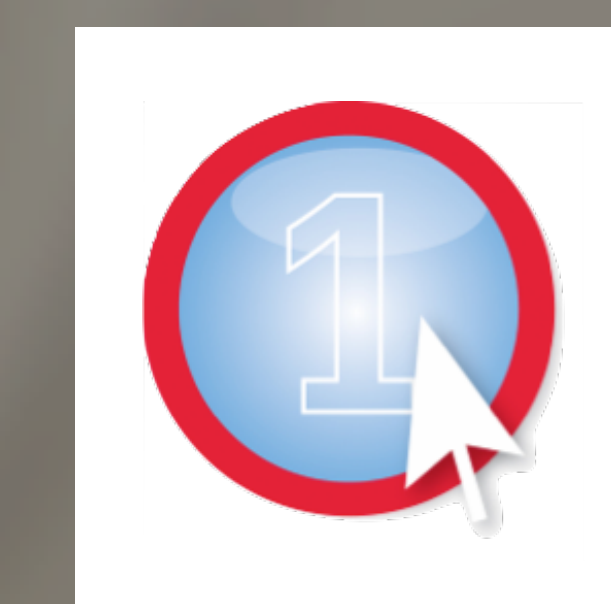




Determining Mercury Content in Fish Oil Capsules Using Inductively Coupled Plasma-Optical Emission Spectrometry



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Introduction

The purpose of this study is to determine whether the three fish oil brands used contained a significant concentration of mercury. Samples of 15,000mg were processed through an Inductively Coupled Plasma Optical Emission Spectroscopy (ICP) to experimentally quantify the projected concentrations of mercury.

What is an ICP?

An ICP uses electrically neutral partially ionized argon gas to excite particles, emitting specific wavelengths of light while relaxing particles to lower energy levels. This wavelength can be quantified to find the concentration of mercury in the fish oil supplements, displayed on a calibration curve. In the case of our experiment, 4 standard solutions of known concentrations of mercury will be used in determining the mercury concentrations found in the samples.¹

Materials

Materials	Quantity
Capsules	
GNC Fish Capsules	10 pills ≈ 15,000mg
Naturemade Capsules	15 pills ≈ 15,000mg
Kirkland Capsules	15 pills ≈ 15,000mg
Chemicals	
Nitric Acid (HNO ₃)	70.4%
Mercury Nitrate Dihydrate Hg ₂ (NO ₃) ₂ · 2H ₂ O	0.0693g
Deionized Water DI-H ₂ O	--
Stock	200ppm Hg ⁺
Standards	
10ppm Hg ⁺	2.5ppm Hg ⁺
5ppm Hg ⁺	1.25ppm Hg ⁺
Machinery and Miscellaneous	
Inductively Coupled Plasma (ICP)	Volumetric Pipets
Fume Hood	Syringe Filter
Orbital Shaker	Analytical Scale
Volumetric Flask, Graduated Cylinder	Buret

Methods

STEPS

- Producing 1L of 2% Nitric Acid Solvent**
70.4% Nitric Acid solution was used to create a 1L dilution of 2% solution. Dilutions were made with D.I. Water.

$$\begin{aligned} & \text{2\% Nitric Acid from 70.4\% Nitric Acid} \\ & (70.4\%)(V_1) = (2\%)(1000\text{ml}) \\ & V_1 \approx 28.409 \text{ ml of 70.4\% Nitric Acid} \end{aligned}$$

- Making Stock Solution**
Required precise measurement of 0.06995g of Mercury Nitrate Dihydrate resulting in actual measurement of 0.0693g with the Analytical scale.

$$\begin{aligned} & \frac{0.200\text{g Hg}^+}{\text{L}} \times \frac{1 \text{ mol Hg}^+}{200.54\text{g}} \times \frac{1 \text{ mol Hg}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}}{2 \text{ mol Hg}^+} \times \\ & \frac{561.2704\text{g}}{1 \text{ mol Hg}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}} = \frac{0.2798\text{g}}{1000\text{mL}} \\ & \frac{0.2798\text{g}}{1000\text{mL}} \times 250\text{mL} = 0.06995\text{g Hg}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O} \end{aligned}$$

- Making Standard Solutions**
Used 200ppm solution to create serial dilutions of the remaining standards.

$$\begin{aligned} & \text{10 ppm Hg}^+ \text{ from 20 ppm Hg}^+ \quad \text{2.50 ppm Hg}^+ \text{ from 5 ppm Hg}^+ \\ & (20\text{ppm})(V_1) = (10\text{ppm})(100\text{ml}) \quad (5\text{ppm})(V_1) = (2.50\text{ppm})(100\text{ml}) \\ & V_1 = 50 \text{ ml} \quad V_1 = 50 \text{ ml} \\ & \text{5 ppm Hg}^+ \text{ from 10 ppm Hg}^+ \quad \text{1.25 ppm Hg}^+ \text{ from 2.50 ppm Hg}^+ \\ & (10\text{ppm})(V_1) = (5\text{ppm})(100\text{ml}) \quad (2.50\text{ppm})(V_1) = (1.25\text{ppm})(100\text{ml}) \\ & V_1 = 50 \text{ ml} \quad V_1 = 50 \text{ ml} \end{aligned}$$

- Prepared Samples for Acid Digestion**
Fish Oil Capsules were scalped, each brand's sample size contained 15,000mg of liquid, for examination and prepared for one week long digestion.

