

in these environmental matrices. Further, a probabilistic environmental hazard assessment (PEHA) was performed with the maximum reported MEC in order to identify the probabilities of exceeding a predicted no-effect concentration (PNEC) of $1.0 \mu\text{g}\cdot\text{L}^{-1}$ for promoting AMR in water/liquid samples from different geographic regions. More information was available (312 publications) for water analysis than solid samples (97 publications). Across environmental compartments we examined, ERY has mainly been detected in Asian, North American and European continents with the majority of studies performed in China, USA, Spain and the United Kingdom. For surface water, 72.4% of the Asian studies have been performed in China, while 85.4% of the observations from North America were from the USA, and Spain represented 41.9% of the European surface water studies. Results from the PEHA indicated that the likelihood of exceeding the ERY PNEC for AMR was higher in Asia (33.3%) than in Europe (20%) or North America (17.8%) WWTP effluents for example. We further identified a higher likelihood of encountering ERY in estuarine and marine sediments compared to samples from freshwater systems. Unfortunately, ERY occurrence data is comparatively limited in these coastal and marine systems, as well as in large geographic regions including Southwest Asia, Eastern Europe, Africa, and Central and South America. Future studies are needed to understand risks of ERY and other antibiotics to human health and the environment in rapidly developing regions where waste management systems and infrastructure is being implemented slower than access to pharmaceuticals is occurring. \n

Contaminants of emerging concern (CECs) in the environment: current knowledge and future challenges

78 ARE TATTOO INKS SAFE? - IN VITRO AND IN VIVO TOXICOLOGICAL EVALUATION

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In the last decade, the number of people who have adhered to global trend of tattooing the body has increased significantly. This has increased the production and development of technologies applied to tattoo inks. However, regulatory agency requirements for these inks are poorly enforced and some components can be harmful to both humans and the environment. In this sense, tattoo inks were studied to identify the composition and its toxicological effects. In the description of the composition of the indicated inks, it contains water, additives and pigments. The pigments are represented by organic dyes and nanostructures. In this work four commercial inks were selected: blue, green red and black. To determine the composition and size of the particles contained in the inks, analyzes of XRD, SEM-EDS, FTIR, PZ, DH and TEM were performed. To evaluate the toxicity of the inks, *in vitro* and *in vivo* tests, different parameters and trophic levels organisms were analyzed, such as: the growth of plants *Lactuca sativa*, immobility and mortality of *Daphnia magna* crustacean and cell viability of HaCat cells (immortalized human keratinocytes). The characterization results indicated that tattoo inks have nanoscale diameters, and confirmed the presence of functional groups of the vehicles contained in ink as well as the presence of some metals. The toxicological results of the exposure of *Lactuca sativa* seeds to the inks led to growth inhibition (5 and 10%) and also morphological changes. Acute tests, performed according to ISO 12713 standard, with *Daphnia magna* showed that the color with lower toxicity is black, followed EC50 is red, followed by green, blue and red respectively. In HaCat cells the loss of mitochondrial viability was confirmed more significantly than lysosomal viability, which was only inhibited at the highest concentration tested. The MTT assay also showed that the red ink has a higher toxicity and in general for all inks increases viability in 12 hours, decreasing significantly in the other times tested. This study provides an overview of the composition and toxicological effects of tattoo inks in epidermis and in the environment after the disposal, since the nanomaterials contained in the inks can become an environmental problem.

80 REDUCED GRAPHENE OXIDE (RGO) INDUCES DNA DAMAGE IN MELANOMA CULTURE CELLS (B16F10)

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Reduced graphene oxide (RGO) is a nanomaterial of generation after carbon nanotubes. The appearance of the RGO is similar to that of a sheet with nanometric dimensions, about 350 nanometers long and 5 nanometers thick. Besides their electrical and physical properties, graphene materials have applications in the biomedical sector for therapy, diagnosis and drug delivery, and no other material has comparable properties. Although some progress has been made in diagnosis and drug delivery, the therapeutic applications of graphene remain in their early stages. Caring for the biologic and nonbiological applications of graphene is owed to the potential toxicity of reduced graphene oxide. Hence, there is an urgent need to identify environmentally friendly and simple approaches to prepare biocompatible graphene materials for biomedical applications. We aimed to evaluate the possible genotoxic effects of exposure to the RGO. Melanoma culture cells, B16F10 were exposed to 10, 20 and 40ng/mL of RGO for 24, 48 e 72 hours. The alkaline comet assay was carried according to Singh (1988) with adaptations. It was observed chromosomal damage at all of the concentrations used and there was not difference between them. However, the DNA injury was proportional to the time of exposure to the RGO. The data suggest that caution should be exercised regarding the biomedical applications of RGO.

