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CHEMICAL EFFECTS

Sole and co-exposure toxicity of commercial formulations ethoprophos and bispyribac-sodium to *Oreochromis niloticus*: Assessment of oxidative stress, genotoxicity, and gill ultrastructure

2024-11-06

Aquatic organisms are simultaneously exposed to multiple hazardous chemicals that can be released into water bodies. The current study aimed to evaluate the effect of sublethal concentration (1/50 96 h-LC50) of two formulated pesticides: ethoprophos, bispyribac-sodium, and their combination for 1, 2, 3, and 4 weeks on oxidative stress, genotoxic response, and gill morphology in Nile tilapia. This study is the first to demonstrate the toxic effects of ethoprophos and bispyribac-sodium mixture on the commercial important species, *Oreochromis niloticus*. The results showed that the 96 h-LC50 values of ethoprophos and bispyribac-sodium were 4.8 and 0.064 mg/L, respectively. Additionally, exposure to individual or combined pesticides induced a significant increase in the level of malondialdehyde (MDA), glutathione S-transferase (GST), and 8-hydroxy-2-deoxyguanosine (8-OHdG), as well as a notable decline in reduced glutathione (GSH), superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx) levels at all time of exposure. Furthermore, there were alterations in ultrastructure of the gill samples, including erosive lesions on the primary and secondary lamellae, fusion of microridges, and excessive mucus secretions on the epithelium. The data clearly demonstrate that the negative effects of the tested compounds are time-dependent and are more severe in combination than in a single compound. Collectively, our results indicated that the interaction of ethoprophos and bispyribac-sodium might be largely synergistic and provide new insights into the molecular mechanisms of fish confronting these substances.

Authors: Kawther S El-Gendy, Eman M Mosallam, Aya S Abd El-Kader, Mohamed A Radwan

Full Source: Environmental science and pollution research international 2024 Nov 6. doi: 10.1007/s11356-024-35420-1.

Aquatic organisms are simultaneously exposed to multiple hazardous chemicals that can be released into water bodies.

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Levels and Classification of Microplastics and Their Impact on the Wellbeing of Selected Commercially Important Fish Species in Kisumu Bay, Lake Victoria

2024-11-05

Microplastics (MPs) are emerging pollutants of concern in aquatic ecosystems. Fish ingest MPs accidentally during normal feeding because they resemble prey or by ingesting prey that previously consumed them. Despite severe plastic pollution in Africa, some countries, including Kenya have implemented laws to curb this pollution menace. MPs have scanty been studied in African freshwaters. This study provides empirical data and describes the levels of MPs in four commercially important fish species in Lake Victoria. A total of 95 fish samples were collected from four sampling sites (inshore-offshore waters) between March and May 2022. Microscopy and Attenuated Total Reflectance Fourier Transformed Infrared (ATR-FTIR) spectroscopy methods were used to identify MPs. In this study, 62 out of 95 (65.26%) of the gastrointestinal tracts of the sampled fish contained MPs. The four species showed different proportions of detected MPs among the sampled individuals: 75.00% (*Clarias gariepinus*), 75.00% (*Synodontis victoriae*), 71.43% (*Lates niloticus*), and 59.26% (*Oreochromis niloticus*). Polystyrene (PS) and poly (perfluorobutadiene) were the main plastic polymers in the fish samples. The condition factors estimated for *O. niloticus*, *S. victoriae*, and *L. niloticus* were > 1 and < 1 for *C. gariepinus*, respectively. Positive correlations were observed between microplastic numbers and fish length and microplastic numbers and fish weight. However, the low R2 values obtained implied no strong relationship exists between these parameters. These findings provide evidence of microplastic contamination in fish in Kisumu Bay.

Authors: Sylvia Wanjiku Gathu, Nzula Kivuva Kitaka, Lewis Morara Sitoki, Elick Onyango Otachi

Full Source: Bulletin of environmental contamination and toxicology 2024 Nov 5;113(6):65. doi: 10.1007/s00128-024-03976-w.

Microplastics (MPs) are emerging pollutants of concern in aquatic ecosystems.

