Mercury (Hg) speciation in sediment of the Belgian Part of the North Sea (BPNS)

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Mercury (Hg) is one of the most toxic elements in natural and urbanised environments and monomethylmercury (MeHg) is the most health concern compound among all mercury species due to its bioaccumulation and biomagnification along the food chain. Coastal zone is often the specific site of high Hg contamination due to the anthropogenic activities and special environmental conditions. The BPNS (Belgian Part of the North Sea) has suffered a long-term, recurrent metallic pollution by atmospheric deposition, direct wastewater discharge from coastal industries and input of the Scheldt Estuary,which is enriched in trace metals originating from its watershed and especially from the industrial site of Antwerp. Marine sediment functions both as a sink of Hg accumulation and a source of Hg release to surface water. In addition, marine sediment can also record both historical and current Hg contamination in aquatic systems if the vertical profile of Hg in sediment available (solid phase). More research has been done on Hg contamination in sediment solid phase, however the Hg and MeHg concentrations in sediment porewater are normally low (at ng/L level) and the conventional methodology (centrifugation and filtration, or Rhizon extraction) to sample Hg and MeHg in porewater cannot always produce accurate results especially for MeHg due to very limited volume and the detection limit of analytical instruments. The passive sampling technique of Diffusive Gradients in Thin-films (DGT) is a suitable technique preconcentrating labile Hg and MeHg from porewater and then be analyzed by different detectors. In addition, different from porewater extraction, DGT measured labile Hg and MeHg fractions are potentially bioavailable in aquatic systems due to the pore size of diffusive gel in the DGT (10-20 nm). In the two Belgica campaigns in March 2020 and March 2021 in the BPNS, both classic sampling methods for porewater extraction and the DGT deployment were carried out and Hg and MeHg concentration profiles were obtained by these two sampling methodologies. Total Hg concentrations were determined both in sediment porewater with a range of 5 to 40 ng/L and solid phase with a range of 110 to 245 µg/kg at sampling station ZB (at theZeebrugge harbor in the BPNS, salinity was around 25). In ZB, the labile Hg profiles (DGT measured) showed large difference from the two sampling campaigns probably due to the dumping activity at the coastal area. Lower total Hg concentrations were found in sediment porewater (3 to 43 ng/L) and solid phase (31 to 147 µg/kg) at sampling station SV (close to Zeebrugge harbor in the BPNS, salinity was around 29). In SV, labile Hg concentrations were fluctuated around 11 ng/L. The range of MeHg is from 0 to 2 ng/L at ZB and from 0 to 1 ng/L at SV in porewater. Monomethylmercuryconcentrations are related to the sediment environment and the concentration of total Hg in porewater. Hg and MeHg levels in sediment are lower than the historical studies in the Scheldt estuary and much lower than the historically Hg contaminated areas.

Keywords
Hg and Mehg Concentrations; Sediment Porewater And Solid Phase; DGT; Bioavailable