

Mercury

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Chem20204

Properties

- ◆ Symbol: Hg
- ◆ Atomic Number: 80
- ◆ Molecular Weight: 200.59 g/mol
- ◆ Melting and Boiling Point: -38.9 and 356.5 degrees Celsius.
- ◆ Description: Silvery, mobile, odorless liquid.



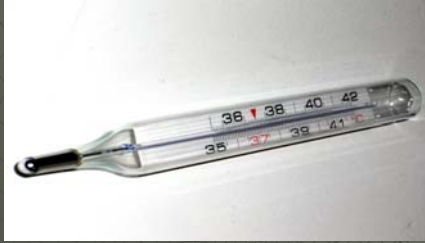
History

- ◆ Used by ancient Chinese, Hindus, and Egyptians, dating from 1500 BC to prolong life and heal fractures.
- ◆ Used by ancient Greeks in ointments and by the Romans in cosmetics
- ◆ By 500 BC mercury was used to make amalgams with other metals by alchemists.

Abundance

- ◆ Rare in the earth's crust with an average crustal abundance by mass of 0.08 ppm.
- ◆ Richest mercury ores contain up to 2.5% mercury by mass, and even the leanest concentrated deposits are at least 0.1% mercury.
- ◆ Most present-day production occurs in Spain, Kyrgyzstan, China and Tajikistan. Over 100,000 tons of mercury were mined from the region of Huancavelica, Peru, over the course of three centuries following the discovery of deposits there in 1563.
- ◆ The metal is extracted by heating cinnabar in a current of air and condensing the vapor. The equation for this extraction is:
$$\text{HgS} + \text{O}_2 \rightarrow \text{Hg} + \text{SO}_2$$

Daily Uses



- ◆ Manufacture of industrial chemicals or for electrical and electronic applications.
- ◆ Thermometers, mercury sphygmomanometers, thimerosal, a preservative in vaccines and tattoo inks, mercury barometers, diffusion pumps, coulometers.
- ◆ Gaseous mercury used in mercury-vapor lamps, neon signs, and fluorescent lamps.
- ◆ Liquid mercury used as a coolant for nuclear reactors. However sodium is proposed for reactors cooled with liquid metal, because the high density of mercury requires much energy for circulating the coolant.

Mercury in the Environment

- ◆ Pre-industrial deposition rates of mercury from the atmosphere range 4 nanograms per liter in the U.S.
- ◆ Volcanic eruptions can increase the atmospheric source by 4–6 times.
- ◆ Mercury enters the environment as a pollutant from various industries such as coal-fired power plants, which are the largest source, accounting for 40% of USA emissions in 1999.
- ◆ Other responsible industrial processes: chlorine, steel, phosphate and gold production; metal smelting; manufacture and repair of weather and electronic devices; incineration of municipal waste streams; and medical applications.
- ◆ Mercury also enters into the environment through the disposal of certain products containing mercury.

Minamata Bay Disaster

- ◆ In Japan, one of the worst industrial disasters was caused by the dumping of mercury compounds into Minamata Bay.
- ◆ Chisso Corporation, a petrochemical company, was found responsible for polluting the bay from 1932 to 1968.
- ◆ It is estimated that over 3,000 people suffered various deformities.
- ◆ Severe mercury poisoning symptoms or death from what became known as Minamata disease.



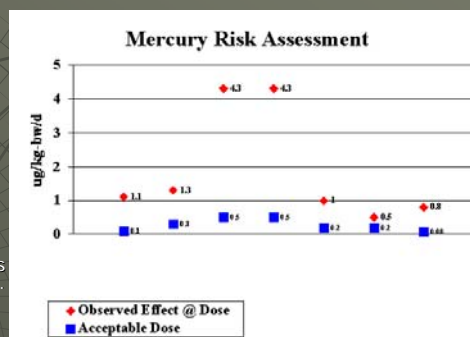
Environmental Effects



- ◆ Methylmercury, a highly toxic organic compound of mercury, incorporated into bodies of fish and shellfish.
- ◆ Sea animals are at greatest risk to mercury exposure. Some species of large fish concentrate mercury more readily than others.
- ◆ The FDA characterizes shrimp, catfish, pollock, salmon, and canned light tuna as low-mercury seafood, although recent tests have indicated that up to 6 percent of canned light tuna may contain high levels.

Health Effects

- ◆ Methylmercury or high levels of elemental mercury can be particularly toxic to unborn or young children.
- ◆ Adults who have been exposed to too much methylmercury may experience various symptoms: trembling hands, numbness in the lips, tongues, fingers or toes.
- ◆ At higher exposures, walking could be affected, as well as vision, speech and hearing. In sufficient quantities, methylmercury can be fatal.
- ◆ The greatest risk, however, is for fetuses and young children because their nervous systems are still developing. They are four or five times more sensitive to mercury than adults.
- ◆ Damage occurring before birth or in infancy can cause a child to be late in beginning to walk and talk and may cause lifelong learning problems.



Regulations of Mercury

- ◆ Organizations such as the U.S. Environmental Protection Agency (EPA) and FDA recommend that pregnant women and young children avoid eating sea food that are at high risk to mercury exposure in large amounts.
- ◆ The World Health Organization, OSHA, and NIOSH all treat mercury as an occupational hazard and have established specific occupational exposure limits.
- ◆ Environmental releases and disposal of mercury are regulated by the EPA in the U.S.



1990 Clean Air Act

- ◆ The United States 1990 Clean Air Act put mercury on a list of toxic pollutants which need to be controlled to the greatest possible extent.
- ◆ Certain industries that emit mercury into the environment must install maximum achievable control technologies.
- ◆ In March, 2005 an EPA rule took power plants off the list of sources which must reduce mercury to the maximum extent.
- ◆ A cap and trade rule was issued in its place, with most of the reductions in mercury pollution from power plants starting in the year 2018.