

Chemical Analysis day2

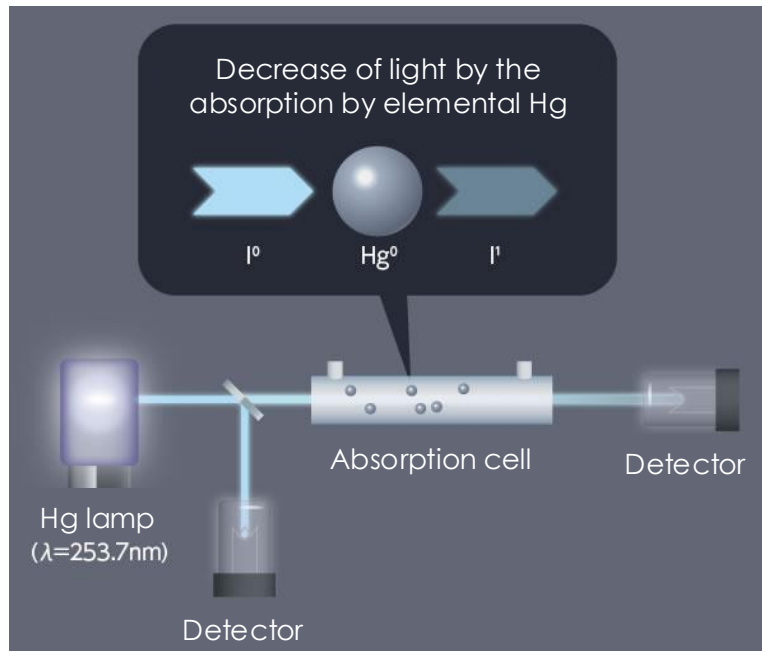
2024/8/1 JSC2024

HOKKAIDO UNIVERSITY, JAPAN

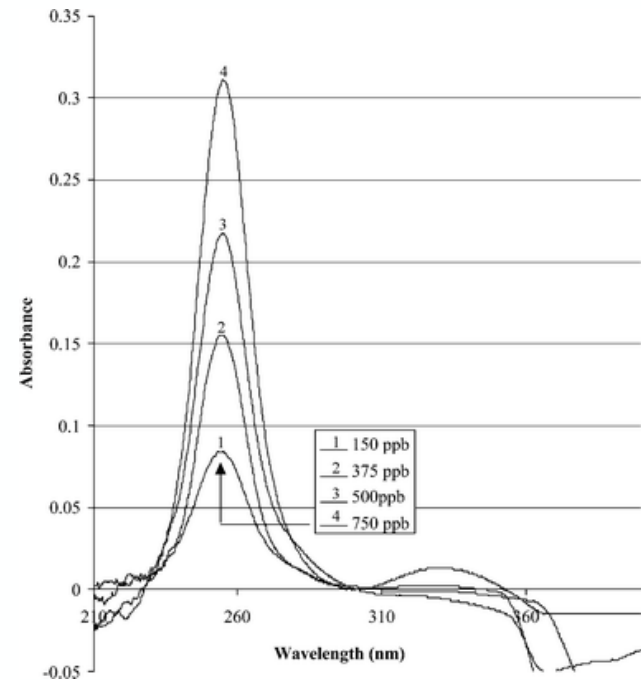
How to "detect" the existence of Hg?

Atomic Absorption Spectrometry (AAS)

- Need to measure specific spectrum of the target element
 - Hg specifically absorbs the light with the wavelength of 253.7 nm
- Peak size correspond with the amount of the element
 - Height of the peak
 - Area of the peak



