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The geochemical behavior of trace metals in the water column of the Belgian Coastal Zone

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INTRODUCTION

The metallic and organic contamination of marine ecosystem in the Belgian coasts has lead to a better understanding of their impact on the aquatic environment. The fate and the ecotoxicity of these trace elements are strongly linked with their chemical speciation, which constantly evolves in space and time.

MATERIAL & METHODS

Six sampling stations: ➔ 4 in harbour zones: Oostende and Zeebrugge ➔ 2 offshore, in the North Sea

Two campaigns: ➔ In March & November 2016

PHASE 1: Chemical speciation of trace metals, using active sampling

- Total dissolved metal measurement from a preconcentration technique thanks to a solid-phase extraction on filtered (0.45µm pore size) & acidified seawater
- Particulate metal measurement from suspended matter caught with pre-weighted Durapore filters (0.45µm pore size) after seawater filtration

PHASE 2: Chemical speciation of trace metals, using passive sampling

Labile metal measurement from an in situ deployment of DGT (Diffusive Gradients in Thin films) probes, integrative measurement over two weeks

DGT enables to measure the labile fraction of trace metals which is a good indicator of their bioavailability

PHASE 3: Suspended Particulate Matter (SPM) origin

Stable C and N isotopic ratio determination in particulate organic matter from water filtration with pre-treated and pre-weighted glass fiber filters (0.7µm pore size)

Depending on the value of the δ13C ratio, we can trace back the origin of SPM

RESULTS

Particulate metal distribution

Labile metals, the bioavailable fraction of total dissolved metals

Stable carbon & nitrogen isotopic ratio

CONCLUSION

- Particulate and total dissolved metal concentrations in harbour sites are much higher than the offshore ones
- Labile fractions do not differ significantly. Moreover, the potential bioavailable species are at low level in Belgian coastal area compared to toxicity criteria
- SPM in the harbour zones is likely from allochthonous sources, while for the two offshore stations it appears to be mainly from marine origin

- Higher dissolved and particulate metal concentrations do not correlate well with their bioavailability

Even though trace metal contamination is higher in the harbour zones, the effect of trace metal toxicity is most likely not higher than in the open sea

With increasing acidification of the ocean, higher particulate trace metal concentrations might lead to increasing adverse effects on the coastal environment

Future work:
- Follow up sampling in 2017
- Identification of spatial and temporal trends
- Validation of a new seawater extraction method
- Comparison between DGT and Voltammetry measurement
- Investigating SPM trap samples for metal and isotopes composition

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More information available on: www.gael.be

References
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