

A Straightforward Method for Determining Inorganic Selenium Speciations by Graphite Furnace Atomic Absorption Spectroscopy in Water Samples

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Abstract : In this experimental study, total selenium in solution was measured with Graphite Furnace Atomic Absorption Spectroscopy, GFAAS, then chemical reactions with sodium borohydride were used to reduce selenite to hydrogen selenide. Hydrogen selenide was then stripped from the solution by purging the solution with nitrogen gas. Since the two main speciations in oxic waters are usually selenite, Se(IV) and selenate, Se(VI), it was assumed that after Se(IV) is removed, the remaining total selenium was Se(VI). Total selenium measured after stripping gave Se(VI) concentration, and the difference of total selenium measured before and after stripping gave Se(IV) concentration. An additional step of reducing Se(VI) to Se(IV) was performed by boiling the stripped solution under acidic conditions, then removing Se(IV) by a chemical reaction with sodium borohydride. This additional procedure of removing Se(VI) from the solution is useful in rare cases where the water sample is reducing and contains selenide speciation. In this study, once Se(IV) and Se(VI) were both removed from the water sample, the remaining total selenium concentration was zero. The method was tested to determine Se(IV) and Se(VI) in both purified water and synthetic irrigation water spiked with Se(IV) and Se(VI). Average recovery of spiked samples of diluted synthetic irrigation water was 99% for Se(IV) and 97% for Se(VI). Detection limits of the method were $0.11 \mu\text{g L}^{-1}$ and $0.32 \mu\text{g L}^{-1}$ for Se(IV) and Se(VI), respectively.

Keywords : Analytical Method, Graphite Furnace Atomic Absorption Spectroscopy, Selenate, Selenite, Selenium Speciations

Conference Title : ICECPM 2019 : International Conference on Environmental Chemical Pollution Management

Conference Location : New York, United States

Conference Dates : August 08-09, 2019