81 Titanium dioxide in neotropical mangrove: transfer through food web and subcellular internalization in top trophic chain fish

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Among the varieties of nanoparticles (NP) produced, metal oxides have been increasingly applied due to their photocatalytic nature, particularly, the titanium dioxide NP (TiO_2 -NP). Considering the presence of TiO_2 -NP in the environment due to industrial and sewage releasing, especially in aquatic ecosystems, *in-situ* studies are required to evaluate the behaviour of these NP in the environmental compartments and biota. Therefore, the purpose of this study was to quantify if Ti is present in abiotic samples (surface water, sediment, atmospheric particulate matter) and in six trophic levels (plankton, plants, oyster, crab, shrimp, fish) of neotropical estuarine mangrove ecosystems and evaluate its potential for biomagnification or biodilution in the food web. Moreover, the nanocrystallographic structure of Ti in abiotic matrices and in fish organ/tissues was analysed to identify the TiO_2 -NP oxidation state. Ti was identified and quantified in almost all matrix analysed, excepting for surface water in all sites. Linear regression showed biodilution through trophic chain based in plankton as primary producer and biomagnification when plants are the primary producers. Nanocrystallographic analyses showed that TiO_2 -NP in atmospheric particulate matter samples were similar to those found in each fish organ, the top trophic chain organism, independent of their localization: inside cytoplasm and in the cell nucleus suggesting that atmospheric particulate matter may be the source of TiO_2 -NP in these mangrove ecosystems.

82 Toxicity studies applied to evaluate the modified zeolites adsorbent for treating copper-complex dyes from simulated dyehouse wastewater

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Textile dyes occur in wastewaters in different concentrations due to their poor fixation to fabrics. Even at low concentrations, textile dyes can cause waste streams to become highly colored. Aside from their negative aesthetic effects, certain textile dyes have been shown to be toxic, and in some cases, these compounds are carcinogenic and mutagenic. Zeolite synthesized from fly and bottom ashes and modified with hexadecyltrimethylammonium (ZMF and ZMB, respectively) were used as adsorbent to remove dyes - Solophenyl Navy and Solophenyl Turquoise and their hydrolyzed forms Solophenyl Navy Hydrolyzed and Solophenyl Turquoise Hydrolyzed, respectively, from simulated textile wastewater. The purpose of the research was to use bioassays with *Lemna minor*, *Ceriodaphnia dubia* and *Chironomus tepperi* to determine the acute and chronic toxicity of these dyes before and after adsorption process. The acute results indicated *C. tepperi* showed to be less sensitive when compared with other test organisms, showing values of 48hLC_{50} 70.8 and $211 \text{mg}\cdot\text{L}^{-1}$ for SN and ST. On the other hand, *C. dubia* showed to be very sensitive to the dyes tested (48hLC_{50} 1.25;

54.5; 0.78 and 2.56 mgL⁻¹ for SN, ST, SNH and STH), while *L. minor* presented response for higher concentration of the dyes, as chlorosis, loss of roots, reduction of the size and etc., showing values of EC₅₀ of 18.9; 69.4; 10.9 and 70.9 mgL⁻¹ for SN, ST, SNH and STH). Chronic tests with *C. tepperi* showed changes in survival, growth, development and gender differences for SN and ST dyes. After adsorption treatment with ZMF the acute effects were substantially reduced for both dyes and their hydrolyzed forms, showing absence of toxicity after treatment. However, the treatment with ZMB showed no difference and/or increased toxicity in some cases. Toxicity Identification Evaluation testes were realized and showed the baseline acute effects were substantially reduced after treatment with Ethylenediaminetetraacetic acid, showing the most of the toxicants in this study are cations metals. These experimental results suggest both dyes, raw and hydrolyzed, are toxic and their removal are necessary.

