

# Bulletin Board

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## CONTACT US

subscribers@chemwatch.net

tel +61 3 9572 4700

fax +61 3 9572 4777

1227 Glen Huntly Rd

Glen Huntly

Victoria 3163 Australia

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## Technical

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## CHEMICAL EFFECTS

## Nanobiotechnology-based strategies in alleviation of chemotherapy-mediated cardiotoxicity

2023-08-24

The cardiovascular diseases have been among the most common malignancies and the first leading cause of death, even higher than cancer. The cardiovascular diseases can be developed as a result of cardiac dysfunction and damages to heart tissue. Exposure to toxic agents and chemicals that induce cardiac dysfunction has been of interest in recent years. The chemotherapy drugs are commonly used for cancer therapy and in these patients, cardiovascular diseases have been widely observed that is due to negative impact of chemotherapy drugs on the heart. These drugs increase oxidative damage and inflammation, and mediate apoptosis and cardiac dysfunction. Hence, nanotechnological approaches have emerged as new strategies in attenuation of chemotherapy-mediated cardiotoxicity. The first advantage of nanoparticles can be explored in targeted and selective delivery of drugs to reduce their accumulation in heart tissue. Nanostructures can deliver bioactive and therapeutic compounds in reducing cardiotoxicity and alleviation toxic impacts of chemotherapy drugs. The functionalization of nanostructures increases their selectivity against tumor cells and reduces accumulation of drugs in heart tissue. The bioplatfoms such as chitosan and alginate nanostructures can also deliver chemotherapy drugs and reduce their cardiotoxicity. The function of nanostructures is versatile in reduction of cardiotoxicity by chemotherapy drugs and new kind of platforms is hydrogels that can mediate sustained release of drug to reduce its toxic impacts on heart tissue. The various kinds of nanoplatfoms have been developed for alleviation of cardiotoxicity and their future clinical application depends on their biocompatibility. High concentration level of chitosan nanoparticles can stimulate cardiotoxicity. Therefore, if nanotechnology is going to be deployed for drug delivery and reducing cardiotoxicity, the first pre-requirement is to lack toxicity on normal cells and have high biocompatibility.

Authors: Xuanming Luo

Full Source: Environmental research 2023 Aug 24;116989. doi: 10.1016/j.envres.2023.116989.

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## Weathering alters the profile of trace metals and organic compounds in leachates and bioavailability extracts from microplastics of trail running shoes

2023-08-24

Microplastics (MPs) from rubber outsoles of trail running shoes may contribute significantly to contamination in protected areas. In the natural environment, weathering processes can damage MP molecular structure and alter the mobility of inorganic and organic compounds used as additives in rubber. In this study, we characterised changes in the surface morphology, functional groups, and thermal stability of MPs weathered on and below the soil surface over 12 weeks and analysed inorganic and organic additives in leachates (0.01M CaCl<sub>2</sub>) and bioaccessibility extracts (ethyl acetate). Weathering conditions included UVC irradiation at 25 °C and 80% soil moisture. Microplastics on the soil surface exhibited cracking, fragmentation, and increased extractability of zinc, sulphur, titanium and fatty acids. Microplastics below the soil surface were not significantly physically or chemically altered, however zinc leachability increased following extended weathering by up to 155%. Bioaccessibility of thiol, aromatic and cyclic organic additives decreased from both surface and sub-surface MPs over the 12 week weathering period, but there was evidence of an increase in transformation by-products. Microplastic toxicity may be significantly altered by environmental conditions and MP weathering. It is critical ecotoxicological studies use weathered MPs to assess impacts on rare and endemic species found in protected spaces.

Authors: Nicola A Forster, Susan C Wilson, Matthew K Tighe

Full Source: Environmental pollution (Barking, Essex: 1987) 2023 Aug 24;122431. doi: 10.1016/j.envpol.2023.122431.

Microplastics (MPs) from rubber outsoles of trail running shoes may contribute significantly to contamination in protected areas.

