

Speciation Analysis of Iodine-129 in Seawater by Coprecipitation and Accelerator Mass Spectrometry

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As a long-lived radioisotope of iodine, ^{129}I is produced by both natural reactions and human nuclear activities. Because of the ubiquity and high water-solubility, ^{129}I can be used as a kind of oceanographic tracer. Base on the different cyclic processes of iodine species, speciation analysis of ^{129}I in seawater can provide useful information on the transportation of water masses. A simple and rapid coprecipitation method combined with accelerator mass spectrometry (AMS) measurement was improved for inorganic speciation analysis of ^{129}I in seawater. Iodide was successfully separated from seawater just by adding a certain amount of carrier (0.6 mg) and 100 mg/L Ag^+ with the separation efficiency high to 95%. When the concentration differences of $^{129}\text{I}^-$ and $^{129}\text{IO}_3^-$ are huge, slight crossover during the separation process can introduce significant analytical error. In order to remove the remaining I^- in supernatant seawater in last step, AgI is coprecipitated with Ag_2SO_3 , AgCl , and AgBr after adding 0.6 mg carrier, 100 mg/L Ag^+ and 0.3 mmol/L Na_2SO_3 at pH about 4.0, which decrease the crossover between $^{129}\text{I}^-$ and $^{129}\text{IO}_3^-$ to 0.05%. Iodate in the supernatant was converted to iodide by Na_2SO_3 at pH 1-2 and then separated by coprecipitation, with the 91% separation efficiency. ^{129}I of total inorganic iodine was analyzed by the same procedure as for iodate. Ag_2SO_3 , AgCl and AgBr in the coprecipitate was removed by washing with 3 mol/L HNO_3 and diluted NH_4OH , and the AgI precipitate was obtained for ^{129}I AMS measurement. Two seawater samples collected from the Indian Ocean were analyzed by this improved method, and the results showed that the concentration of $^{129}\text{I}^-$ is significantly high than the concentration of $^{129}\text{IO}_3^-$ in seawater. Three seawater samples at different depths of the Pacific Ocean were used to analyze ^{129}I of total inorganic iodine by this method and solvent extraction and back extraction method, and the results showed no significant difference ($p=0.05$ for t-test) between two methods.