The potential of diffusive gradients in thin films (DGT) technique as a monitoring tool for uranium in the aquatic environment

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Since the majority of the planet's surface is covered in water, which is an essential premise of life on Earth, the issue of its pollution receives nowadays increasing attention from researchers as well as the decision-makers and public. Although the trends in water pollution monitoring have turned over the years towards microplastic or organic pollutants such as antibiotics, hormones, pesticides, or drugs, monitoring of trace elements remains at the centre of research attention. This is not only because of the increasing pollution by toxic trace elements and their persistent and bioaccumulative nature in the environment but also because of the need to understand the biogeochemical behaviour of those elements that represent essential nutrients in the aquatic environment. The diffusive gradients in thin films (DGT) is a passive sampling technique that can not only overlap the lack of knowledge in the biogeochemical cycling of trace elements and their bioavailability for living organisms but also represent a useful tool for long-term monitoring of trace metal concentrations in-situ. The field application of newly developed DGT technique designs utilizing different sorbents is a crucial part of its validation. Therefore, we present development in the use of the DGT technique for the evaluation of uranium concentrations in the aquatic environment that was performed in the Scheldt estuary. The salinity gradient found in estuaries represents an ideal location for evaluation of the DGT technique performance which may be hampered by the complex nature of seawater in contrary to freshwaters. In this work, we provide a comparison of different DGT designs utilizing various sorbents (i.e., Chelex-100, Diphonix, Lewatit FO 36, and PIWBA) that were deployed in water along the Scheldt estuary. Results show that an improper selection of the binding phase can lead to providing skewed results that do not correspond to reality. On the contrary, the use of sorbents with high selectivity for the targeted analyte that have been thoroughly evaluated in a wide range of natural conditions may provide a DGT design that has the potential not only to quantify the labile fraction of uranium that may pose a risk to biota but may be used as a long-term monitoring passive sampler in seawater.

Acknowledgments
This work was supported by the project PROFISH CZ.02.1.01/0.0/0.0/16_019/0000869, which is financed by the European Regional Development Fund in the Operational Programme Research, Development and Education and The Czech Ministry of Education, Youth and Sports.

Keywords: DGT; Uranium; Estuary