk of IPF, probably through interaction with genetic factors. Many of the predisposing factors appear to act also as trigger for acute exacerbations of the disease, which herald a poor prognosis. The more recent literature on inhalation injuries has focused on the first responders in the World Trade Center attacks and military exposure. In this review, we present an overview of the environmental and occupational causes of IPF and its pathogenesis. While our list is not comprehensive, we have selected specific exposures to highlight based on their overall disease burden.
Authors: Sheiphali Gandhi, Roberto Tonelli, Margaret Murray, Anna Valeria Samarelli, Paolo Spagnolo
Full Source: International journal of molecular sciences 2023 Nov 18;24(22):16481. doi: 10.3390/ijms242216481.

Idiopathic pulmonary fibrosis (IPF), the most common and severe of the idiopathic interstitial pneumonias, is a chronic and relentlessly progressive disease, which occurs mostly in middle-aged and elderly males.

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PHARMACEUTICAL/TOXICOLOGY

Prevalence of Multidrug-Resistant Pseudomonas aeruginosa Isolated from Dairy Cattle, Milk, Environment, and Workers' Hands

2023-11-15
Pseudomonas aeruginosa is an opportunistic pathogen causing severe infection in animals and humans. This study aimed to determine the ecological distribution and prevalence of multidrug-resistant (MDR) P. aeruginosa isolated from dairy cattle, the environment, and workers' hand swabs. Samples (n = 440) were collected from farms and households (n = 3, each). Rectal swabs, udder skin swabs, milk, workers' hand swabs, feed, water, water sources, and beddings were collected. Samples were subjected to the bacterial identification of P. aeruginosa via 16S rRNA. Antimicrobial resistance (AMR) was detected either phenotypically using an antibiotic susceptibility test or genotypically with AMR resistance genes (ARGs) such as drfA, sul1, and ermB. P. aeruginosa was detected on dairy farms and households (10.3-57.5%, respectively), with an average of 23.2%. The resistance of dairy farm strains was observed against sulfamethoxazole, imipenem, cefepime, piperacillin-tazobactam, and gentamycin (100%, 72.7%, 72.7%, 68.8%, and 63.3%, respectively). Meanwhile, the resistance of household strains was observed against sulfamethoxazole, imipenem, amoxicillin, gentamicin, cefepime, and erythromycin by 91.3%, 82.6%, 75.4%, 75.4%, 68.1%, and 63.8%, respectively. The susceptibility of farm strains was detected against norfloxacin, ciprofloxacin, and levofloxacin (90.9%, 84.8%, and 72.7%, respectively). Meanwhile, the susceptibility of household strains was detected against ciprofloxacin, amikacin, and norfloxacin (100%, 84.1%, and 72.5%, respectively). About 81.4% of P. aeruginosa strains were MDR. ARGs (drfA, sul1, and ermB) were detected in farm strains (48.5%, 72.7%, and 24.4%, respectively) and household strains (50.7%, 72.5%, and 47.8%, respectively). Almost all P. aeruginosa had MAR over 0.2, indicating repeated application of antibiotics. P. aeruginosa prevalence was fivefold higher in households than on farms. MDR strains were higher amongst household strains than farm strains.
Authors: Basma Badawy, Samar Moustafa, Radwa Shata, Mohamed Z Sayed-Ahmed, Saad S Alqahtani, Md Sajid Ali, Nawazish Alam, Sarfaraz

Pseudomonas aeruginosa is an opportunistic pathogen causing severe infection in animals and humans.

Ahmad, Nahed Kasem, Elzahara Elbaz, Hesham S El-Bahkiry, Reda M Radwan, Adel El-Gohary, Mona M Elsayed
Full Source: Microorganisms 2023 Nov 15;11(11):2775. doi: 10.3390/microorganisms11112775.

Amphidinium spp. as a Source of Antimicrobial, Antifungal, and Anticancer Compounds

