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Published in:

Final Program of the 6th East Asia Accelerator Mass Spectrometry Symposium (EA-AMS 6)

Publication date:

2015

Document Version

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Hou, X., Zhang, L., Xu, S., & Zhou, W. (2015). Speciation analysis of ^{129}I in atmosphere by AMS and its applications for studies of environmental processes. In *Final Program of the 6th East Asia Accelerator Mass Spectrometry Symposium (EA-AMS 6)* (pp. 52-53). National Taiwan University.

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Speciation analysis of ^{129}I in atmosphere by AMS and its applications for studies of environmental processes

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Keywords: AMS, iodine-129, aerosol, rainwater, speciation,

The long-lived ^{129}I has been mainly released to the environment from nuclear reprocessing plants, nuclear weapons testing and nuclear accidents. The special source term of ^{129}I , unique chemical properties and environmental behavior of iodine make ^{129}I an ideal tracer to investigation of the pathway of gaseous pollution in the atmosphere, atmospheric chemistry and geochemical cycle of iodine. However, the very low concentration of ^{129}I and its species make their determination a challenge for these investigations. In the past year, our laboratory has developed a series of methods for speciation analysis of ^{129}I in air, aerosol and rainwater (snow) and applied them in the studies of environmental processes. This work aims to give an overview and summary of the methodologies of speciation analysis for ^{129}I in atmosphere and their applications. ^{129}I in iodide and iodate form as well as total iodine in rainwater, particulate associated iodine, gaseous inorganic iodine and gaseous organic iodine species in air samples, water soluble iodide, water soluble iodate, water soluble organic iodine, alkali soluble iodine, and insoluble iodine species in aerosol samples were separated using different physical and chemical methods, and the separated ^{129}I was then measured by AMS and ^{127}I was measured using ICP-MS. The atmospheric behaviors of radioactive iodine released from Fukushima accident have been investigated by speciation analysis of ^{129}I and ^{127}I in time series of aerosol samples and rainwater collected at Fukushima, Japan. The aerosol samples collected in Denmark during the Fukushima accident period were also analyzed for species of ^{129}I and ^{127}I to investigate the sources of ^{129}I in the Europe and the atmospheric behavior of ^{129}I from different sources. Time series of rainwater samples collected in Denmark and seawater samples collected in the North Sea were analyzed for chemical species of ^{129}I and ^{127}I to investigate the interaction of iodine between seawater and atmosphere. Particulate associated iodine, gaseous inorganic iodine and gaseous organic iodine were separately collected at locations with different distance to the North Sea from 50 meter to 1000 km to investigate sources of iodine in the terrestrial, transport pathway of iodine in the atmosphere. A series of snow and seawater samples collected in the Antarctic have been analyzed for ^{129}I , the sources of ^{129}I in the Antarctic and transport pathway of gaseous pollutant to the Antarctic were investigated.