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Multi-element river water monitoring by quantifying 68 elements in one single analytical run

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Multi-analyte methods are crucial to obtain a fast and accurate overview of the chemical status of environmental samples. River water is transporting a large number of different compounds from various sources (e.g., catchments, surface run-off or waste water) into the oceans. To extend the scope of standard monitoring approaches and to gain new insights into the distribution of major and trace elements in river water, a multi-element method was developed enabling the quantification of up to 68 elements including metals, metalloids and non-metals in filtered (<0.45 µm) and unfiltered river water samples in one single analytical measurement run by ICP-QQQ-MS [1, 2]. One of its first applications was conducted during the Oder fish disaster in August 2022 [3]. Moreover, it was applied to assess spatiotemporal variabilities in riverine systems. A sampling frame with five vertically fixed Van-Dorn bottles was used at three different cross-profile locations along the German part of the river Rhine. First results revealed spatial heterogeneities in dissolved concentrations in river cross-sections for both, routinely analysed elements such as manganese but also for rarely analysed emerging elements like gadolinium (Figure 1), which is used in medical imaging and enters rivers via waste water [4]. Further examples of observed spatiotemporal variabilities of element concentrations in river water will be presented. The application of our multi-element method represents an important advance for the long-term monitoring of element concentrations in surface waters and will contribute to a better understanding of element distributions in riverine systems.

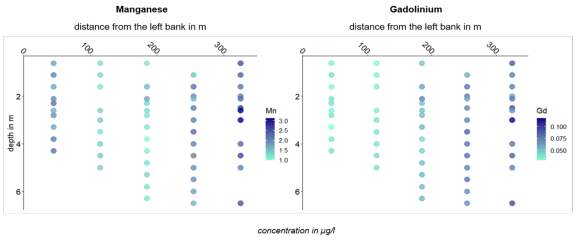

Figure 1: Exemplary concentrations in µg/l for two out of 68 elements for the dissolved fraction of manganese and gadolinium at one of the sampling locations (Emmerich, river Rhine, discharge = 3160 m³/s, width of the river cross-profile = 350 m, maximal water depth = 7.10 m).

References

[1] N. Belkouteb, H. Schroeder, J. Arndt, J.G. Wiederhold, T.A. Ternes, L. Duester, Quantification of 68 elements in river water monitoring samples in single-run measurements, Chemosphere (2023) 138053, https://doi.org/10.1016/j.chemosphere.2023.138053

[2] N. Belkouteb, H. Schroeder, J.G. Wiederhold, T.A. Ternes, L. Duester, Multi-element analysis of unfiltered river water samples – How to digest and analyse via ICP-QQQ-MS, in preparation for submission

[3] BMUV, 2022. https://www.bmuv.de/en/pressrelease/oder-fish-die-off-salt-discharges-caused-mass-proliferation-of-toxic-alga

[4] S. Kulaksiz, M. Bau, Anthropogenic dissolved and colloid/nanoparticle-bound samarium, lanthanum and gadolinium in the Rhine River and the impending destruction of the natural rare earth element distribution in rivers, Earth Planet Sc Lett 362 (2013) 43-50, https://doi.org/10.1016/j.epsl.2012.11.033