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CHEMICAL EFFECTS

Dietary application of Lactococcus lactis alleviates toxicity and regulates gut microbiota in Cyprinus carpio on exposure to heavy metals mixture

2021-11-27

Heavy metals (HMs) contaminated fish is a threat to humans when consumed. Dietary probiotics have evolved as a successful HMs removal approach. In this study, probiotics Enterococcus (EC) sp. and Lactococcus (LC) sp. were evaluated for toxicity alleviation and gut microbiota maintenance in Cyprinus carpio (single and combined approach) on Cr, Cd, and Cu mixture (0.8 mg/L and 1.6 mg/L) exposure (28 days). HMs removal, oxidative stress, cytokines response, histology, and gut microbiota were investigated. LC alone showed remarkable HMs removal for Cr (62.28%-87.57%), Cd (89%-90.42%), and Cu (72%-88%) than LC + EC. Probiotics up-regulated superoxide dismutase and total protein levels, while decreased the activity of malondialdehyde than the control. Pro-inflammatory cytokine (TNF-α) and chemokine (IL-8) expressions were higher at 1.6 mg/L concentration, whereas anti-inflammatory cytokine (IL-10) was higher in the 0.8 mg/L group. LC mitigated the histological alterations of gills, kidneys, and intestines, particularly at the lower concentration. Sequencing results revealed that Proteobacteria (44%-61%) was the most dominant phylum in all groups, followed by Fusobacteria (34%-36%) at 0.8 mg/L and Firmicutes (19%-34%) at 1.6 mg/L. The current study presented LC and EC potential separately and in combination to countermeasure HMs mixture induced toxicity and gut microbial dysbiosis, in which the conjoint group was less effective.

Authors: Apurva Kakade, El-Sayed Salama, Muhammad Usman, Muhammad Arif, Pengya Feng, Xiangkai Li

Full Source: Fish & shellfish immunology 2021 Nov 27;120:190-201. doi: 10.1016/j.fsi.2021.11.038.

Heavy metals (HMs) contaminated fish is a threat to humans when consumed.

Structures of Endocrine-Disrupting Chemicals Correlate with the Activation of 12 Classic Nuclear Receptors

2021-12-03

Endocrine-disrupting chemicals (EDCs) can inadvertently interact with 12 classic nuclear receptors (NRs) that disrupt the endocrine system and cause adverse effects. There is no widely accepted understanding about what structural features make thousands of EDCs able to activate different NRs as well as how these structural features exert their functions and induce different outcomes at the cellular level. This paper applies the hierarchical characteristic fragment methodology and high-throughput screening molecular docking to comprehensively explore the structural and functional features of EDCs for the 12 NRs based on more than 7000 chemicals from curated datasets. EDCs share three levels of key fragments. The primary and secondary fragments are associated with the binding of EDCs to four groups of receptors: steroidal nuclear receptors (SNRs, including androgen, estrogen, glucocorticoid, mineralocorticoid, and progesterone), retinoic acid receptors, thyroid hormone receptors, and vitamin D receptors. The tertiary fragments determine the activity type by interacting with two key locations in the ligand-binding domains of NRs (N-H5-H3-C and N-H7-H11-C for SNRs and N-H5-H5′-H2′-H3-C and N-H6′-H11-C for non-SNRs). The resulting compiled structural fragments of EDCs together with elucidated compound NR binding modes provide a framework for understanding the interactions between EDCs and NRs, facilitating faster and more accurate screening of EDCs for multiple NRs in the future.

Authors: Haoyue Tan, Qinchang Chen, Huixiao Hong, Emilio Benfenati, Giuseppina C Gini, Xiaowei Zhang, Hongxia Yu, Wei Shi

Full Source: Environmental science & technology 2021 Dec 3. doi: 10.1021/acs.est.1c04997.

