Determination of $^{129}$I in aerosols using pyrolysis and AgI-AgCl coprecipitation separation and accelerator mass spectrometry measurements

Airborne radioactive iodine is a key concern for the transport and dispersion of radioactive contamination and radiation exposure evaluation during nuclear accidents and nuclear emergency preparedness. Information about long-lived $^{129}$I in aerosols is vital for the reconstruction of the level and distribution of short-lived and highly radiotoxic $^{131}$I, as well as for understanding the atmospheric cycling of iodine. However, aerosol $^{129}$I concentration is difficult to measure due to its low concentration in remote areas, away from nuclear pollution sources. In this study, a novel method for the determination of $^{129}$I in aerosols collected on a glass fiber filter was developed using high-temperature pyrolysis and AgI-AgCl coprecipitation for separation coupled with highly sensitive accelerator mass spectrometry (AMS) measurements. It is worth noting that even though the pyrolysis behaviors of various iodine species were investigated and found to be different, all of the iodine can be quantitatively recovered. Iodate was released from the aerosols through its decomposition to iodine at temperatures over 500 °C. The chemical yield of iodine during pyrolysis was 81.5 ± 5.8%. The detection limit for $^{129}$I in the aerosol samples was $1.3 \times 10^4$ atoms per m$^3$, at least reducing the required aerosol sample size by a factor of three, in contrast to the method using alkaline-ashing separation coupled to solvent extraction. For aerosol samples collected in Asia with $^{129}$I/$^{127}$I ratios of $(0.1-10) \times 10^{-9}$, a volume of 1000 m$^3$ air is sufficient for the determination of $^{129}$I. The developed method was used to analyse aerosol samples collected in Xi'an, an inland Chinese city. It is observed that $^{129}$I concentrations ranged within $(0.38-5.19) \times 10^5$ atoms per m$^3$, with $^{129}$I/$^{127}$I ratios of $(21.7-252) \times 10^{-10}$, which are comparable to those collected in Japan before the Fukushima nuclear accident and Spain, while much lower than those observed in Northern Europe.

General information
State: Published
Organisations: Center for Nuclear Technologies, The Hevesy Laboratory, Radioecology and Tracer Studies, Chinese Academy of Sciences
Contributors: Zhang, L., Hou, X., Fu, Y., Fang, M., Chen, N.
Pages: 1729-1736
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Journal of analytical atomic spectrometry
Volume: 33
Issue number: 10
ISSN (Print): 0267-9477
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.4 SJR 1.066 SNIP 1.198
Web of Science (2017): Impact factor 3.608
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.3 SJR 1.005 SNIP 1.197
Web of Science (2016): Impact factor 3.379
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.19 SJR 0.99 SNIP 1.181
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.22 SJR 0.975 SNIP 1.386
Web of Science (2014): Impact factor 3.466
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.24 SJR 1.076 SNIP 1.233
Web of Science (2013): Impact factor 3.396
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.99 SJR 1.195 SNIP 1.104
Web of Science (2012): Impact factor 3.155
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.03 SJR 1.126 SNIP 1.128
Web of Science (2011): Impact factor 3.22
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.403 SNIP 1.197
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.122 SNIP 1.094
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.207 SNIP 1.07
Scopus rating (2007): SJR 1.255 SNIP 1.126
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.371 SNIP 1.028
Scopus rating (2005): SJR 1.364 SNIP 1.14
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.699 SNIP 1.249
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.433 SNIP 1.257
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.845 SNIP 1.28
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.701 SNIP 1.365
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.117 SNIP 1.507
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.397 SNIP 1.556
Original language: English
DOIs:
10.1039/c8ja00248g
Source: FindIt
Source-ID: 2438390758
Research output: Research - peer-review \ Journal article – Annual report year: 2018