Assessing 21st century contaminants of concern using integrative passive sampling devices to obtain more meaningful and cost effective data on impacts from stormwater runoff

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RESULTS: Puget Sound, WA

Comparison of first half and second half of ~24 hr storm in comparison with DGT samplers placed for full storm.

APPLICATION OF DGT APPROACH FOR REAL TIME MONITORING OF METALS IN STORM DRAINS (ABOVE LEFT) IN SHORT TERM (≤ 24 H) EXPOSURES AT TWO IMPREGNATION SITES AT NAVAL BASE SAN DIEGO (ABOVE RIGHT).

INTRODUCTION

- Grab (and composite) stormwater samples may not be representative of stormwater impacts to the receiving environment, as they may miss the "pulse" of contaminants.
- Total recoverable metal concentrations used in compliance monitoring are not biologically meaningful for ecological effects.
- Composite autosampling has limitations (reliability, cost).
- Integrative passive sampling with Diffusive Gradients in Thin film (DGT) and Polar Organic Chemical Integrative Samplers (POCIS) can provide cost-effective continuous monitoring.
- DGTs are being evaluated for end-of-pipe monitoring and value towards assessment of best management practices (BMP) at Naval Base San Diego (NBSD).
- DGTs and POCIS were deployed during ambient monitoring at nearshore locations at Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS&IMF), Naval Base Kitsap (NBK) and reference locations.
- DGT² samplers provide a time-averaged concentration of labile (biologically available) metal concentrations following diffusion through a gel layer and permanent binding to a resin layer (Chelex-100).
- POCIS² sample weakly lipophilic-balanced; HLB)
- Analysis of variance (ANOVA) on the data revealed that the levels of metals were significantly different (p < 0.05).
- Mass accumulation on POCIS following sampling from sites in Sinclair Inlet and nearby reference sites during Feb. - Mar. 2017 for household chemicals, pharmaceuticals, fragrances, and endocrine disrupting compounds.

RESULTS: San Diego Bay, CA

Linear loading of copper on to DGT Chelex-100 resin in between 1.5-24 h durations in copper solutions. Shows detectable metal loading during short pulses.

APPLICATION OF A UNIQUE DGT APPROACH FOR REAL TIME MONITORING OF METALS IN STORM DRAINS (ABOVE LEFT) IN SHORT TERM (≤ 24 H) EXPOSURES AT TWO IMPREGNATION SITES AT NAVAL BASE SAN DIEGO (ABOVE RIGHT).

Stations (above) within Naval Base Kitap in Sinclair Inlet and nearby reference locations with varying landuse and runoff regimes (below).

REFINEMENTS


CONCLUSIONS

- Integrative passive samplers show promise towards biologically relevant exposure/assessment of stormwater discharges and associated contaminants of concern in receiving water monitoring.
- Highly sensitive, reproducible results that support trace level changes in metal availability (DGT) and weakly hydrophobic (POCIS) contaminants in a marine estuary.
- End of pipe sampling promising, but requires additional work to address possible issues associated with low ionic strength rainwater and highly dynamic stormwater discharges.
- Passive sampling devices provide supplemental data to reduce costly traditional monitoring.
- Surveillance monitoring with passive samplers can be used to fingerprint likely sources of contamination.

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