

Monitoring of Mercury in Hair Samples

Background

People engaged in activities using mercury or consuming food containing mercury such as fish are 'exposed' to mercury. Thus it is essential to monitor the level of human exposure and develop appropriate strategies to address the resulting health impacts. Article 19 of the Minamata Convention on mercury also calls on the parties to cooperate and develop and improve monitoring of mercury and its compounds, particularly in vulnerable populations and environmental biota.

Japanese experience of the Minamata disease in the 1950s, caused by ingestion of methylmercury via contaminated fish, resulted in various groundbreaking research on mercury. Hence, Japan now possesses various technologies related to mercury identification, management and risk reduction.



Source : Website of NIMD

Overview of the Technology

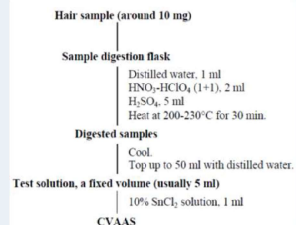
Analysis of Mercury in human bio samples like hair, blood and urine are useful methods for evaluating the level of human exposure and burden to the human body from mercury exposure. Hair is the most suitable media for estimating methylmercury exposure of humans.

However, the mercury concentration in hair can increase as a result of adhesion of external mercury vapor and inorganic mercury. In cases of no exposure to external inorganic mercury or mercury vapor, almost all mercury in hair is in the form of methylmercury; therefore, the level of methylmercury exposure from diet can be evaluated by measuring total mercury. However, since people involved in gold mining and gold refining have a high risk of contamination from metallic mercury and mercury vapor, evaluation of actual methylmercury exposure is possible only by measuring methylmercury as well as total mercury in hair.

The National Institute for Minamata Disease (NIMD), under the Ministry of the Environment, Japan (MOEJ), has carried out multiple researches to develop analytical methods for mercury, and published a "**Mercury Analysis Manual**". Analytical methods for measuring total mercury in hair samples based on this manual is described below. General methods for measuring total mercury include absorption spectrometry (dithizone colorimetry), neutron activation analysis, X-ray fluorescent spectrometry and cold vapor atomic absorption spectrometry (CVAAS). CVAAS is superior to other methods in terms of sensitivity, convenience, and cost-effectiveness. CVAAS is classified into reduction/aeration method and thermal decomposition method according to the generation mode for mercury in the elemental form. The former involves wet digestion with a mixture of strong acids following addition of a reducing agent to generate mercury in the elemental form, whereas the latter involves elemental vapor generation through direct combustion of the sample. Analysis method for hair samples using wet digestion-reduction-cold vapor atomic absorption spectrometry offers substantial improvements over other methods and has been explained in detail in the "Mercury Analysis Manual".

In Japan, data obtained from biomonitoring (including hair samples), is used for implementing various policy measures, aimed at protecting human health. For example, the report: "Advice for Pregnant Women on Fish Consumption and Mercury" has been prepared by the Ministry of Health, Labor and Welfare, which provides a guide on the types and amounts of fish that can be safely consumed.

Determination of total mercury in hair



Source : Mercury Analysis Manual, MOEJ

Apparatus for reduction/aeration



Source : Website of NIMD

Mercury Technology Bulletin Series: Advantages/Strengths

Ease of sampling

Mercury analysis through hair samples is simple, and it is a non-invasive sampling method where samples are also easy to preserve. Since the hair grows at a rate of roughly 1cm per month, evaluation of past exposure is also possible.

Decent tool for policy making and concrete action

For people concerned about their mercury exposure, providing their hair sampling results can be useful to help decision makers formulate policies, and take concrete actions to protect the population from mercury exposure.

Data accuracy

Method developed by NIMD is very useful that can be performed by relatively low-cost equipment and can be obtained a high sensitivity and good accuracy data.

Hair Weighing



Photo provided by IDEA Consultants, Inc.

Applicability

Sampling and analysis of hair samples can be done easily and accurately even outside Japan by following the mercury analysis manual prepared by NIMD.

Measurement using CVAAS



Photo provided by IDEA Consultants, Inc.

Further Reading

National Institute for Minamata Disease – Japan (NIMD)
(<http://www.nimd.go.jp/english/index.html>)

Advice for Pregnant Women on Fish Consumption and Mercury (2005)
(<http://www.mhlw.go.jp/topics/bukyoku/iyaku/syoku-anzen/suigin/dl/051102-1en.pdf>)

*this version has been updated in 2010 – Updated Japanese version is available at
(<http://www.mhlw.go.jp/topics/bukyoku/iyaku/syoku-anzen/suigin/dl/index-a.pdf>)

MOEJ, Mercury Analysis Manual
([http://www.nimd.go.jp/kenkyu/docs/march_mercury_analysis_manual\(e\).pdf](http://www.nimd.go.jp/kenkyu/docs/march_mercury_analysis_manual(e).pdf))

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