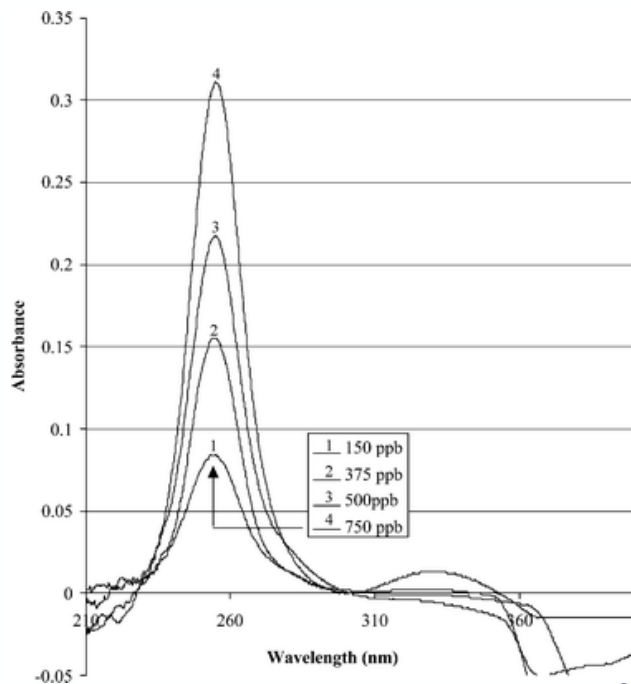
modified from NIC



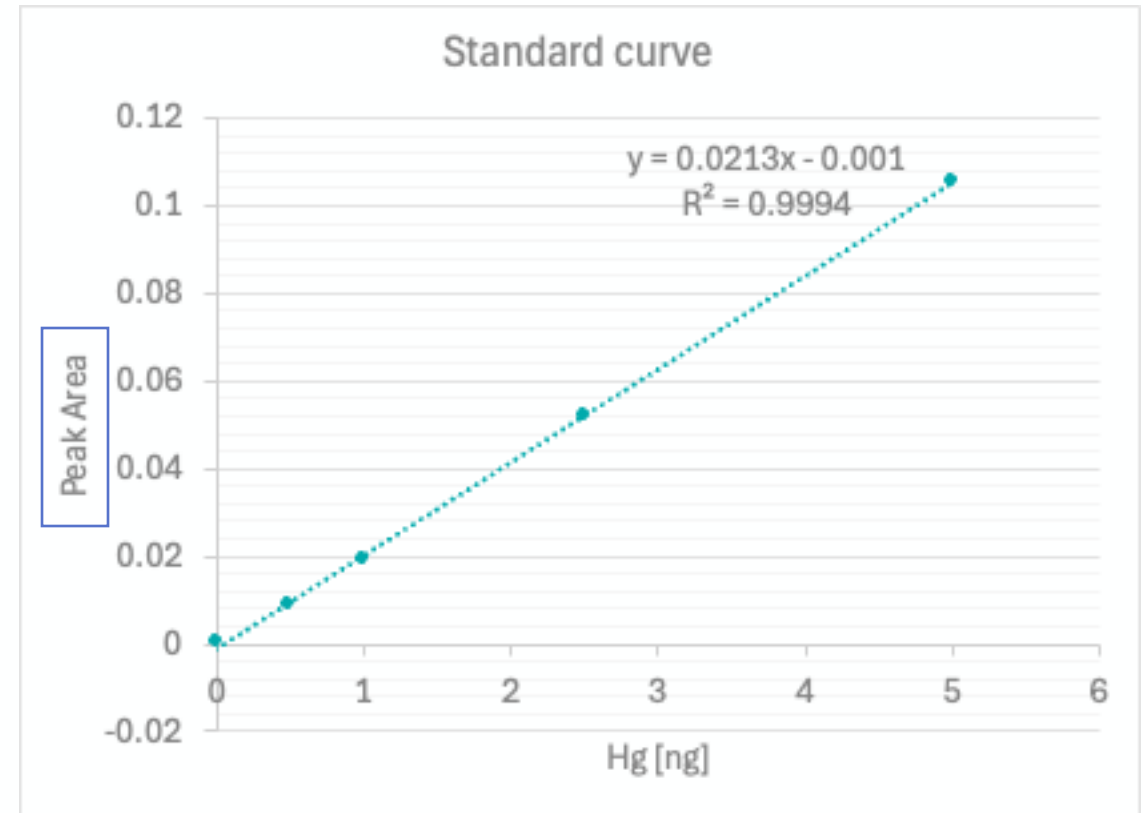
2004, Tao et al.

How to "quantify" the amount of Hg?

- Peak size correspond with the amount of the element
 - Height of the peak
 - Area of the peak



2004, Tao et al.



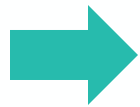
$y = ax + b$
a: slope
b: intercept



[Peak area] = a[Hg amount] + b
a: slope
b: intercept

How to "quantify" the amount of Hg?

$y = ax + b$
a: slope
b: intercept



[Peak area] = a[Hg amount] + b
a: slope
b: intercept



$$y = ax + b$$

a: slope

b: intercept

we need to know "x" value
(x=Hg amount)

