

WP039. Effects of Diclofenac to the mussel *Perna perna* (Linnaeus, 1758): a preliminary environmental risk assessment in Santos bay (Brazil)

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The continued increase of the human population demands a huge use of chemicals for a wide range of purposes, including human and veterinary pharmaceuticals. These substances may be considered as emerging contaminants, which are bioactive even at low concentrations ($\mu\text{g.L}^{-1}$ a ng.L^{-1}). Diclofenac is as an important anti-inflammatory used worldwide and may affect non-target organisms such as crustaceans, fish and filter mollusks. Diclofenac residues have been detected in surface waters, sewage treatment plants, rivers and estuaries, but studies about environmental risk and biologic effects of this drug in marine ecosystems are scarce, especially in tropical zones. Thereby, this study employed a tiered approach to evaluate Diclofenac effects on the reproduction of the brown mussel *Perna perna*, as well as damages on the lysosomal membrane stability. In the TIER 0, water samples (surface and bottom) were collected at 5 sites located around the diffusers of the Santos bay sewage submarine outfall for Diclofenac quantification. The TIER I consisted of the use of acute toxicity assays (fertilization test with *P. perna* gametes) considering 1 hour exposure to different Diclofenac concentrations. In the TIER II, chronic effects were evaluated through embryonic development assay and Neutral Red Retention Time (NRRT) assay. The Risk Quotient (RQ) was calculated as the ratio between MEC (Measured Environmental Concentration) and PNEC (Predicted No Effect Concentration), using a risk ranking criteria (high, medium or low risk). Diclofenac was quantified at 20 ng.L^{-1} in site 4. An EC_{50} of 243.5 mg.L^{-1} was found through fertilization assay whereas effects on the embryonic development was found in embryos exposed to 10 mg.L^{-1} . The RQ calculated from these assays was 0.0002, which would, in a preliminary assessment, indicate a low environmental risk. However, the NRRT assay showed significant effects on lysosomal membrane stability in mussels exposed 96 h to 20 ng.L^{-1} of Diclofenac. These findings pointed out risk in environmentally relevant concentrations and suggest the need of employing more sensitive responses to detect adverse effects of emerging compounds in marine environments. In this context, our results may contribute to development of new criteria of environmental risk assessments as well as pharmaceuticals regulation.

WP040. Effects of triclosan and its interaction with UV radiation on biomarker responses of a native species (*Corydoras paleatus*): ex vivo exposure of gills

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The addition of antimicrobial agents such as triclosan (TC) in personal care products intensified its presence in urban waste waters and therefore into the aquatic environment. Moreover, in presence of UV radiation (eg. sunlight), TC has been shown to degrade into two dioxins: 2,7-dibenzodichloro-p-dioxin and 2,8-dibenzodichloro-p-dioxin, which are more toxic than the parent compound. The effect of TC and its interaction with UV radiation were assessed on biomarker responses of a native species (*C. paleatus*) after ex vivo exposure of gills. The biomarkers studied were the enzymatic activities of glutathione-S-transferase (GST) and catalase (CAT), total antioxidant capacity against peroxyl radicals (ACAP) and lipid peroxidation levels (thiobarbituric acid reactive substances, TBARS). Stock solution of TC was dissolved in methanol, two nominal concentrations $340 \mu\text{g/L}$ (TC1) and 1 mg/L (TC2) were tested. A total of 20 fish were sacrificed, and the gills were dissected and assigned to four treatment groups: saline for fresh-water fish as control (Co); methanol in saline (0,05%) (Co.sv); TC1 and TC2. All treatments were prepared in two sets: a dark set (without UV light incidence), and an UV set (solutions under ultraviolet radiation). Then the gills were kept under continuous stirring for 1h at 25°C . Statistical differences between treatments and UV or dark condition were determined using a two way analysis of variance ($p < 0,05$) followed by Tukey's test. No significant differences between the parameters of Co and Co.sv groups, nor effect of UV radiation in these groups were detected. TC exposure showed a significant increment (53%) in enzymatic activity of CAT respect to Co group, being higher after exposure to UV radiation. A similar response was observed in GST, mainly after UV exposure (75% TC1 and 94% TC2). On the other hand, in TC2 exposure, a decrease in total antioxidant capacity and an increase in TBARS

