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CHEMICAL EFFECTS

γ-Oryzanol from Rice Bran Antagonizes Glutamate-Induced Excitotoxicity in an In Vitro Model of Differentiated HT-22 Cells

2024-04-21

The excessive activation of glutamate in the brain is a factor in the development of vascular dementia. γ -Oryzanol is a natural compound that has been shown to enhance brain function, but more research is needed to determine its potential as a treatment for vascular dementia. This study investigated if γ -oryzanol can delay or improve glutamate neurotoxicity in an in vitro model of differentiated HT-22 cells and explored its neuroprotective mechanisms. The differentiated HT-22 cells were treated with 0.1 mmol/L glutamate for 24 h then given γ -oryzanol at appropriate concentrations or memantine (10 μ mol/L) for another 24 h. Glutamate produced reactive oxygen species and depleted glutathione in the cells, which reduced their viability. Mitochondrial dysfunction was also observed, including the inhibition of mitochondrial respiratory chain complex I activity, the collapse of mitochondrial transmembrane potential, and the reduction of intracellular ATP levels in the HT-22 cells. Calcium influx triggered by glutamate subsequently activated type II calcium/calmodulin-dependent protein kinase (CaMKII) in the HT-22 cells. The activation of CaMKII-ASK1-JNK MAP kinase cascade, decreased Bcl-2/Bax ratio, and increased Apaf-1-dependent caspase-9 activation were also observed due to glutamate induction, which were associated with increased DNA fragmentation. These events were attenuated when the cells were treated with γ -oryzanol (0.4 mmol/L) or the N-methyl-D-aspartate receptor antagonist memantine. The results suggest that γ -oryzanol has potent neuroprotective properties against glutamate excitotoxicity in differentiated HT-22 cells. Therefore, γ -oryzanol could be a promising candidate for the development of therapies for glutamate excitotoxicity-associated neurodegenerative diseases, including vascular dementia.

Authors: Li-Chai Chen, Mei-Chou Lai, Tang-Yao Hong, I-Min Liu

Full Source: *Nutrients* 2024 Apr 21;16(8):1237. doi: 10.3390/nu16081237.

The excessive activation of glutamate in the brain is a factor in the development of vascular dementia.

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Hues of risk: investigating genotoxicity and environmental impacts of azo textile dyes

2024-04-27

The textile industry, with its extensive use of dyes and chemicals, stands out as a significant source of water pollution. Exposure to certain textile dyes, such as azo dyes and their breakdown products like aromatic amines, has been associated with health concerns like skin sensitization, allergic reactions, and even cancer in humans. Annually, the worldwide production of synthetic dyes approximates 7×10^7 tons, of which the textile industry accounts for over 10,000 tons. Inefficient dyeing procedures result in the discharge of 15-50% of azo dyes, which do not adequately bind to fibers, into wastewater. This review delves into the genotoxic impact of azo dyes, prevalent in the textile industry, on aquatic ecosystems and human health. Examining different families of textile dye which contain azo group in their structure such as Sudan I and Sudan III Sudan IV, Basic Red 51, Basic Violet 14, Disperse Yellow 7, Congo Red, Acid Red 26, and Acid Blue 113 reveals their carcinogenic potential, which may affect both industrial workers and aquatic life. Genotoxic and carcinogenic characteristics, chromosomal abnormalities, induced physiological and neurobehavioral changes, and disruptions to spermatogenesis are evident, underscoring the harmful effects of these dyes. The review calls for comprehensive investigations into the toxic profile of azo dyes, providing essential insights to safeguard the aquatic ecosystem and human well-being. The importance of effective effluent treatment systems is underscored to mitigate adverse impacts on agricultural lands, water resources, and the environment, particularly in regions heavily reliant on wastewater irrigation for food production.

Authors: Karthikeyan Ramamurthy, Peter Snega Priya, Raghul Murugan, Jesu Arockiaraj

Full Source: *Environmental science and pollution research international* 2024 Apr 27. doi: 10.1007/s11356-024-33444-1.

