Quantifying Total Mercury in Plankton by Cold Vapor Atomic Fluorescence Spectroscopy: Simple and Efficient Acid Digestion Procedure

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Investigating the role of plankton in mercury accumulation in aquatic food webs requires reliable procedures for mercury analysis. Established wet digestion methods exist for total mercury determination in various biological matrices, yet planktonic samples remain relatively underexplored. In response to this need, we developed a cost-effective and straightforward wet digestion method for assessing total mercury in small plankton material via cold vapor atomic fluorescence spectroscopy (CVAFS).

The digestion procedure was optimized by employing glass vessels with Teflon caps, utilizing minimal amounts of acids (either 3 mL w/w 65% HNO_3 or 3 mL 50% v/v HNO_3), maintaining a constant temperature of 85°C, and applying a continuous digestion period of 12 hours. Additionally, the protocol was tested with and without pre-ultrasound treatment in order to determine which option yields higher recoveries.

To optimize and validate the digestion procedure, we used certified reference materials IAEA-450 (unicellular alga *Scenedesmus obliquus*) and BRC-414 (plankton). The recovery efficiency of the proposed method was between 94.1 ± 7.6% and 97.2 ± 4.6% for IAEA-450 and BCR-414 (3.1 mg and 21.5 mg), respectively.

In conclusion, the method offers high recovery efficiency and precision for low-sized plankton matrices, thereby enhancing the digestion of planktonic samples for mercury analysis using CVAFS techniques.

Keywords: wet acid digestion; IAEA-450; BCR-414; plankton; microalgae; zooplankton; total mercury; CVAFS, mercury analysis