levels (2.5 TC2 and 5.5 TC2+UV times more than in Co) were detected. In addition, TBARS levels were doubled in both TC concentrations with UV radiation respect dark condition. These results suggested that ex vivo exposure of *C. paleatus* gills to TC promoted changes at biotransformation and oxidative stress levels in both concentrations, which were not enough to prevent oxidative damage to lipid levels. At the same time, most of these changes were intensified after the effect of UV radiation on TC solutions.

WP041. Emerging pollutants in reservoirs: Detection and photo-degradation under simulated sunlight radiation

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The presence of emerging contaminants, such as pharmaceutical and personal care products (PPCPs), in water sources used for drinking water production have been reported. There is also a lack of detailed information on the toxicological risks that their presence may represent to aquatic environments and living organisms. PPCPs reach water bodies mainly from urban wastewater, but also from industrial and agricultural discharges. In this way, samples from two water reservoirs in Colombia were analyzed with the objective of determining the presence of a group of PPCPs, including Ibuprofen (IBU), Diclofenac (DIC), Methylparaben (MPB) and Carbamazepine (CBZ). Ultra-high performance liquid chromatography (UHPLC) coupled to tandem mass spectrometry (MS/MS) was employed to PPCPs detection. According to the most recent literature, LC-MS/MS is the preferred technique to measure emerging contaminants due to its robustness and the fact that it's excellent sensitivity and selectivity. Results indicated that the occurrence of MPB ($5\text{-}425 \text{ ng/L}$) and IBU ($5\text{-}62 \text{ ng/L}$) was highly relevant in both reservoirs. On the other hand, there were not evidences on the presence of DIC and CBZ. This shows that Colombia is indeed affected by the presence of emerging contaminants and revealed the importance of monitoring these compounds, as well as other contaminants in different water bodies. In addition, pollutants photodegradation was evaluated at natural reservoirs conditions (pH, Fe and organic matter concentration) using a sunlight simulator. Results indicated that pollutants photodegradation was highly dependent on the conditions of the aquatic environment. In addition, data showed that first-order reaction kinetics describe substrates degradation adequately. In general, experimental results allow to appreciate that under evaluated conditions and after 12 h of treatment, extents of removal were: between 7.9 and 11.5 % for CBZ, between 6.4 and 14.1 % for IBU, between 3.4 and 6.4 % for MPB and around 100 % for DIC. Half-life times for CBZ, IBU and MPB elimination were in the range 2-12 days; in the case of DIC photodegradation, this value was approximately 1h due to its fast removal. This implies that pollutants remain in their original form in the reservoirs for several days; but due to reservoirs high retention times (17-77 days), it is likely that evaluated PPCPs coexist with their corresponding degradation by-products.

WP042. Environmental performance of wastewater facilities addressing emerging contaminants

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One of the greatest concerns in the environmental field is associated risk due to emissions of new pollutants produced by human activities. Early identification and investigation of potential contamination is essential to protect environment. Emerging contaminant has taken relevance in the last years including a specific group of compounds, the Pharmaceutical and Personal Care Products (PPCPs). One source of important PPCPs pollution are wastewater treatment plants (WWTPs) where they can suffer degradation and sorption processes by the biomass present in biological treatments. However, the difficulty of identifying and quantifying makes the process simulation a relevant tool for behavior analysis of these compounds. There is also another problem that arises when two or more alternative treatments are analyzed to determine which one offers the best results, not only in performance terms but also environmental efficiency. In this way the introduction of an environmental metric is useful to select the best alternative. In the present work were carried out WWTPs simulations with the GPS-X software of three treatment alternatives, including sludge treatment and PPCPs behavior in the simulations. Then, using the software OpenLCA, a life cycle impact analysis of the operation phase in each alternative was carried out to determine the most suitable option.

WP043. Esterase alterations in *Oreochromis niloticus* exposed to alprazolam isolatedly and in combination with the insecticide diazinon