UV-aging of microplastics increases proximal ARG donor-recipient adsorption and leaching of chemicals that synergistically enhance antibiotic resistance propagation

2021-11-25

Despite growing attention to environmental pollution by microplastics (MP), the effects of MP aging on bacterial horizontal gene transfer (HGT) have not been systematically investigated. Here, we used UV-aged polystyrene microplastics (PS-MPs) to investigate how aging affects antibiotic resistance genes (ARGs) transfer efficiency from various ARG vectors to recipient bacteria. The adsorption capacity of MP20 (20-day UV-aged PS-MPs) towards E. coli (harboring plasmid-borne blaTEM-1), plasmid pET29 (harboring blaNDM-1) and phage lambda (carrying the aphA1 ARG) increased by 6.6-, 5.2- and 8.3-fold, respectively, relative to pristine PS-MPs (MP0), due to increased specific surface area and affinity for these ARG vectors. Moreover, MP20 released more organic compounds (TOC 1.6 mg/g-MP20, versus 0.2 mg/g-MP0 in 4 h) -possibly depolymerization byproducts (verified by GC-MS), which induced intracellular ROS generation, increased cell permeability and upregulated HGT associated genes. Accordingly, MP20 enhanced ARG transfer frequency from E. coli,

Despite growing attention to environmental pollution by microplastics (MP), the effects of MP aging on bacterial horizontal gene transfer (HGT) have not been systematically investigated.

plasmid pET29 and phage lambda (relative to MP0) by 1.3-, 4.7- and 3.5-fold, respectively. The Bliss independence model infers that higher bacterial adsorption and exposure to chemicals released during MP aging synergistically enhanced ARG transfer. This underscores the need to assess the significance of this overlooked phenomenon to the environmental dissemination of antibiotic resistance and other HGT processes.
Authors: Qingbin Yuan, Ruonan Sun, Pingfeng Yu, Yuan Cheng, Wenbin Wu, Jiming Bao, Pedro J J Alvarez
Full Source: Journal of hazardous materials 2021 Nov 25;127895. doi: 10.1016/j.jhazmat.2021.127895.

In utero exposure to endocrine-disrupting chemicals, maternal factors and alterations in the epigenetic landscape underlying later-life health effects

2021-11-26
Widespread persistence of endocrine-disrupting chemicals (EDCs) in the environment has mandated the need to study their potential effects on an individual's long-term health after both acute and chronic exposure periods. In this work a particular focus is given on in utero exposure to EDCs in rodent models which resulted in altered epigenetic programming and transgenerational effects in the offspring causing disrupted reproductive and metabolic phenotypes. The literature to date establishes the impact of transgenerational effects of EDCs potentially associated with epigenetic mediated mechanisms. Therefore, this review aims to provide a comprehensive overview of epigenetic programming and it's regulation in mammals, primarily focusing on the epigenetic plasticity and susceptibility to exogenous hormone active chemicals during the early developmental period. Further, we have also in depth discussed the epigenetic alterations associated with the exposure to selected EDCs such as Bisphenol A (BPA), di-2-ethylhexyl phthalate (DEHP) and vinclozlin upon in utero exposure especially in rodent models.
Authors: Christy Lite, Glancis Luzeena Raja, Melita Juliet, Vasisht Varsh Sridhar, K Divya Subhashree, Praveen Kumar, Paromita Chakraborty, Jesu Arockiaraj
Full Source: Environmental toxicology and pharmacology 2021 Nov 26;103779. doi: 10.1016/j.etap.2021.103779.

Widespread persistence of endocrine-disrupting chemicals (EDCs) in the environment has mandated the need to study their potential effects on an individual's long-term health after both acute and chronic exposure periods.

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ENVIRONMENTAL RESEARCH

Towards understanding the impact of plastics on freshwater and marine microalgae: A review of the mechanisms and toxicity endpoints

2022-02-05
Plastics are ubiquitous and persistent in aquatic environments, threatening environmental and human health. This review focused on the effects of plastics (single toxicity) and associated chemicals (combined or leachate toxicities) on freshwater and marine microalgae. Forty-seven publications from 2010 to 2020 were used in this review. Based on their topic of focus, we classified the publications among the following categories: single plastic toxicity, combined toxicity of plastics and other chemicals, and toxicity of leachates released from plastics. The test species Chlorophyta and Ochrophyta were generally used to assess the impacts of plastics on aquatic microalgae. This study identified the inhibition of algal growth and photosynthesis due to single toxicity through the physical adsorption of plastics, showing that leachates released from plastics contained non-specific chemicals which could potentially affect microalgae. Production of malondialdehyde or reactive oxygen species presented significant effects on algae independent of the experimental conditions. This review could improve our understanding of the effects of plastic pollution on microalgae in freshwater and marine environments. It has implications for further research in this field and associated water management in light of the global ubiquity of plastic pollution.
Authors: Sun-Hwa Nam, Jieun Lee, Youn-Joo An
Full Source: Journal of hazardous materials 2022 Feb 5;423(Pt B):127174. doi: 10.1016/j.jhazmat.2021.127174.