The textile industry, with its extensive use of dyes and chemicals, stands out as a significant source of water pollution.

Identification of early events in nitrogen mustard pulmonary toxicity that are independent of infiltrating inflammatory cells using precision cut lung slices.

2024-04-25

Nitrogen mustard (NM; mechlorethamine) is a cytotoxic vesicant known to cause acute lung injury which can progress to chronic disease. Due to the complex nature of NM injury, it has been difficult to analyze early responses of resident lung cells that initiate inflammation and disease progression. To investigate this, we developed a model of acute NM

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toxicity using murine precision cut lung slices (PCLS), which contain all resident lung cell populations. PCLS were exposed to NM (1-100 μM) for 0.5-3 h and analyzed 1 and 3 d later. NM caused a dose-dependent increase in cytotoxicity and a reduction in metabolic activity, as measured by LDH release and WST-1 activity, respectively. Optimal responses were observed with 50 μM NM after 1 h incubation and these conditions were used in further experiments. Analysis of PCLS bioenergetics using an Agilent Seahorse showed that NM impaired both glycolytic activity and mitochondrial respiration. This was associated with injury to the bronchial epithelium and a reduction in methacholine-induced airway contraction. NM was also found to cause DNA damage in bronchial epithelial cells in PCLS, as measured by expression of $\gamma\text{-H2AX}$, and to induce oxidative stress, which was evident by a reduction in glutathione levels and upregulation of the antioxidant enzyme catalase. Cleaved caspase-3 was also upregulated in airway smooth muscle cells indicating apoptotic cell death. Characterizing early events in NM toxicity is key in identifying therapeutic targets for the development of efficacious countermeasures.

Authors: Alyssa Bellomo, Julia Herbert, Melissa J Kudlak, Jeffrey D Laskin, Andrew J Gow, Debra L Laskin
Full Source: Toxicology and applied pharmacology 2024 Apr 25:116941. doi: 10.1016/j.taap.2024.116941.

ENVIRONMENTAL RESEARCH

Research on the purification effect of major pollutants in water by modular constructed wetlands with different filler combinations

2024-04

Constructed wetland systems have been widely used in China due to their advantages of good treatment effect, low cost and environmental friendliness. However, traditional constructed wetlands have challenges in application such as deactivation due to filler clogging, difficulty in filler replacement and low adaptability. To address the above problems, this research proposes a modular filler design constructed wetland based on the concept of assembly construction, which can quickly replace the clogged filler without destroying the overall structure of the wetland. Four commonly used fillers were selected and applied to the pilot system of the assembled constructed wetland in this study, in order to investigate the purification effect of the constructed wetland system with different filler module combinations (CW1, CW2, CW3) on the simulated wastewater.

Constructed wetland systems have been widely used in China due to their advantages of good treatment effect, low cost and environmental friendliness.

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The results showed that the filler combination CW1 was the best for the removal of $\text{NH}_4^+\text{-N}$, and for TP and COD, CW2 has the best removal effect. Therefore, the assembled constructed wetland is adjustable and substantially reduces the maintenance cost, which provides technical guidance for its application in engineering.

Authors: Xiaoting Liu, Xuhao Li, Xiangling Zhang, Hui Zhao, Chen Wang, Hao Zhu, Xinlu Xiao, Shilong Cao, Rang Liu
Full Source: Water science and technology: a journal of the International Association on Water Pollution Research 2024 Apr;89(8):2090-2104. doi: 10.2166/wst.2024.107.