## Toxicity of tire particle leachates on early life stages of keystone sea urchin species

2023-08-24

Particles from tires are a major fraction of microplastic pollution. They contain a wide range of chemical additives that can leach into the water and be harmful to aquatic organisms. In this study, we investigated the acute toxicity of tire particle leachates in early life stages of three keystone echinoderm species (*Paracentrotus lividus*, *Arbacia lixula*, *Diadema africanum*). Embryos were exposed for 72 h to a range of leachate dilutions, prepared using a concentration of 1 g L<sup>-1</sup>. Larval growth, abnormal development, and mortality were the measured endpoints. Furthermore, we estimated the activity of glutathione S transferase (GST)

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and the electron transport chain (ETS) in *P. lividus*. Strong concentration-dependent responses were observed in all species, though with differing sensitivity. The median effect concentrations for abnormal development in *P. lividus* and *A. lixula* were 0.16 and 0.35 g L<sup>-1</sup>, respectively. In *D. africanum*, mortality overshadowed abnormal development and the median lethal concentration was 0.46 g L<sup>-1</sup>. Larvae of *P. lividus* were significantly smaller than the control from 0.125 g L<sup>-1</sup>, while the other two species were affected from 0.5 g L<sup>-1</sup>. ETS activity did not change but there was a non-significant trend of increasing GST activity with leachate concentration in *P. lividus*. Seven organic chemicals and eight metals were detected at elevated concentrations in the leachates. While we regard zinc as a strong candidate to explain some of the observed toxicity, it can be expected that tire particle leachates exhibit a cocktail effect and other leached additives may also contribute to their toxicity. Our results emphasize the importance of multi-species studies as they differ in their susceptibility to tire particle pollution. We found negative effects at concentrations close to projections in the environment, which calls for more research and mitigation actions on these pollutants.

Authors: Sinja Rist, Jessy Le Du-Carrée, Kevin Ugwu, Chiara Intermite, Andrea Acosta-Dacal, Octavio Pérez-Luzardo, Manuel Zumbado, May Gómez, Rodrigo Almeda

Full Source: Environmental pollution (Barking, Essex : 1987) 2023 Aug 24;122453. doi: 10.1016/j.envpol.2023.122453.

## ENVIRONMENTAL RESEARCH

### Global perspective on microplastics in landfill leachate; Occurrence, abundance, characteristics, and environmental impact

2023-08-25

Plastic wastes deposited in landfills eventually break down and degrade into microplastics by physical, chemical, and biological forces. Though microplastics in leachate pose significant threats to the environment, the leachate generated from landfills has not received much attention as a possible source of environmental microplastics. A descriptive and systematic investigation of the global distribution of microplastics in landfill leachate does not exist to date. Therefore, this attempt is to provide a concise scientometric review of the studies on the presence of microplastics in landfill leachate. The present review revealed that the global trend in research on microplastics in leachate has increased

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exponentially after 2018 and China is the leading country. Different geographical regions have reported different microplastic abundances with the highest of 291.0 ± 91.0 items/L from a landfill in Shanghai. The use of novel sampling techniques to detect small microplastics (20-100 µm) has led to the high abundance of microplastics in landfill leachate in Shanghai. Due to its widespread usage, polyethylene is the most typically encountered polymer type in landfill leachate around the world. However, it is quite challenging to compare the results among studies due to the use of different size categories and extraction techniques. The removal of microplastics by the current leachate treatment facilities is still mostly unexplored, thus it is crucial to develop novel technologies to treat the microplastics in landfill leachate. Further investigations on the transport of microplastics in landfill leachate are urgently required to have a better understanding of potential human exposure and health implications.

Authors: Gayathri Chamane, Madushika Sewwandi, Hasintha Wijesekara, Meththika Vithanage

Full Source: Waste management (New York, N.Y.) 2023 Aug 25;171:10-25. doi: 10.1016/j.wasman.2023.08.011.

### Investigation on microfiber release from elastane blended fabrics and its environmental significance

2023-08-24

Elastane blended apparel is one of the most preferred items by consumers with fashion interest due to its enhanced comfort and fit. The environmental impact and microfiber release due to elastane usage is often ignored due to its lower percentage in apparel. To address such a gap, this study aimed to quantify and characterize the microfiber release behavior of cotton/elastane knitted fabric. Cotton/elastane blended knitted fabrics with three different proportions of cotton/elastane (98/2, 95/5, and 92/8) were considered for this analysis. Upon laundry and quantification, the results of the study showed that 98/2 Cotton/Elastane fabric released 21.04 ± 12.46 microfibers/sq.cm, whereas, 92/8 Cotton/Elastane fabric showed 46.56 ± 6.21 microfibers/sq.cm. An increase in elastane proportion increased the overall emission of microfibers per unit area of fabric. The results also showed a higher contribution of elastane fibers in the total microfibers released. 13.40% of the total fibers released were elastane microfibers in the case of 98/2 Cotton/Elastane fabric, whereas, 92/8 Cotton/Elastane fabric released 19.60%. The elastane percentage of the fabric showed a significant positive correlation with total microfiber emission (r = 63%) and elastane microfiber emission (r = 62%). Repeated laundering results showed an overall reduction in