Plastics are ubiquitous and persistent in aquatic environments, threatening environmental and human health.

New insights into submarine tailing disposal for a reduced environmental footprint: Lessons learnt from Norwegian fjords

2021-11-27
Submarine tailing disposal (STD) in fjords from land-based mines is common practice in Norway and takes place in other regions worldwide. We synthesize the results of a multidisciplinary programme on environmental impacts of STDs in Norwegian fjords, providing new knowledge that can be applied to assess and mitigate impact of tailing disposal globally, both for submarine and deep-sea activities. Detailed geological seafloor mapping provided data on natural sedimentation to

monitor depositional processes on the seafloor. Modelling and analytical techniques were used to assess the behaviour of tailing particles and process-chemicals in the environment, providing novel tools for monitoring. Toxicity tests showed biological impacts on test species due to particulate and chemical exposure. Hypersedimentation mesocosm and field experiments showed a varying response on the benthos, allowing to determine the transition zone in the STD impact area. Recolonisation studies indicate that full community recovery and normalisation of metal leakage rates may take several decades due to bioturbation and slow burial of sulfidic tailings. The results are synthesised to provide guidelines for the development of best available techniques for STDs.

Authors: Eva Ramirez-Llodra, Hilde Cecilie Trannum, Guri S Andersen, Nicole J Baeten, Steven J Brooks, Carlos Escudero-Oñate, Hege Gundersen, Rolf Arne Kleiv, Olga Ibragimova, Aivo Lepland, Raymond Nepstad, Roar Sandøy, Morten Thorne Schaanning, Tracy Shimmield, Evgeniy Yakushev, Laura Ferrando-Climent, Per Helge Høgaas

Full Source: Marine pollution bulletin 2021 Nov 27;174:113150. doi: 10.1016/j.marpolbul.2021.113150.

Mass Spectrometry in Wastewater-Based Epidemiology for the Determination of Small and Large Molecules as Biomarkers of Exposure: Toward a Global View of Environment and Human Health under the COVID-19 Outbreak

2021-11-08

Wastewater-based epidemiology (WBE) estimates collective consumption or exposure to chemicals or pathogens by monitoring the substances excreted in the population's wastewater. Advances in mass spectrometry (MS) and the application of some clinical diagnostic tools and proteomics to wastewater fingerprinting have been linked to the discovery of new biomarkers and indicators of population health and are broadening the scope of WBE that nowadays cover not only small molecule biomarkers but also genetic biomarkers, large molecules, viruses, infection diseases, resistance, etc. This mini-review highlights recent WBE advances using MS and how this progress can create a fingerprint of a city's health hazards, habits, and lifestyle, which is gaining in public health emphasis.

Authors: Yolanda Picó, Damià Barceló

Full Source: ACS omega 2021 Nov 8;6(46):30865-30872. doi: 10.1021/acsomega.1c04362.

Wastewater-based epidemiology (WBE) estimates collective consumption or exposure to chemicals or pathogens by monitoring the substances excreted in the population's wastewater.

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OCCUPATIONAL

Association of occupational exposure to pesticides with overweight and abdominal obesity in family farmers in southern Brazil

2021-11-30

The association of chronic exposure to pesticides with overweight and abdominal obesity in adult farmers was investigated. This cross-sectional study included a random sample of 122 farmers and their family members of both sexes (61% were male), living in the municipality of Farroupilha, southern Brazil. Pesticide groups and their individual compounds were self-reported and classified according to major functional and chemical classes (never used, 1-20 years, or > 20 years of use). Abdominal obesity and overweight were the outcomes of interest. A multivariate Poisson regression model was analyzed. After confounding factors were controlled, chronic use (>20 years) of insecticides (PR: 1.45; 95% CI: 1.00-2.10) and organophosphorus pesticides (PR: 1.48, 95% CI: 1.02-2.12) was associated with a higher prevalence of overweight but not abdominal obesity. Additional studies are needed to confirm our findings and clarify the specific mechanisms of these pollutants in the etiology of obesity.

Authors: Roberta Andressa Line Araújo, Cleber Cremonese, Ramison Santos, Camila Piccoli, Gabriela Carvalho, Carmen Freire, Raquel Canuto

Full Source: International journal of environmental health research 2021 Nov 30;1-12. doi: 10.1080/09603123.2021.1991284.

The association of chronic exposure to pesticides with overweight and abdominal obesity in adult farmers was investigated.