ENVIRONMENTAL RESEARCH

Assessing the interaction between 4-methylbenzylidene camphor and microplastic fibers in aquatic environments: Adsorption kinetics and mechanisms

2024-11-04

Wastewater treatment plants play a crucial role in managing environmental pollutants, but they often release persistent contaminants

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like synthetic microplastic fibers (MPFs) into ecosystems. These microplastics, mainly from the textile industry and domestic washing of synthetic fabrics, are a major type of microplastic found in aquatic environments. Some harmful chemicals have an affinity for these microplastics, making them vectors for contaminants. This study investigates the adsorption of 4-methylbenzylidene camphor (4-MBC), an organic UV filter, onto microplastic fibers from two different sources. Batch experiments conducted at room temperature (25 °C) under laboratory conditions assessed the adsorption kinetics and mechanisms. Morphological and visual characterization of the microplastic fibers was done using optical microscopy and scanning electron microscopy (SEM), revealing diverse shapes, types, and colors. Physico-chemical properties were confirmed through thermogravimetric analysis (TGA) and Fourier-transform infrared spectroscopy (FTIR). The data matched well with the PSO kinetic model and Langmuir isotherm, indicating monolayer chemisorption with equilibrium achieved within 24 h. The adsorption mechanisms involved electrostatic attraction, hydrogen bonding, and π - π interactions. Both types of microplastic fibers exhibited a tendency to adsorb 4-MBC, indicating the significance of this research in understanding the interactions between this compound and various fiber types emphasizing the need for further research under the different environmental conditions.

Authors: Vujić Maja, Vasiljević Sanja, Simetić Tajana, Kordić Branko, Molnar Jazić Jelena, Agbaba Jasmina, Tubić Aleksandra
Full Source: The Science of the total environment 2024 Nov 4:177383. doi: 10.1016/j.scitotenv.2024.177383.

Cationic waste hemp fibers-based membrane: Case study of anionic pollutants removal through environmentally friendly processes

2024-11-05

In this study, waste hemp fibers were transformed into cationically modified lignocellulosic adsorbent through a three-step process. First, a delignification/defibrillation pretreatment was performed, followed by quaternization of fibers using the synthesized ionic liquid chlorocholine chloride-urea (CCC-U). Pressure-assisted cross-linking of modified fibres, using a citric acid, produced new membrane (CCC-UHM). The removal of anionic dyes (Acid Yellow 36 (AY36), Congo Red (CR), Acid Green 25 (AG25), and Acid Blue 92 (AB92)), and oxyanions (As(V) and Cr(VI)) was tested in batch and column system. The structural characteristics and chemical properties of the synthesised materials were investigated by SEM, FTIR,

In this study, waste hemp fibers were transformed into cationically modified lignocellulosic adsorbent through a three-step process.

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Raman, XPS, XRD, specific density, porosity and point of zero charges analysis. The endothermic and spontaneous equilibration of the system resulted in high capacity (qm), i.e., 302.9 mg g⁻¹ (AY36), 456.8 mg g⁻¹ (CR), 812.8 mg g⁻¹ (AG25), 587.6 mg g⁻¹ (AB92), 107.9 mg g⁻¹ (As(V)), and 67.84 mg g⁻¹ (Cr(VI)) at 25 °C, using the Langmuir model. The optimum pH for the adsorption process was 7. The multi-cycle adsorption/desorption process was followed by either decolorization, using laccase from *M. thermophile* expressed in *Aspergillus oryzae* (Novozym 51,003® laccase) immobilized on amino-modified fibers as biocatalyst, or photocatalytic degradation, in the presence of zinc oxide. The high decolorization efficiency (96%) observed for AG25 and AB92 underscores the considerable potential of laccase immobilized preparations as sustainable and eco-friendly approach for treating dye-contaminated wastewater. Photodegradation process provided low environmental threat of processed water, and biodegradability of exhausted membrane confirmed the circularity of the developed technology with implemented principles of sustainability.

Authors: Nataša Knežević, Marija M Vuksanović, Katarina Banjanac, Krstimir Pantić, Zlate Veličković, Ilija Cvijetić, Aleksandar Marinković, Milena Milošević

Full Source: Journal of environmental management 2024 Nov 5:371:123174. doi: 10.1016/j.jenvman.2024.123174.

Ion-exchange chromatography in the assessment of environmental pollution with chlortetracycline

2024-11-02

Chemical substances such as drugs pose a threat to the environment. One of the substances recorded in soil and water is chlortetracycline, an antibiotic used in veterinary medicine. Plants exposed to such xenobiotics show changes in the content of biogenic amines. An analytical technique - ion exchange chromatography is used to assess their content. The occurrence of these active compounds is used to determine the degree of environmental pollution with chemical substances. The study aimed to evaluate the toxicity of chlortetracycline (CTC) at concentrations of 0; 0.05; 0.1; 0.2 0.5; 1; 2; 3; and 5 mM towards the test organism *Lemna minor*, and determine the content of biogenic amines in the plant tissues. The content of biogenic amines was analyzed by ion-exchange chromatography with post-column ninhydrin derivatization and photometric detection. The *Lemna* test proved that increasing concentrations of CTC had a toxic effect on the plants. It was calculated that the Lowest Observed Effects Concentration (LOEC) of CTC at >0.04 mM and >0.05 mM was

Chemical substances such as drugs pose a threat to the environment.