$$y - b = ax$$

$$x = (y - b) / a$$

$$[\text{Hg amount}] = ([\text{peak}] - b) / a$$

Unit

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ g} = 1000 \text{ mg}$$

$$1 \text{ mg} = 1000 \mu\text{g} (\text{micro})$$

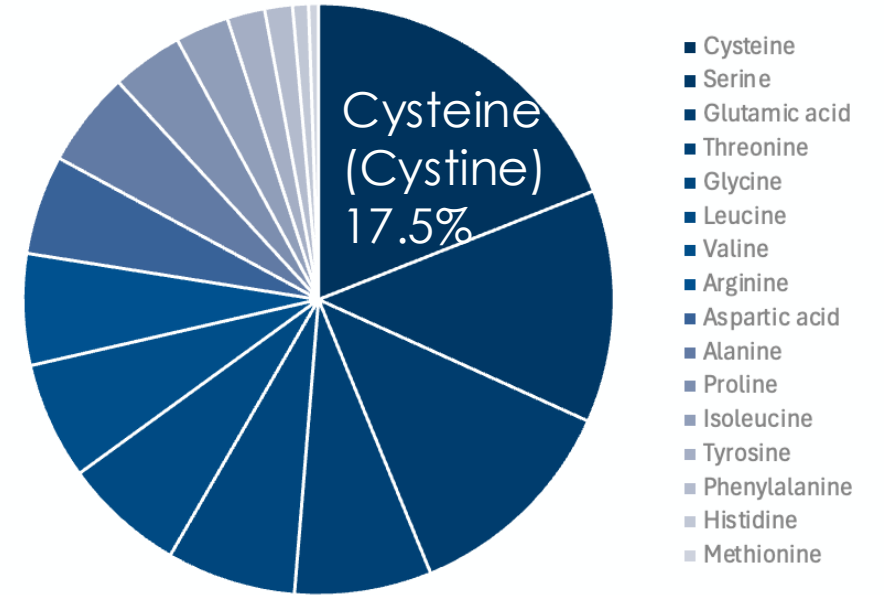
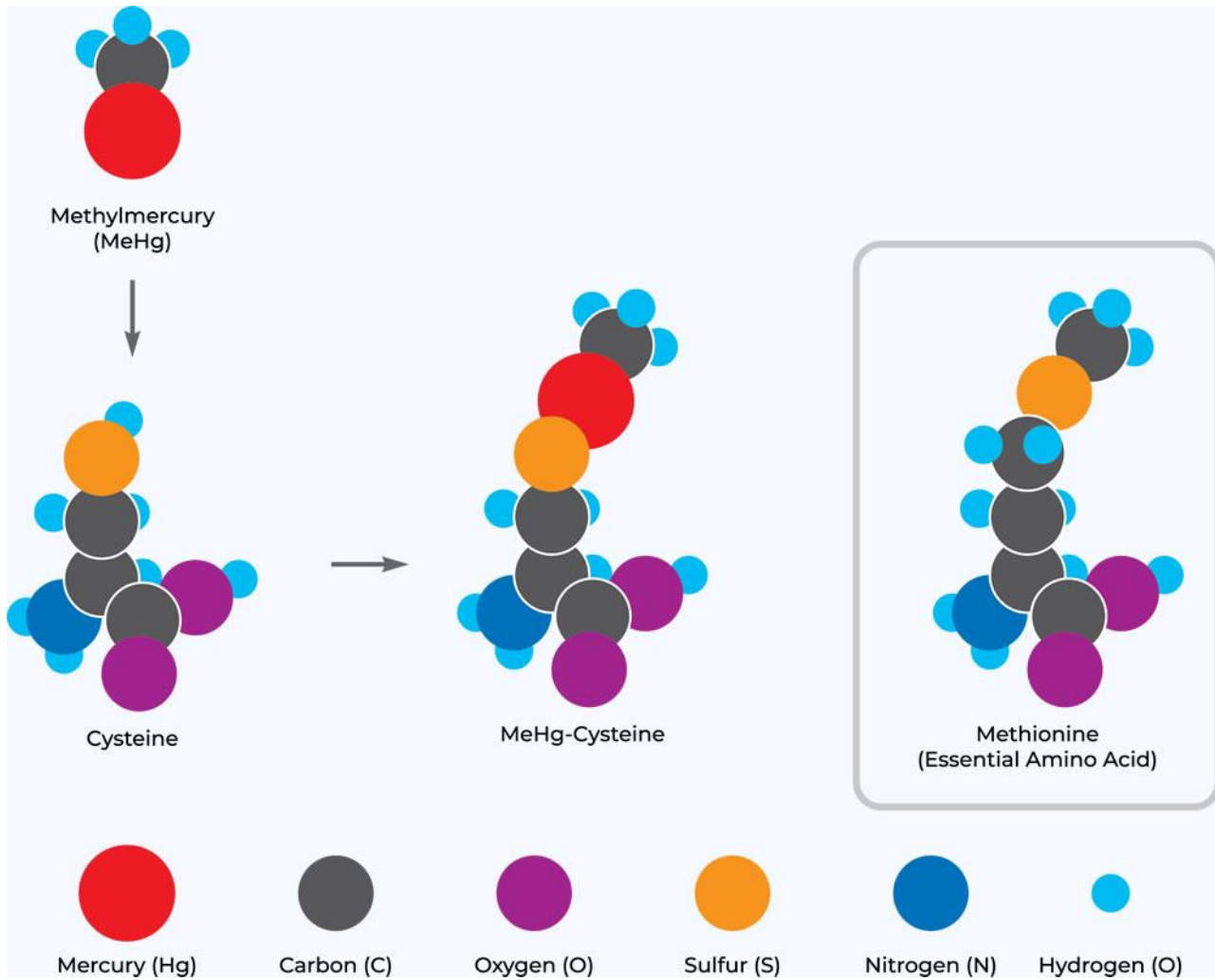
$$1 \mu\text{g} = 1000 \text{ ng} (\text{nano})$$

Let's calculate your result by yourself!

