Danielle Michaud
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Outline

Using Cold Vapor Atomic Fluorescence Spectroscopy (CV-AFS) and Gold Amalgamation to Detect Mercury

Introduction

- J.F. Kopp first published this method in 1972 in the Journal for American Water Works Association.
- can detect low concentrationns of Mercury in soil, water, and air samples.
- atomic absorption can also measure mercury concentrations, but it is not as sensitive or selective as cold vapor AFS, which means one can get a better idea of how contaminated the soil, etc. is with mercury.

Technique

- Preparation
  - the sample must be digested, usually with an acid, to break down the compounds so that all the mercury present can be measured.
- Gold Amalgamation
  - gold amalgamation is used to concentrate the mercury before it is vaporized – the mercury gathers on a gold trap, and then it is heated and vaporized, and carried to a second gold trap by argon, for the process to be repeated, this time carrying the mercury vapors to the fluorescence cell.
- CV-AFS
  - the sample is vaporized, and collimated (almost parallel) UV light passes through the sample, and the mercury fluoresces.
  - the fluoresce is detected by a photomultiplier tube or a photodiode.
  - must use with an inert gas carrier such as Argon, so that the fluorescent signal will not be absorbed
  - Diagram (from Bruce, 2001)

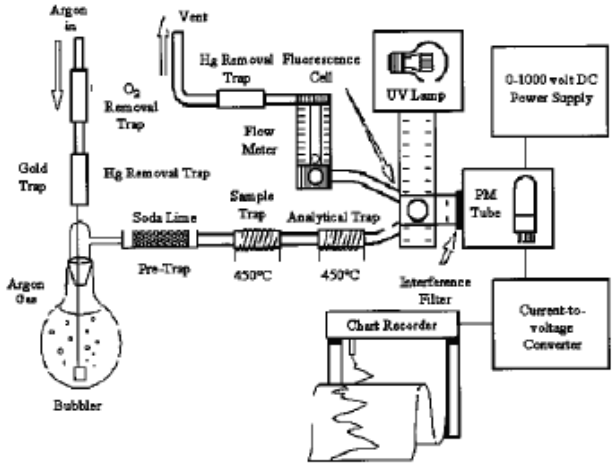

Figure 1 *Apparatus for Method 1631.*

- Sources of Error
    - contamination from sample collection (i.e. dirty hands, etc, if not collected carefully), and the analysis process.
    - sample vials that may contain mercury should be made of borosilicate glass or fluoropolymer, because mercury might leach/absorb, etc. other materials.

Mercury

- For mercury, the light wavelength used is 253.7 nm.
- The general range of detection is 0.2 -10 μg Hg/L, but modifications to sample size can expand the range.

References

- Bruce, Mark L. and David L. Pfeil. "Automated determination of mercury by cold vapor atomic fluorescence with gold amalgamation." American Laboratories. 2001. 28-33.
- "Method 245.1: Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectrometry." Revision 3.0. EPA. 1994.