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phytotoxic to *L. minor* growth and yield. It was determined that the levels of histamine, tyramine, and cadaverine exhibited an increase, reaching 1.04, 1.90, and 3.10 $\mu\text{g g}^{-1}$ of tissue at 2.00 mM CTC. Simultaneously, spermine and putrescine increased to 1.21 and 3.89 $\mu\text{g g}^{-1}$ of tissue at concentrations of 0.10 and 0.50 mM of the drug. Conversely, the study revealed an over 88 % reduction in spermidine in plants at 5 mM of CTC. Using ion-exchange chromatography, analysis of biogenic amines, particularly spermidine and cadaverine, highlighted these intra-tissue compounds as sensitive biomarkers for water contamination with the tested drug. This research confirmed that the Lemna test is effective for assessing CTC toxicity and that ion-exchange chromatography is useful for evaluating environmental pollution by this antibiotic.

Authors: Łukasz Sikorski, Agnieszka Bęś, Elżbieta Karetko-Sikorska, Wojciech Truszkowski, Katarzyna Tomaszewska
Full Source: Aquatic toxicology (Amsterdam, Netherlands) 2024 Nov 2:277:107142. doi: 10.1016/j.aquatox.2024.107142.

PHARMACEUTICAL/TOXICOLOGY

Global trends and projections of occupational trichloroethylene (TCE) exposure-associated kidney cancer: Insights of the Global Burden of Disease (GBD) Study 2021 from 1990 to 2021 and prediction to 2050

2024-11-05

Background: Exposure to trichloroethylene (TCE) in occupations is associated with an increased risk of kidney cancer (KC). However, there is a lack of comprehensive study on the global burden of occupational exposure to TCE-related KC.

Methods: Epidemiological data on occupational TCE exposure-associated KC from 1990 to 2021 were obtained from Global Burden of Disease (GBD) 2021 study, including death counts and disability-adjusted life years (DALYs). Global burden of this disease was stratified by genders, age, socio-demographic index (SDI) quintiles, GBD subcontinental regions, and countries. The estimated annual percentage change (EAPC) was calculated to illustrate trends over the last 32 years, and forecasts were conducted to predict the disease burden until 2050.

Results: In 2021, the global age-standardized death rate (ASDR) of occupational TCE exposure-related KC was 0.0009 (95 %UI: 0.0002-0.0016) per 100,000 persons, and the age-standardized DALY rate (ASDAR) was 0.0284 (95 %UI: 0.0062-0.0522) per 100,000 individuals. The disease

Background: Exposure to trichloroethylene (TCE) in occupations is associated with an increased risk of kidney cancer (KC).

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showed significant heterogeneity by sex and age, with males bearing a notably higher burden, and the burden being concentrated in the 50-79 year-old group. Major burdens were focused in middle to high-middle SDI regions, especially in Southern Latin America (Uruguay, Argentina, and Chile). Over 32 years, the burden of occupational TCE exposure-associated KC has gradually increased, with projections indicating continued growth to 2050, particularly among males and individuals aged 50-79. Regions like high-middle SDI areas, North America, High-income North America, Southern Sub-Saharan Africa, saw the most significant increases. Correlation analyses indicated a positive association between ASDR and ASDAR with SDI, while EAPC showed a notable negative correlation with SDI. Decomposition analyses reveals three global population determinants that positively contributed to the increase in deaths, but negatively impacted DALYs.

Conclusion: This study highlights a significant rising trend of occupational TCE exposure-associated KC from 1990 to 2021 and projected to 2050, with an emphasis on the disease burden in men, elderly population, and middle to high-middle SDI regions, underscoring the impact of occupational TCE exposure on KC.

Authors: Hang Huang, Ping Li, Haoran Jiang, Junkai Hong, Yongyong Lu
Full Source: Ecotoxicology and environmental safety 2024 Nov 5:287:117252. doi: 10.1016/j.ecoenv.2024.117252.