Removal effect of pollutants from stormwater runoff in shallow bioretention system with gramineous plants

2024-04

The bioretention system is one of the most widely used low impact development (LID) facilities with efficient purification capacity for stormwater, and its planting design has been a hot spot for research at home and abroad. In this paper, ryegrass (*Lolium perenne* L.), bermuda (*Cynodon dactylon* Linn.), bahiagrass (*Paspalum notatum* Flugge), and green grass (*Cynodon dactylon* \times *C. transadlensis* 'Tifdwarf') were chosen as plant species to construct a shallow bioretention system. The growth traits and nutrient absorption ability of four gramineous plants were analyzed. Their tolerance, enrichment, and transportation capacity were also evaluated to compare plant species and their absorptive capacity of heavy metals (Cu, Pb, and Zn). Results showed that the maximum absorption rate (I_{max}) ranged from 22.1 to 42.4 $\mu\text{g}/(\text{g}\cdot\text{h})$ for P and ranged from 65.4 to 104.8 $\mu\text{g}/(\text{g}\cdot\text{h})$ for $\text{NH}_4^+\text{-N}$; ryegrass had the strongest absorption capacity for heavy metals and the maximum removal rates of Cu, Pb, and Zn by four grasses were 78.4, 59.4, and 51.3%, respectively; the bioretention cell with ryegrass (3#) was significantly more effective in purifying than the unplanted bioretention cell (1#) during the simulated rainfall test. Overall, the system parameters were optimized to improve the technical application of gramineous plants in the bioretention system.

Authors: Jing Yang, Hui Luo, Huiteng Wang, Teng Qin, Mingyu Yang, Limin Chen, Xi Wu, Bao-Jie He
Full Source: Water science and technology : a journal of the International Association on Water Pollution Research 2024 Apr;89(8):1946-1960. doi: 10.2166/wst.2024.111.

The bioretention system is one of the most widely used low impact development (LID) facilities with efficient purification capacity for stormwater, and its planting design has been a hot spot for research at home and abroad.

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PHARMACEUTICAL/TOXICOLOGY

Characterization of Per- and Polyfluoroalkyl Substances (PFAS) and Other Constituents in MSW Landfill Leachate from Puerto Rico

2024-04-25

Elevated per- and polyfluoroalkyl substance (PFAS) concentrations have been reported in municipal solid waste (MSW) landfill leachate with higher levels in wet and warmer subtropical climates. Information about landfill leachate characteristics is much more limited in tropical climates. In this study, 20 landfill leachate samples were collected from three MSW landfills on the tropical island of Puerto Rico and results were compared against landfills nationally and within Florida, USA. The samples collected in Puerto Rico underwent physical-chemical analysis, as well as a quantitative analysis of 92 PFAS. Samples described in this study include discrete leachate types, such as leachate, gas condensate, and leachate which has undergone on-site treatment (e.g., RO treatment, phytoremediation, lagoons). A total of 51 PFAS were detected above quantitation limits, including perfluorohexylphosphonic acid, a perfluoroalkyl acid (PFAA) which has not been reported previously in landfill leachate. Σ PFAS concentrations in this study (mean: 38,000 ng L⁻¹), as well as concentrations of individual PFAS, are significantly higher than other reported MSW landfill leachate concentrations. The profiles of leachates collected from on-site treatment systems indicate possible transformation of precursor PFAS as a result of treatment processes - oxidizing conditions, for example, may facilitate aerobic transformation, increase the concentrations of PFAAs, and possibly increase the apparent Σ PFAS concentration. Extreme climate events, including rising temperatures and more frequent hurricanes, have placed additional strain on the solid waste management infrastructure on the island - adding complexity to an already challenging PFAS management issue. As concern grows over PFAS contamination in drinking water, these findings should inform solid waste and leachate management decisions in order to minimize PFAS emissions in island environments.

Authors: Nicole M Robey, Yalan Liu, Melitza Crespo-Medina, John A Bowden, Helena M Solo-Gabriele, Timothy G Townsend, Thabet M Tolaymat

Full Source: Chemosphere 2024 Apr 25;142141. doi: 10.1016/j.chemosphere.2024.142141.

Elevated per- and polyfluoroalkyl substance (PFAS) concentrations have been reported in municipal solid waste (MSW) landfill leachate with higher levels in wet and warmer subtropical climates.

