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Speciation of ¹²⁹I and ¹²⁷I in soil and sediment samples

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Iodine is a biophilic tracer element with thirty-four isotopes including one long-lived isotope, ¹²⁹I (15,7 My), and one stable isotope, ¹²⁷I. Toxicity, mobility, bioavailability, bioactivity, and the uptake of iodine in environment are governed by its chemical speciation and the soil or sediment conditions. It is therefore important to identify and quantify different physicochemical contaminant species.

In this work, a sequential extraction procedure combined with accelerator mass spectrometry (AMS), and inductively coupled plasma mass spectrometry (ICP-MS), respectively, was applied for investigation of ¹²⁹I and ¹²⁷I in different physicochemical forms in soil and sediment samples. The fractionation allowed identification of water soluble, exchangeable, carbonate, oxides, iodine bound humic acid, iodine bound fulvic acid and iodine bound humin forms. This is the first study to identify humic acid, fulvic acid and humin bound ¹²⁹I. A Danish soil sample, a soil reference material (IAEA-375), an anoxic sediment sample collected from Helvik Fjord (South Norway) and an oxic sediment sample collected from the Barents Sea (Russia) were investigated. The results of the work show that in the investigated samples, ¹²⁹I bound to organic matter accounted for more than 50% of the total iodine. Approximately 90% of the ¹²⁹I is bound to organic matter and oxides, and 10% was found in the readily exchangeable fractions.

Speciation analysis of ¹²⁹I in soil/sediments is indispensable for a better understanding of bioavailability, mobility, bioactivity, uptake and toxicity of iodine in the environment.

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