National and subnational burden of disease attributable to occupational exposure to solar ultraviolet radiation (SUVR) in Iran, 2005-2019

2021-11-30

Overexposure to solar ultraviolet radiation (SUVR) can cause skin and eye adverse effects for outdoor workers. In this study, the burden of disease induced by occupational exposure to SUVR and its spatiotemporal trend at national and sub-national levels in Iran, 2005-2019 were assessed. The attributable burden of disease was assessed using the following five datasets: (1) distribution of occupational exposure to SUVR, (2) total incidences and deaths of health outcomes of SUVR exposure, (3) population attributable fractions of the health outcomes of SUVR exposure, (4) age-gender distribution of outdoor workers, and (5) disability-adjusted life year (DALY) calculation constants. During 2005-2019, the attributable DALYs increased from 2442 to 2907 and the

attributable DALY rate (per 100,000 workers) slightly decreased from 11.94 to 11.91. The share of YLL in the attributable burden of disease was in the range of 43%-46%. Out of nine causes, about 90% of the attributable burden of disease in 2019 was related to cataracts (29.9%), malignant skin melanoma (27.4%), squamous-cell carcinoma (18.6%), and sunburn (17.2%). During the study period, the attributable DALY rate in women increased by 60.95% (from 5.04 to 8.11) and in men decreased by 2.06% (from 13.03 to 12.76). The total attributable DALYs and DALY rate rose by age during 2005-2019. The contributions of population growth, risk-deleted DALY rates, exposure risk, and population age structure in temporal changes of the attributable burden of disease were 19.27%, 9.13%, -1.35%, and -14.8%, respectively. The three highest attributable DALY rates in 2019 were observed in South Khorasan (21.28), Chahar Mahal and Bakhtiari (17.42), and Kordestan (17.26), respectively. The preventive interventions against SUVR overexposure, regular screenings, and early treatments with an emphasis on occupations with continuous sun exposure and provinces with increasing attributable DALY rates should be considered in the occupational health action plan in the country.

Authors: Reza Saeedi, Hossein Miri, Mehrnoosh Abtahi, Sina Dobaradaran, Ali Koolivand, Sahand Jorfi, Azita Mohagheghian, Sama Amirkhani Ardeh

Full Source: International journal of hygiene and environmental health 2021 Nov 30;240:113897. doi: 10.1016/j.ijheh.2021.113897.

PHARAMACEUTICAL/TOXICOLOGY

Levels and risks of surface contamination by thirteen antineoplastic drugs in the Czech and Slovak hospitals and pharmacies

2021-12-02

The consumption of hazardous antineoplastic drugs (ADs) used in anticancer chemotherapies is steadily increasing representing thus risks to both human health and the environment. Hospitals may serve as a contamination source, and pharmacists preparing the antineoplastic drugs (ADs) as well as nurses administering chemotherapy and caring for oncology patients are among the healthcare professionals being highly exposed. Here, we present the results of systematic monitoring (2018-2020) of surface contamination by 13 ADs in the pharmacies and hospitals in the Czech Republic (CZ; large-scale monitoring, 20 workplaces) and Slovak Republic (SK; pilot study at 4 workplaces). The study evaluated contamination by three commonly monitored ADs, i.e., 5-fluorouracil (FU),

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cyclophosphamide (CP), and platinum (total Pt representing cis-, carbo-, and oxaliplatin) together with ten less explored ADs, i.e., gemcitabine (GEM), ifosfamide (IF), paclitaxel (PX), irinotecan (IRI), docetaxel (DOC), methotrexate (MET), etoposide (ETOP), capecitabine (CAP), imatinib (IMAT), and doxorubicin (DOX). Floors and desktop surfaces in hospitals (chemotherapy application rooms, nurse working areas) were found to be more contaminated, namely with CP and Pt, in both countries when compared to pharmacies. Comparison between the countries showed that hospital surfaces in SK are generally more contaminated (e.g., CP median was 20 times higher in SK), while some pharmacy areas in the CZ were more contamined in comparison with SK. The newly studied ADs were detected at lower concentrations in comparison to FU, CP, and Pt, but some markers (GEM, IF, PX, and IRI) were frequently observed, and adding these compounds to routine monitoring is recommended.

Authors: Lenka Doležalová, Lucie Bláhová, Jan Kuta, Tereza Hojdarová, Šárka Kozáková, Luděk Bláha

Full Source: Environmental science and pollution research international 2021 Dec 2. doi: 10.1007/s11356-021-17607-y.

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