2023-11-04
Dinoflagellates make up the second largest marine group of marine unicellular eukaryotes in the world ocean and comprise both heterotrophic and autotrophic species, encompassing a wide genetic and chemical diversity. They produce a plethora of secondary metabolites that can be toxic to other species and are mainly used against predators and competing species. Dinoflagellates are indeed often responsible for harmful algal bloom, where their toxic secondary metabolites can accumulate along the food chain, leading to significant damages to the ecosystem and human health. Secondary metabolites from dinoflagellates have been widely investigated for potential biomedical applications and have revealed multiple antimicrobial, antifungal, and anticancer properties. Species from the genus Amphidinium seem to be particularly interesting for the production of medically relevant compounds. The present review aims at summarising current knowledge on the diversity and the pharmaceutical properties of secondary metabolites from the genus Amphidinium. Specifically, Amphidinium spp. produce a range of polyketides possessing cytotoxic activities such as amphidinolides, caribenolides, amphidinins, and amphidinols. Potent antimicrobial properties against antibiotic-resistant bacterial strains have been observed for several amphidinins. Amphidinols revealed instead strong activities against infectious fungi such as Candida albicans and Aspergillus fumigatus. Finally, compounds such as amphidinolides, isocaribenolide-I, and chlorohydrin 2 revealed potent cytotoxic activities against different cancer cell lines. Overall, the wide variety of antimicrobial, antifungal, and anticancer properties of secondary metabolites from Amphidinium spp. make this genus a highly suitable candidate for future medical applications, spanning from cancer drugs to antimicrobial products that are alternatives to currently available antibiotic and antimycotic products.
Authors: Ida Orefice, Sergio Balzano, Giovanna Romano, Angela Sardo
Full Source: Life (Basel, Switzerland) 2023 Nov 4;13(11):2164. doi: 10.3390/life13112164.

Dinoflagellates make up the second largest marine group of marine unicellular eukaryotes in the world ocean and comprise both hetero-trophic and autotrophic species, encompassing a wide genetic and chemical diversity.

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OCCUPATIONAL

Effects of a workplace-based exercise program on shoulder pain and function in fruit workers: A randomized controlled trial

2023-11-18
Background: Shoulder pain affects millions of workers worldwide and is considered one of the leading causes of absenteeism and presenteeism. Therefore, using exercises in the work environment emerges as a strategy to prevent or reduce shoulder pain.
Objective: The objective of this study was to evaluate the effects of a workplace-based exercise program on shoulder pain and function in fruit workers.
Methods: This was an 8-week parallel two-arm randomized controlled trial. Forty-four fruit workers who reported chronic shoulder pain were randomized to an Experimental Group (EG) or Control Group (CG). The EG was submitted to a program of resistance and stretching exercises for eight weeks, twice a week. The CG received a booklet with muscle stretching and mobility exercises. The primary outcome was shoulder pain intensity; the secondary outcomes were Shoulder Pain and Disability Index (SPADI) and perceived global effect.
Results: Both groups showed reductions in pain intensity EG: 4.26 (95% CI 2.78-5.74) and CG: 3.74 (95% CI 1.98-5.50) points. The SPADI results showed an average reduction of 17.76 (CI 95% 3.10-32.43) for the EG and 18.39 (CI 95% 3.66-33.13) for the CG. The mean value of the perceived global effect for the CG was 3.45±2.01, and for the EG, the mean was 4.13±1.24. No differences were observed between groups in any outcome analyzed.
Conclusion: Both groups showed significant changes in the analyzed outcomes. However, the workplace-based exercise program was not superior to the exercise booklet.
Authors: Sol Patricia Beltrán, Gabriel de Amorim Batista, Muana Hiandra Pereira Dos Passos, Hitalo Andrade da Silva, Francisco Locks, Rodrigo Cappato de Araújo
Full Source: Work (Reading, Mass.) 2023 Nov 18. doi: 10.3233/WOR-230085.

Background: Shoulder pain affects millions of workers worldwide and is considered one of the leading causes of absenteeism and presenteeism.

Bisphenol derivatives in cord blood and association between thyroid hormones and potential exposure sources

2023-11-26
Endocrine-disrupting environmental chemicals are a public health concern, particularly fetal exposure to Bisphenol derivatives. This study

aimed to assess fetal exposure to Bisphenol derivatives (BPA, BPF, and BPS) by measuring their levels in cord blood and investigating their association with plastic material used in daily life as well as cord blood TSH and free L-thyroxine (fT4) levels. In this descriptive study, a questionnaire with a face-to-face interview was administered before birth, and cord blood samples were taken immediately after delivery. The mean levels of BPA, BPF, TSH, and fT4 were measured as 10.69 ± 2.39 ng/ml, 3.80 ± 0.58 ng/ml; 2.36 ± 0.23 µIU/ml, and 14.18 ± 0.53 pg/ml, respectively, in a total of 104 cord blood samples. All BPS levels remained below the detection limit. Linear regression analysis revealed a positive association between birth weight and cord blood BPA concentration ($\beta = 0.26$; $p = 0.02$). Further research on maternal exposure during the fetal and neonatal period is critical for public health.

Authors: Merve Buke Sahin, Murat Cagan, Anıl Yirun, Aylin Balcı Ozyurt, Selinay Basak Erdemli Kose, Irem Iyigun, Melda Celik, Ozgur Ozyuncu, Pınar Erkekoglu, Cavit Isik Yavuz

Full Source: International journal of environmental health research 2023 Nov 26:1-10. doi: 10.1080/09603123.2023.2286016.