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Interpretation of specification for service of cancer screening for workers

2024-04-10

As the backbone force of China's social and economic construction, the health status of workers is closely related to the nation's productivity and social development. Currently, cancers have become one of the major diseases threatening the health of workers. However, there are still many shortcomings in the cancer screening services for the workers. To standardize cancer screening services for workers, ensure the quality of screening services, and improve the overall screening effectiveness, 19 institutions, including Peking Union Medical College Hospital of the Chinese Academy of Medical Sciences, have jointly formulated the Group Standard "Specification for service of cancer screening for workers (T/CHAA 023-2023)". This standard follows the principles of "legality, scientific rigor, advancement, and feasibility" and combines the frontier scientific advances in cancer screening. It clarifies the relevant requirements for service principles, service design, service delivery, service management, service evaluation, and improving worker cancer screening. Implementing this group standard will help connect the common screening needs of workers, employers, and cancer screening service providers, standardize the screening process, improve screening quality, and ultimately increase the early diagnosis rate and survival rate of cancer patients. Consequently, this group standard will help safeguard workers' health rights and interests, ensure the labor force resources, promote the comprehensive coordinated and sustainable development of society, and contribute to realizing the "Healthy China 2030" strategic policy.

Authors: H D Chen, B Lu, Y Zheng, P Du, X Qi, K Zhang, Y Y Liu, J L Wei, D H Wei, J Y Gong, Y C Huang, Z Y Song, X Chu, D Dong, W J Zheng, M Dai

Full Source: Zhonghua liu xing bing xue za zhi = Zhonghua liuxingbingxue zazhi 2024 Apr 10;45(4):486-489. doi: 10.3760/cma.j.cn112338-20240311-00114.

As the backbone force of China's social and economic construction, the health status of workers is closely related to the nation's productivity and social development.

OCCUPATIONAL

Effect of exposure to disinfection by-products during swimming exercise on asthma-related immune responses

2024-04

Swimming is a widely practiced exercise in modern society, where there is a heightened interest in health. The exceptional benefits of swimming are well-known, yet the issue of water quality management

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inevitably arises due to its nature as an aquatic exercise. Several studies reported that chlorine disinfectants commonly used in swimming pool water disinfection could degrade into toxic disinfection by-products (DBPs) and suggested that the DBPs might induce respiratory disorders, including asthma. Conversely, there were also reports that the DBPs had no significant effects on respiratory conditions. In this study, we investigated the influence of swimming exercise and DBPs on asthma. The decomposition products had little effect on the number of T cells in various immune organs. However, swimming exercise was found to increase the cell count in proportion to the exercise duration. Nevertheless, there were no significant changes in other immune cells and the secretion of asthma-related cytokines. These findings indicate that the effects of swimming pool DBPs on respiratory conditions during swimming exercise are either negligible or absent, and instead, the immunological benefits gained through consistent swimming exercise outweigh any potential drawbacks.

Authors: Bo-Ae Lee

Full Source: Journal of water and health 2024 Apr;22(4):735-745. doi: 10.2166/wh.2024.390.

Short-term exposures to PM2.5, PM2.5 chemical components, and antenatal depression: Exploring the mediating roles of gut microbiota and fecal short-chain fatty acids.

2024-04-26

Background: PM2.5 and its chemical components increase health risks and are associated with depression and gut microbiota. However, there is still limited evidence on whether gut microbiota and short-chain fatty acids (SCFAs) mediate the association between PM2.5, PM2.5 chemical components, and antenatal depression. The purpose of this study was to investigate the mediating role of maternal gut microbiota in correlations between short-term exposure to PM2.5, short-term exposure to PM2.5 chemical components, and antenatal depression.