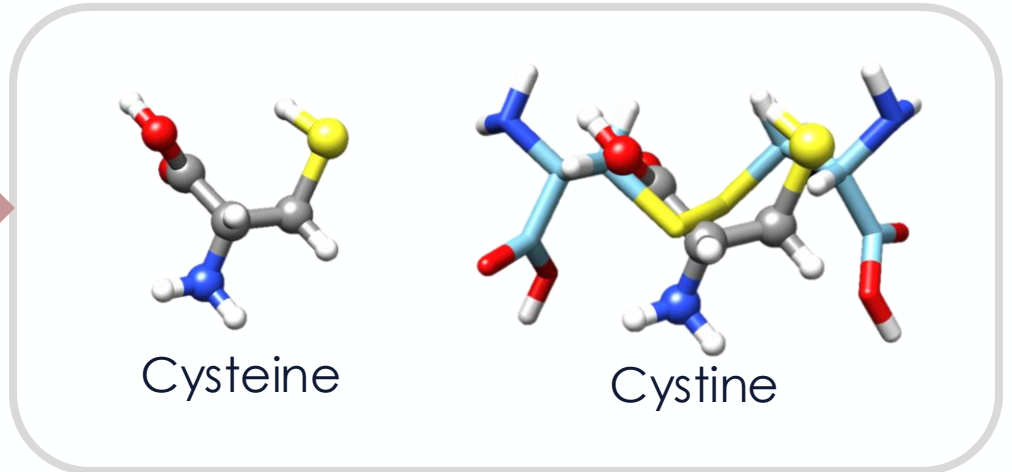


<https://africa.vetmed.hokudai.ac.jp/en/jsc2024.html>

Hg in Hair



Amino acid composition of human hair



Methionine is converted into cysteine/cystine

Hg in Hair

ppm
(mg/g)

50

成人で神経症状出現が疑われる最小値 (WHO1990) Minimum concern level for general population

11

胎児影響が疑われる母親の最小値 (日本2005) Minimum concern level for pregnant women

5

成人に対する耐容摂取量に相当 (日本1973) Tolerable level for general population

2.8

胎児影響を考慮した母親の耐容摂取量に相当 (日本2005) Tolerable level for pregnant women

2.5

男性の平均レベル Average level in men

1.6

女性の平均レベル Average level in women

毛髪水銀レベルの参照値 Reference levels of Hg

“Is it safe to eat seafood?”

<https://www.pref.miyagi.jp/soshiki/shoku-k/suigin.html>

World Health Organization

Home / Publications / Overview / Preventing disease through healthy environments: exposure to mercury: a major public health concern, 2nd ed

8 April 2021 | Publication

Overview

Mercury is highly toxic to human health, posing a particular threat to the development of the child in utero and early in life. It occurs naturally and exists in various forms: elemental (or metallic); inorganic (e.g. mercuric chloride); and organic (e.g., methyl- and ethylmercury). These forms all have different toxicities and implications for health and for measures to prevent exposure. Elemental mercury is a liquid that vaporizes readily. It can stay for up to a year in the atmosphere, where it can be transported and deposited globally. It ultimately settles in the sediment of lakes, rivers or bays where it is transformed into methylmercury, absorbed by phytoplankton, ingested by zooplankton and fish, and accumulates especially in long-lived predatory species, such as shark and swordfish.

Other languages: Arabic | Chinese | French | Portuguese | Spanish

United States Environmental Protection Agency

Mercury

Guidelines for Eating Fish that Contain Mercury

To enjoy the benefits of eating fish while minimizing exposure to mercury, you should:

- Eat mainly types of fish low in mercury; and
- Limit your consumption of types of fish with typically higher levels of mercury.

Fish are important in a healthy diet. They are a lean, low-calorie source of protein. However, some fish may contain mercury or other harmful chemicals at sufficiently high levels to be a concern.

Federal, state and local governments issue fish consumption advisories when fish are unsafe to eat. The advisories may suggest that people avoid eating certain kinds or certain amounts of fish.

News

July 2019 Food and Drug Administration (FDA) Notice. In accordance with a directive from Congress,

厚生労働省

これからママになるあなたへ

お魚について知っておいてほしいこと

お魚はからだに良いものでも妊娠中はちょっと注意が必要

次のページからの注意内容を読み、妊娠期間中に食べるお魚の種類と量とのバランスを考えながら食べましょう。

MHLW Japan
Guidebook for pregnant women
“Vulnerable population”