Nonaqueous capillary electrophoresis mass spectrometry for the analysis of the micropollutant metformin in biota and optimization of the geometry of the capillary tip

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With more than 600 million defined daily doses, the antidiabetic drug metformin is one of the most commonly prescribed pharmaceutical worldwide. Metformin and its transformation product guanylurea are present in surface waters in the low µg/L range. Their ecotoxicological effects and their uptake by aquatic organisms are poorly investigated. In this study, an analytical methodology for the determination of their uptake by zebrafish embryos (*Danio rerio*) and brown trout (*Salmo trutta f. fario*) was developed.

We developed a method using nonaqueous capillary electrophoresis-mass spectrometry for the analysis of the two compounds, which provides high selectivity towards matrix components in fish extracts so that sample preparation could be limited to extraction with methanol upon ultrasonication and filtration. Robust analysis was achieved using a bare fused silica capillary with an applied voltage of +30 kV in a non-aqueous background electrolyte (BGE) composed of a mixture of methanol and acetic acid. The absolute recovery was 95 % determined by using deuterated metformin as internal standard. The method was validated with respect to specificity, linearity, limit of detection, accuracy and precision. Afterwards, the method was successfully applied to zebrafish embryos and brown trout exposed to metformin. Internal concentrations in the ng/g range, differing dependent on dose and duration of exposure, were observed for brown trout.

For routine analysis of metformin in biota samples, we observed differences in the performance due to limited robustness of the electrospray, especially when newly installing capillaries in the ESI sprayer. We here want to show that improvements in robustness can be achieved with an optimized capillary geometry sharpened via polishing.