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microfiber emissions in subsequent washes. However, interestingly, an increase in the wash cycle increased the proportion of elastane microfibers in the total microfibers released. 92/8 Cotton/Elastane fabric released 20% of elastane microfibers in the first wash and the proportion increased to 36% in the 4th wash. In contrast to that, the release of cotton microfibers is noted to decrease with the number of laundry cycles. As far as the length of microfiber is considered, elastane microfibers are shorter than cotton microfibers. The length of elastane microfibers was higher in the initial wash (98/2 Cotton/Elastane fabric - 352.5  $\mu\text{m}$ ; 95/5 Cotton/Elastane fabric - 920  $\mu\text{m}$ ; 92/8 Cotton/Elastane fabric - 695  $\mu\text{m}$ ) and it is reduced with increment in the number of washes with a strong negative correlation of -0.88. A higher proportion of emissions and lower fiber length are the alarming negative impacts of elastane fibers in apparel. Based on this analysis, it is estimated that one square meter of fabric with a lower elastane percentage (2%) can release up to  $2.81 \times 10^4$  microfibers into the environment at the first wash. The threatening issues of microfibers on aquatic life, particularly in terms of bioaccumulation and biomagnification, are alarming. Elastane blended fabrics should be given special attention because they can make the problem more serious by posing a risk of chemical leachates, such as bisphenols.

Authors: R Rathinamoorthy, S Raja Balasaraswathi, S Madhubashini, A Prakalya, J B Rakshana, S Shathvika

Full Source: The Science of the total environment 2023 Aug 24;166553. doi: 10.1016/j.scitotenv.2023.166553.

## PHARMACEUTICAL/TOXICOLOGY

### Zoledronic Acid Prevents Bone Resorption Caused by the Combination of Radium-223, Abiraterone Acetate, and Prednisone in an Intratibial Prostate Cancer Mouse Model

2023-08-15

An increased risk of non-pathological fractures in patients with prostate cancer and bone metastases has been associated with combination treatment with radium-223, abiraterone, and prednisone/prednisolone in the absence of bone-protecting agents. Here, we investigated possible mechanisms leading to this outcome using an intratibial LNCaP model mimicking prostate cancer bone metastases. Male NOD.scid mice were inoculated intratibially with LNCaP prostate cancer cells and treated with vehicle, radium-223, abiraterone, prednisone, zoledronic acid, or their combinations for 28 days. Serum TRACP 5b and PSA levels were

An increased risk of non-pathological fractures in patients with prostate cancer and bone metastases has been associated with combination treatment with radium-223, abiraterone, and prednisone/prednisolone in the absence of bone-protecting agents.

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measured. Bone structure, quality, and formation rate of non-tumor-bearing and tumor-bearing tibiae were analyzed by microCT, 3-point bending assay, and dynamic histomorphometry, respectively. Radium-223 incorporation into bone was also measured. Radium-223/abiraterone/prednisone combination treatment induced a transient increase in bone resorption indicated by elevated TRACP 5b levels, which was inhibited by concurrent treatment with zoledronic acid. Furthermore, radium-223/abiraterone/prednisone combination reduced periosteal and trabecular new bone formation and the number of osteoblasts, but bone structure or biomechanical quality were not affected. The abiraterone/prednisone treatment decreased radium-223 incorporation into tumor-bearing bone, possibly explaining the lack of additional antitumor efficacy. In conclusion, radium-223/abiraterone/prednisone combination increased bone resorption, which may have been one of the mechanisms leading to an increased fracture risk in patients with mCRPC.

Authors: Mari I Suominen, Matias Knuutila, Birgitta Sjöholm, Timothy Wilson, Esa Alhoniemi, Dominik Mumberg, Sanna-Maria Käkönen, Arne Scholz

Full Source: Cancers 2023 Aug 15;15(16):4115. doi: 10.3390/cancers15164115.