83 Non-invasive human biomonitoring techniques for per- and polyfluoroalkyl substances

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Non-invasive biomonitoring techniques present many ethical and practical benefits for investigating human exposure to hazardous contaminants, but are inherently difficult to validate for chemicals which are ubiquitous in the indoor environment. For per- and polyfluoroalkyl substances (PFASs) there only a limited number of studies using non-invasive human samples typically including a small number of PFASs. Here we investigated the validity and potential applications of using hair, nail and urine samples for characterizing internal exposure to range perfluoroalkane sulfonic acids, perfluoroalkyl carboxylic acids and chlorinated polyfluoroalkyl sulfonic acids (Cl-PFESAs). Human samples were obtained from two different populations: i) highly exposed fishery employees from Tangxun Lake, Hubei province (n=8) and ii) a background exposed population from Shijiazhuang, Hebei province (n=41). Passive uptake experiments for hair and nails were performed using both spiked standard solutions and naturally contaminated house dust and air. Nail and serum samples from the highly exposed fishery employees showed that perfluorohexane sulfonic acid, perfluorooctane sulfonic acid (PFOS), the eight carbon chlorinated polyfluoroalkylether sulfonic acid (C8 Cl-PFESA) and perfluoroundecanoic acid were transferred from serum to nails in a dose dependent manner ($p > 0.65$; $p < 0.05$). Measurements of PFOS and C8 Cl-PFESA in hair and nail samples in a background exposed population displayed a plausible link to internal exposure by evaluation of statistical correlations and transfer ratios in urine compared to the highly exposed population. In contrast, the occasional detection of short-chain PFASs in the background population was more likely a consequence of uptake from the external environment. Passive uptake experiments confirmed that all studied PFASs can be absorbed in hair and nail matrices from standard solutions with low efficiency. No significant uptake of PFASs in hair was observed over 56 days of contact with naturally contaminated indoor dust and air. In conclusion, the current study supports the use of nail and urine for long-chain PFASs as a measure of internal exposure. However, further studies are needed to better understand homologue specific transfer rates and the potential for passive uptake under realistic conditions. For short-chain PFASs, urine is the preferred sampling matrix with respect to both detection capability and reliable interpretation of internal exposure.

84 Occurrence of flame retardants in soil, dust, well water and leachate from a Brazilian landfill site

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DBDPE and BTBPE were the most abundant brominated compounds in soil, and the highest levels were observed in the samples collected next to a storage place of electronic waste. Concerning dust samples, FRs were detected at levels ranging from 8.7 ng g⁻¹ to 28800 ng g⁻¹. The highest levels of brominated FRs were observed in dust samples collected in the place where electronic waste is stored and in the local where the recycling cooperative operates. The highest levels of OPFRs in dust were observed in an office located in the landfill area. The occurrence of OPFRs in water from monitoring wells and leachate was studied. TCEP, TCIPP and TDCIPP were detected in the well water sample collected downstream the area of storage of mattresses and upholstered furniture, which indicated that the inadequate disposal of polyurethane foam residues on soil can generate groundwater pollution by OPFRs. Finally, TCEP, TCIPP, TDCIPP, TNBP, TIBP and TBOEP were detected in leachate, which demonstrated that these compounds are still released even after five years of the end of the landfill operation. In conclusion, this case study demonstrates that an inappropriate management of waste material containing flame retardants in landfill sites can result in uncontrolled emission of these contaminants to environmental matrices.

85 Toxicity of commercial aqueous film foam formers (AFFF) to marine organisms

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86 Hormones and environmental estrogens in conventional sewage treatment plants and receiving waters in Minas Gerais, Brazil

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Increasing concern combined with lack of data on the role of Brazilian domestic sewage treatment plants (STPs) as sources of microcontaminants in aquatic ecosystems motivated this investigation into the presence of estrogenic activity and endocrine disrupting compounds (EDCs) in conventional municipal sewage treatment plants (STPs) in Brazil. Composite samples of raw and treated sewage and grab samples of receiving waters and sediments upstream and downstream of STP discharges were collected at three plants operating with different, commonly used, biological treatment processes over the course of eighteen months. Estrogenicity (YES assay) and the presence (qualitative GC/MS) of seven estrogenic compounds commonly found in domestic sewage: estrone (E1), 17β-estradiol (E2), estriol (E3), 17α-ethynlestradiol (EE2), bisphenol-A (BPA), 4-nonylphenol (4-NP) and 4-octylphenol (4-OP) were analyzed. The activated sludge system (STP1) presented the