Carbon stable isotope fractionation of sulfamethoxazole during biodegradation and photolysis

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Sulfonamides (SAs) belong to the most commonly used antibiotics worldwide and have wide application range in veterinary and human medicine. SAs are polar and fairly water-soluble and are detected in wastewater effluents, ground- and surface waters. Once released to the environment, they undergo different degradation processes, biotic and abiotic, e.g. sorption, hydrolysis, redox and photodegradation. Therefore it is important to have analytical tools, such as compound specific stable isotope analysis (CSIA), to understand the fate and processes contributing to their removal *in situ*. Thus far, CSIA approaches were mostly limited to gas chromatography amenable environmental contaminants. Liquid chromatography (LC-IRMS) methods have only recently emerged.

In this study, we developed a LC-IRMS method for sulfamethoxazole (SMX), frequently studied SA, and its known metabolite 3-amino-5-methylisoxasole. Reference biotic (*Microbacterium* sp. strain BR1) and abiotic (photolysis) degradation experiments were performed to assess and compare the carbon stable isotope fractionation. Significant carbon stable isotope fractionation of SMX was observed during both biotic and photolytic degradation, however, the observed isotope fractionation was stronger in the abiotic reaction. Biodegradation by strain BR1 proceeds through recently described *ipso*-hydroxylation pathway [1], while for the photolysis multiple cleavage sites and degradation products have been proposed [2,3,4,5]. Various reaction mechanisms may contribute to the observed differences in fractionation in biotic and abiotic experiments. Here, we show, for the first time the applicability of CSIA for the assessment of sulfomethoxazole's transformation *in situ*.

[1] Ricken *et al* (2013) *AEM* **79,** 5550-8 [2] Zhou & Moore (1994) *Int J Pharm* **110**, 55-63 [3] Boreen *et al* (2004) *ES&T* **38**, 3933-40 [4] Trovo *et al* (2009) *Chemosphere* **77**, 1292-98 [5] Perisa *et al* (2013) *ESPR* **20**, 8934-46