### Development of Nanotechnology-Based Drug Delivery Systems for Controlling Clinical Multidrug-Resistant Staphylococcus aureus and Escherichia coli Associated with Aerobic Vaginitis

2023-08-14

The growing prevalence of resistance to antibiotics potentially makes Escherichia coli and Staphylococcus aureus serious pathogens, necessitating the development of new antimicrobial agents. We extracted crude biosurfactants from a potential probiotic Bacillus spp. to control pathogenic bacteria associated with aerobic vaginal infection. Using nanotechnology formulations, we developed nanoemulsions based on biosurfactants at different concentrations (1% and 3.33%). The results showed that these nanoemulsions were stable, with a weighted index of 0.3, and demonstrated broad-spectrum antibacterial activity against Escherichia coli and Staphylococcus aureus, with MICs ranging between 1.25 and 4 mg/mL. Additionally, the nanoemulsions exhibited interesting antibiofilm effects. All strains became more sensitive to the antibiotics to which they were resistant because of various biosurfactant formulations combined with antibiotics. Lower concentrations of BNE1% and 3.33% were still more efficient than the crude biosurfactants. Our findings

The growing prevalence of resistance to antibiotics potentially makes Escherichia coli and Staphylococcus aureus serious pathogens, necessitating the development of new antimicrobial agents.

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demonstrated that the biosurfactant had a strong antibiofilm effect against all tested pathogens. This antibacterial effect can be explained by their ability to alter cell physiology such as cell hydrophobicity and membrane disintegration. Thus, we can conclude that the use of nanotechnology formulations has improved this effect, and the nanoemulsions developed in this study can be used as a potential anti-infectious therapy against multidrug-resistant bacterial strains of clinical origin.

Authors: Najla Haddaji, Badr Bahloul, Wael Bahia, Olfa Bechambi, Abdelkarim Mahdhi

Full Source: *Pharmaceutics* 2023 Aug 14;15(8):2133. doi: 10.3390/pharmaceutics15082133.

## OCCUPATIONAL

### Bacterial Contamination of Mobile Phones Used by Healthcare Workers in Critical Care Units: A Cross-Sectional Study from Saudi Arabia

2023-08-02

**Background:** Healthcare-associated infections (HAIs) present a formidable challenge for healthcare institutions, resulting in heightened mortality, morbidity, and economic burden. Within healthcare settings, various equipment and materials, including mobile phones, can potentially act as sources of infection. This study sought to examine the occurrence of bacterial contamination on mobile phones utilized by healthcare workers (HCWs) in intensive care units (ICUs), pediatric intensive care units (PICUs), neonatal intensive care units (NICUs), and cardiac care units (CCUs) within a central hospital (CH) and two peripheral hospitals (PHs) situated in the southwestern province of Saudi Arabia.

**Materials and methods:** We collected a total of 157 samples from mobile phones utilized by HCWs across all ICUs in the CH and PHs. These samples underwent bacteriological analysis to evaluate the degree of bacterial contamination.

**Results:** We found that 45 out of 55 samples from physicians (81.81%) and 58 out of 77 samples from nurses (75.32%) showed bacterial contamination. Contamination rates on HCWs' mobile phones in the ICU, PICU, and NICU departments of the CH were observed at 69.56%, 80.95%, and 70.27%, respectively. Furthermore, the overall contamination rates in the ICUs, NICUs, and CCUs of the PHs were 78.26%, 88.88%, and 66.66%,

**Background:** Healthcare-associated infections (HAIs) present a formidable challenge for healthcare institutions, resulting in heightened mortality, morbidity, and economic burden.

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respectively. The overall contamination rates of mobile phones in the CH and PHs were 72.11% and 81.13%, respectively.

**Conclusion:** These findings underscore the necessity of routinely disinfecting the mobile phones of HCWs to mitigate the risk of cross-contamination. Implementing robust disinfection protocols can significantly contribute to curtailing the propagation of bacterial pathogens and reducing the incidence of HAIs in healthcare settings.