A critical review on heavy metal contamination in aquatic food webs by edible fish species: a special case concerning Bangladesh

2024-11-07

Heavy metals (HMs) are ubiquitous in terrestrial and aquatic environments due to unplanned industrial waste discharge, the release of untreated wastewater, and improper mining activities. In particular, the concentrations of HMs are found to be higher in aquatic environments. As a result, the aquatic biota was heavily affected by HM contamination. This critical review aims to understand the sources and toxicity of HMs in commercial fish species, explore their ecological exchange, and examine the related human health challenges in Bangladesh. A modified PRISMA review technique is used in this paper to analyze the current status and research limitations of HM studies in Bangladesh fish species and their toxicity within aquatic food webs. Briefly, we searched several keywords to explore the research trend of HM concentrations and toxicity in fish species. Furthermore, potential toxicity and risk assessment of HMs through the aquatic food chain in Bangladesh were explored. On the

Heavy metals (HMs) are ubiquitous in terrestrial and aquatic environments due to unplanned industrial waste discharge, the release of untreated wastewater, and improper mining activities.

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other hand, a cross-tabulation approach was used to process the toxicity findings of HMs. Previous studies indicate that fish species can possess comparatively higher HMs than river water due to ecological exchange factors, including bioaccumulation and biotransformation. This review focuses on Bangladesh, highlighting areas for improvements and the need for further study to achieve a transparent understanding of HM deposition in fish species and the sustainable management of aquatic food chain toxicity.

Authors: Md Refat Jahan Rakib, Aniruddha Sarker, Zinat Tahira Nahida, Abu Reza Md Towfiqul Islam, Md Yousuf Mia, Md Naimur Rahman, S M Ahsan, Abubakr M Idris, Minh-Ky Nguyen, Rakesh Kumar, Guilherme Malafaia
Full Source: Environmental monitoring and assessment 2024 Nov 7;196(12):1175. doi: 10.1007/s10661-024-13347-x.

OCCUPATIONAL

The price of pressure: nationwide survey on lifestyle disturbances, occupational burnout and compromised perceived-competency among radiology residents in China

2024-10-23

Objectives: The competency of radiology directly affects the quality and equity of medical services. Due to their different occupational characteristics compared to other specialists, this study aims to evaluate the impacts of lifestyles on competency and burnout in radiology residents in China.

Materials and methods: A nationwide, cross-sectional survey was conducted from December 1, 2020 to April 30, 2021. A total of 12,208 radiology residents during their standardized residency training in China were invited. Multivariate linear regression and logistic regression were conducted to identify perceived competency and burnout associated with lifestyles.

Results: Of the 3,666 participants, 58.02% were female, 82.24% were aged <30 years, 40.53% were from the Eastern region, and 92.06% obtained a bachelor's degree. The radiology residents with high-level lifestyles had higher competency ($\beta = 0.16$, 95% CI = [0.01, 0.32]), particularly in the realms of sleep, physical activity, and alcohol consumption. The correlation was stronger in residents with longer work hours and more night shifts. Residents with insomnia (OR = 7.69, 95% CI = [4.23, 14.67]) and less exercise (OR = 6.24, 95% CI = [1.33, 29.37]) had higher burnout risk, while residents who smoked had a lower risk (OR = 0.60, 95% CI = [0.40,

Objectives: The competency of radiology directly affects the quality and equity of medical services.

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0.89]). And lifestyle factors had a slightly different impact on emotional exhaustion and depersonalization.

Conclusion: Radiology residents' lifestyles can be emphasized, as it may reflect their pressure and wellbeing and influence their concentration, competency, burnout and performance. Policymakers and hospital administrators should incorporate practical and modifiable strategies into work routines to improve the lifestyle quality of residents.

Authors: Zeqi Liu, Qinqi Yao, Peicheng Wang, Lijun Shen, Hange Li, Jingfeng Zhang, Maoqing Jiang, Zhenghan Yang, Zhenchang Wang, Jianjun Zheng, Jiming Zhu, You Wu

Full Source: Frontiers in public health 2024 Oct 23;12:1472397. doi: 10.3389/fpubh.2024.1472397.