Methods: Demographic information and stool samples were collected from 75 pregnant women in their third trimester. Their exposure to PM2.5 and PM2.5 chemical components was measured. Participants were divided into the non-antenatal depression group or the antenatal depression group according to the cut-off of 10 points on the Edinburgh Postnatal Depression Scale (EPDS). The gut microbiota were analyzed using the 16 S rRNA-V3/V4 gene sequence, and the concentration of PM2.5 and its chemical components was calculated using the Tracking Air Pollution in

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China (TAP) database. Gas chromatography-mass spectrometry was used to analyze SCFAs in stool samples. In order to assess the mediating effects of gut microbiota and SCFAs, mediation models were utilized. Results: There were significant differences between gut microbial composition and SCFAs concentrations between the non-antenatal depression group and the antenatal depression group. PM2.5 and its chemical components were positively associated with EPDS scores and negatively associated with genera *Enterococcus* and *Enterobacter*. Genera *Candidatus_Soleaferrea* ($\beta = -7.21$, 95%CI -11.00 to -3.43, $q = 0.01$) and *Enterococcus* ($\beta = -2.37$, 95%CI -3.87 to -0.87, $q = 0.02$) were negatively associated with EPDS scores, indicating their potential protective effects against antenatal depression. There was no significant association between SCFAs and EPDS scores. The mediating role of *Enterococcus* between different lagged periods of PM2.5, PM2.5 chemical component exposure, and antenatal depression was revealed. For instance, *Enterococcus* explained 29.23% (95%CI 2.16-87.13%, $p = 0.04$) of associations between PM2.5 exposure level at the day of sampling (lag 0) and EPDS scores.

Conclusion: Our study highlights that *Enterococcus* may mediate the associations between PM2.5, PM2.5 chemical components, and antenatal depression. The mediating mechanism through which the gut microbiota influences PM2.5-induced depression in pregnant women still needs to be further studied.

Authors: Tianlai Qiu, Qingbo Fang, Xueer Zeng, Xu Zhang, Xiaoxiao Fan, Tianzi Zang, Yanan Cao, Yiming Tu, Yanting Li, Jinbing Bai, Jing Huang, Yanqun Liu

Full Source: Ecotoxicology and environmental safety 2024 Apr 26;277:116398. doi: 10.1016/j.ecoenv.2024.116398.

Biochemical and molecular-level effects of co-exposure to chlorpyrifos and lambda-cyhalothrin on the earthworm (*Eisenia fetida*)

2024-04-26

Farmland soil organisms frequently encounter pesticide mixtures presented in their living environment. However, the underlying toxic mechanisms employed by soil animals to cope with such combined pollution have yet to be explored. This investigation aimed to reveal the changes in cellular and mRNA levels under chlorpyrifos (CPF) and lambda-cyhalothrin (LCT) co-exposures in earthworms (*Eisenia fetida*). Results exhibited that the combination of CPF and LCT triggered an acute synergistic influence on the animals. Most exposures resulted in significant

Farmland soil organisms frequently encounter pesticide mixtures presented in their living environment.

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alterations in the activities of total superoxide dismutase (T-SOD), copper/zinc superoxide dismutase (Cu/Zn-SOD), caspase 3, and carboxylesterase (CarE) compared to the basal level. Moreover, when exposed to chemical mixtures, the transcription levels of four genes [heat shock protein 70 (hsp70), *gst*, *sod*, and calreticulin (*crt*)] also displayed more pronounced changes compared with their individual exposures. These changes in determined parameters indicated the occurrence of oxidative stress, cell death, detoxification dysfunction, and endoplasmic reticulum damage after co-exposure to CPF and LCT in *E. fetida*. The comprehensive examination of mixture toxicities of CPF and LCT at different endpoints would help to understand the overall toxicity they cause to soil invertebrates. The augmented deleterious effect of these pesticides in a mixture suggested that mixture toxicity assessment was necessary for the safety evaluation and application of pesticide mixtures.

Authors: Dou Wang, Liping Chen, Guiling Yang, Zhenlan Xu, Lu Lv, Tao Tang, Yanhua Wang

Full Source: *Ecotoxicology and environmental safety* 2024 Apr 26;277:116374. doi: 10.1016/j.ecoenv.2024.116374.