Authors: Nabil Dhayhi, Nader Kameli, Mohammed Salawi, Amjad Shajri, Vinod Kumar Basode, Abdullah Algaissi, Edrous Alamer, Majid Darraj, Khalid Shrwani, Abdulaziz H Alhazmi

Full Source: *Microorganisms* 2023 Aug 2;11(8):1986. doi: 10.3390/microorganisms11081986.

### Occupational Health Applied Infodemiological Studies of Nutritional Diseases and Disorders: Scoping Review with Meta-Analysis

2023-08-14

**(1) Objective:** to identify and review existing infodemiological studies on nutritional disorders applied to occupational health and to analyse the effect of the intervention on body mass index (BMI) or alternatively body weight (BW);

**(2) Methods:** This study involved a critical analysis of articles retrieved from MEDLINE (via PubMed), Embase, Cochrane Library, PsycINFO, Scopus, Web of Science, Latin American, and Caribbean Health Sciences Literature (LILACS) and Medicina en Español (MEDES) using the descriptors "Nutrition Disorders," "Occupational Health" and "Infodemiology", applying the filters "Humans" and "Adult: 19+ years". The search was conducted on 29 May 2021;

**(3) Results:** a total of 357 references were identified from the bibliographic database searches; after applying the inclusion and exclusion criteria, a total of 11 valid studies were obtained for the review. Interventions could be categorised into (1) interventions related to lifestyle, physical activity, and dietary changes through education programmes, (2) interventions associated with lifestyle, physical activity, and dietary changes through the use of telemonitoring systems or self-help applications, (3) interventions tied to lifestyle, physical activity, and dietary changes through control and/or social network support groups, and (4) interventions linked to changes in the work environment, including behavioural change training and work environment training tasks. The meta-analysis demonstrated that the heterogeneity present when analysing the results for BMI was 72% ( $p < 0.01$ ), which decreased to 0% ( $p = 0.57$ ) when analysing the outcomes

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for weight, in which case the null hypothesis of homogeneity could be accepted. In all instances, the final summary of the effect was on the decreasing side for both BMI and BW;

(4) Conclusions: Despite the high heterogeneity of the results reported, the trend shown in all cases indicates that the intervention methodologies implemented by empowering individuals through Web 2.0 technologies are positive in terms of the problem of overweight. Further implementation of novel strategies to support individuals is needed to overcome obesity, and, at least in the early studies, these strategies seem to be making the necessary change.

Authors: Ruben Palomo-Llinares, Julia Sánchez-Tormo, Carmina Wandenberghe, Javier Sanz-Valero

Full Source: *Nutrients* 2023 Aug 14;15(16):3575. doi: 10.3390/nu15163575.

### Occupational exposure to inhalable pathogenic microorganisms in waste sorting

2023-08-24

This study assessed microorganisms in personal inhalable work air samples aiming to identify potential human pathogens, and correlate exposure to adverse health outcomes in waste workers. Full-shift personal exposure was measured in six different waste sorting plants. Microbial concentrations in inhalable air samples were analysed using MALDI-TOF MS for cultivable, and next generation sequencing (NGS) for non-cultivable microorganisms. Concentrations of bacterial and fungal CFUs varied substantially within and between waste sorting plants, ranging from no identifiable organisms to a maximum concentration in the order of 10<sup>5</sup> CFU/m<sup>3</sup>. *Bacillus* and *Staphylococcus* were among the most abundant bacterial genera, whilst fungal genera were dominated by *Aspergillus* and *Penicillium*. Approximately 15% of all identified species were human pathogens classified in risk group 2, whereas 7% belonged to risk group 1. Furthermore, significant correlations between concentrations of fungi in risk group 1 and self-reported adverse symptoms, such as wheezing were identified in exposed workers. The combination of culture-based methods and NGS facilitated the investigation of infectious microbial species with potential pathophysiological properties as well as non-infectious biological agents in inhalable work air samples and thereby

This study assessed microorganisms in personal inhalable work air samples aiming to identify potential human pathogens, and correlate exposure to adverse health outcomes in waste workers.

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contributed to the risk assessment of occupational exposure in waste sorting.

Authors: Elke Eriksen, Anne Mette Madsen, Anani Komlavi Afanou, Anne Straumfors, Alexander Eiler, Pål Graff

Full Source: *International journal of hygiene and environmental health* 2023 Aug 24;253:114240. doi: 10.1016/j.ijheh.2023.114240.