Mercury, Cold Vapor

Introduction

Mercury is sometimes dumped into rivers and lakes by industry. Farmers have also used mercury compounds to prevent fungi attack on seeds. In nature, bacteria change elemental mercury to organic mercury compounds that are very toxic to all living organisms. These compounds bioaccumulate in the food chain and can eventually reach humans. At high enough levels, mercury causes nerve damage, mutations and death. Because mercury is so toxic, environmental monitoring is necessary— especially at sources of industrial discharge.

Chemical reactions

The sample is digested to convert all forms of mercury to mercuric ions (Hg^{2+}) and to destroy interfering substances that may be present. The sample is then treated with a reducing agent to convert the mercuric ions to elemental mercury (Hg). The elemental mercury is volatilized from the sample in a semi-closed system by bubbling air through the sample.

The airstream containing the mercury vapor is swept through an absorber column that contains hypochlorous acid and hypochlorite ions. The vaporized mercury ions react in the column and form mercuric chloride ($HgCl_2$). The mercuric chloride is then eluted off the column with an acid solution.

The eluate is treated with HgEx™ Reagent 3 to destroy the excess hypochlorous acid and hypochlorite, and to make the solution alkaline. A sensitive indicator (HgEx 4) forms a complex with the mercuric ions, and HgEx 5 maximizes the mercury-indicator reaction, thus increasing the sensitivity of the test. The spectrophotometer is zeroed on this solution at the absorbance peak (412 nm) of the unreacted indicator. HgEx 6 is added to break the mercury-indicator bond. The analyst then measures the absorbance increase of unreacted indicator. This increase is proportional to the amount of mercury in the sample.