Association of ambient ozone exposure with early cardiovascular damage among general urban adults: A repeated-measures cohort study in China

2024-11-04

Longitudinal evidence of long-term ozone exposure on heart rate variability (HRV, an early indicator of cardiovascular damage) is lacking and the potential mechanism remains largely unclear. Our objectives were to evaluate the cross-sectional and longitudinal associations of ozone exposure with HRV alteration, and the potential roles of protein carbonyl (PC, biomarker of oxidative protein damage) and transforming growth factor (TGF)- β 1 in this association. This repeated-measures prospective study included 4138 participants with 6617 observations from the Wuhan-Zhuhai cohort. Ozone concentrations were estimated using a high temporospatial resolution model for each participant. HRV indices, PC, and TGF- β 1 were also repeatedly measured. Cross-sectional and longitudinal relationships of ozone exposure with HRV alteration were evaluated by linear mixed model. Cross-sectionally, the strongest lag effect of each 10 ppb increment in short-term ozone exposure showed a 12.40 %, 8.47 %, 4.31 %, 8.03 %, 3.69 %, and 2.41 % decrement on very low frequency (VLF, lag 3 weeks), LF (lag 2 weeks), high frequency (HF, lag 0-7 days), total power (TP, lag 2 weeks), standard deviation of all normal-to-normal intervals (SDNN, lag 3 weeks), and square root of the mean squared difference between adjacent normal-to-normal intervals (lag 2 weeks), respectively. Longitudinally, each 10 ppb increment of annual average ozone was related with an annual change rate of -0.024 ms²/year in VLF, -0.009 ms²/year in LF, -0.013 ms²/year in HF, -0.014 ms²/year in TP, and -0.004 ms²/year in SDNN. Mediation analyses indicated that PC mediated 20.77 % and 12.18 % of ozone-associated VLF and TP decline, respectively;

Longitudinal evidence of long-term ozone exposure on heart rate variability (HRV, an early indicator of cardiovascular damage) is lacking and the potential mechanism remains largely unclear.

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TGF- β 1 mediated 16.87 % and 27.78 % of ozone-associated VLF and SDNN reduction, respectively. Our study demonstrated that ozone exposure was cross-sectionally and longitudinally related with HRV decline in general Chinese urban adults, and oxidative protein damage and increased TGF- β 1 partly mediated ozone exposure-related HRV reduction.

Authors: Qiyu Tan, Min Zhou, Xiaojie You, Jixuan Ma, Zi Ye, Wendi Shi, Xiuqing Cui, Ge Mu, Linling Yu, Weihong Chen

Full Source: The Science of the total environment 2024 Nov 4:177380. doi: 10.1016/j.scitotenv.2024.177380.

Early-life antibiotic exposure aggravate the metabolic dysfunction-associated steatotic liver disease associated hepatocellular carcinoma

2024-11-06

Background: Metabolic dysfunction-associated steatotic liver disease (MASLD) associated hepatocellular carcinoma (HCC) is becoming a growing concern in global healthcare. The early-life gut microbiota plays a crucial role in maintaining healthy. However, the impact of early-life gut microbiota dysbiosis on the advancement of MASLD-HCC remains inadequately understood.

Methods: In the present study, we investigated the role of early-life gut microbiota in the development of MASLD-HCC in streptozotocin and high-fat diet (STZ-HFD) induced mouse model. We recorded the body weight and lifespan, and dynamically monitored the level of alanine aminotransferase (ALT), aspartate aminotransferase (AST), triglyceride (TG), total cholesterol (T-CHO) and blood glucose in the serum monthly. In addition, we examined various immune cells present in the liver, such as T cells, B cells, NK cells, NKT cells, $\alpha\beta$ T cells, $\gamma\delta$ T cells, macrophage and MDSC cells by flow cytometry and conducted liquid chromatography mass spectrometry (LC-MS) based analysis on liver tissue from control and early-life antibiotic exposure mice (early-Abx) MASLD-HCC mice.

Results: We found that early-Abx mice suffered from more severe tumor burden and further confirmed that hepatocytes and immune cells were all disturbed. Importantly, early-life antibiotic exposure alters the liver metabolic profiling especially glycerophospholipids and lipid accumulation. Furthermore, mice exposed to antibiotics in early-life showed disturbances in glucose metabolism and developed insulin resistance.

Conclusions: Collectively, our findings revealed that early-life antibiotic exposure accelerated the progression of MASLD-HCC by impairing the hepatocytes, immune homeostasis and metabolites persistently,

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highlighting the importance of the early-life microbiota in the development of MASLD-HCC.

Authors: Panpan Tian, Xinyu Tian, Lifeng Gao, Chunhong Ma, Xiaohong Liang

Full Source: BMC cancer 2024 Nov 6;24(1):1358. doi: 10.1186/s12885-024-13136-2.

Background: Metabolic dysfunction-associated steatotic liver disease (MASLD) associated hepatocellular carcinoma (HCC) is becoming a growing concern in global healthcare.