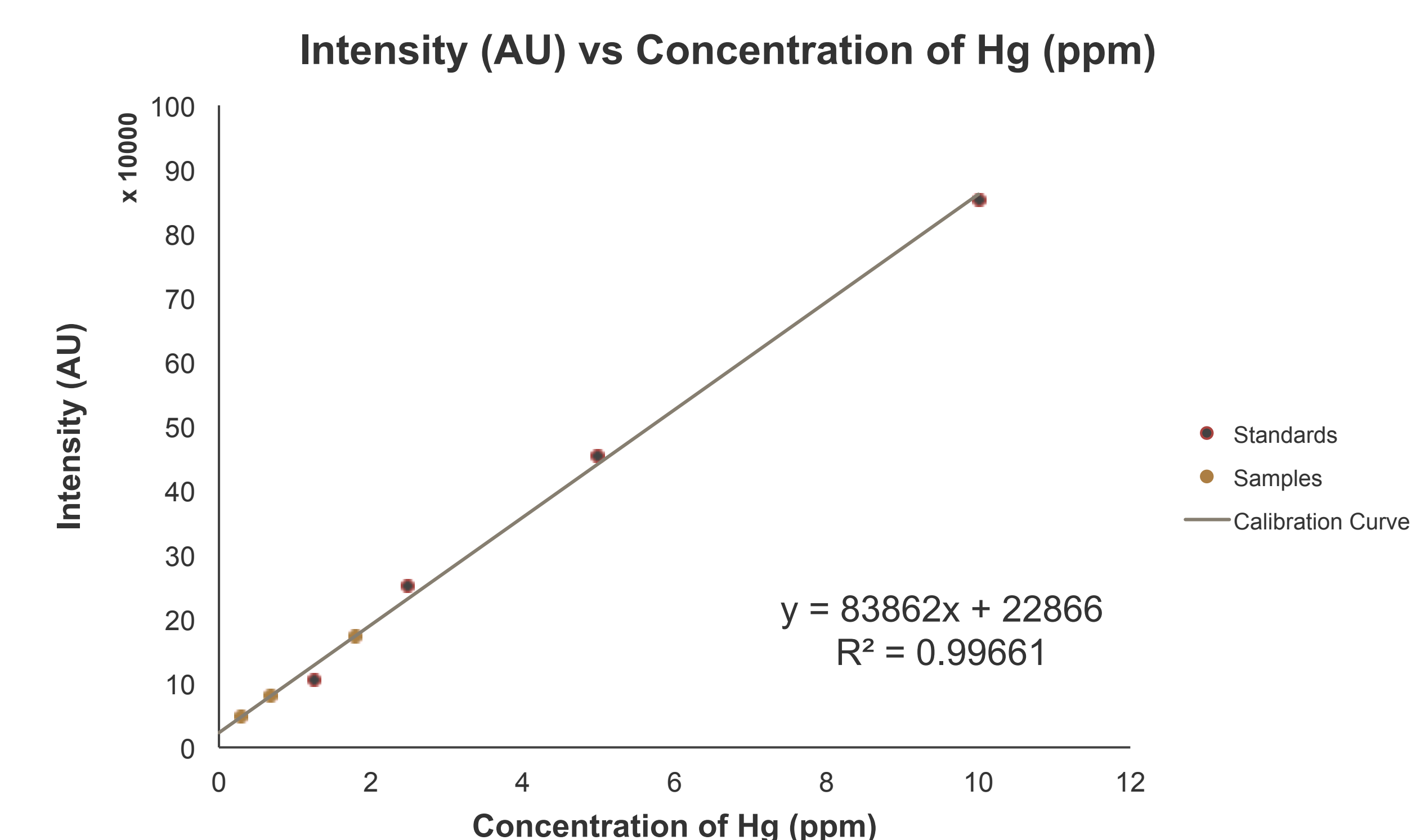
- Spiking and Preparing Samples**
30% Nitric Acid was used for the digestion of the liquid samples. 10mL of the stock solution was added to the spiked sample.

$$\begin{aligned} & \text{30\% Nitric Acid from 70.4\% Nitric Acid} \\ & (70.4\%)(V_1) = (30\%)(1000\text{ml}) \\ & V_1 \approx 63.90.409 \text{ ml of 70.4\% Nitric Acid} \end{aligned}$$

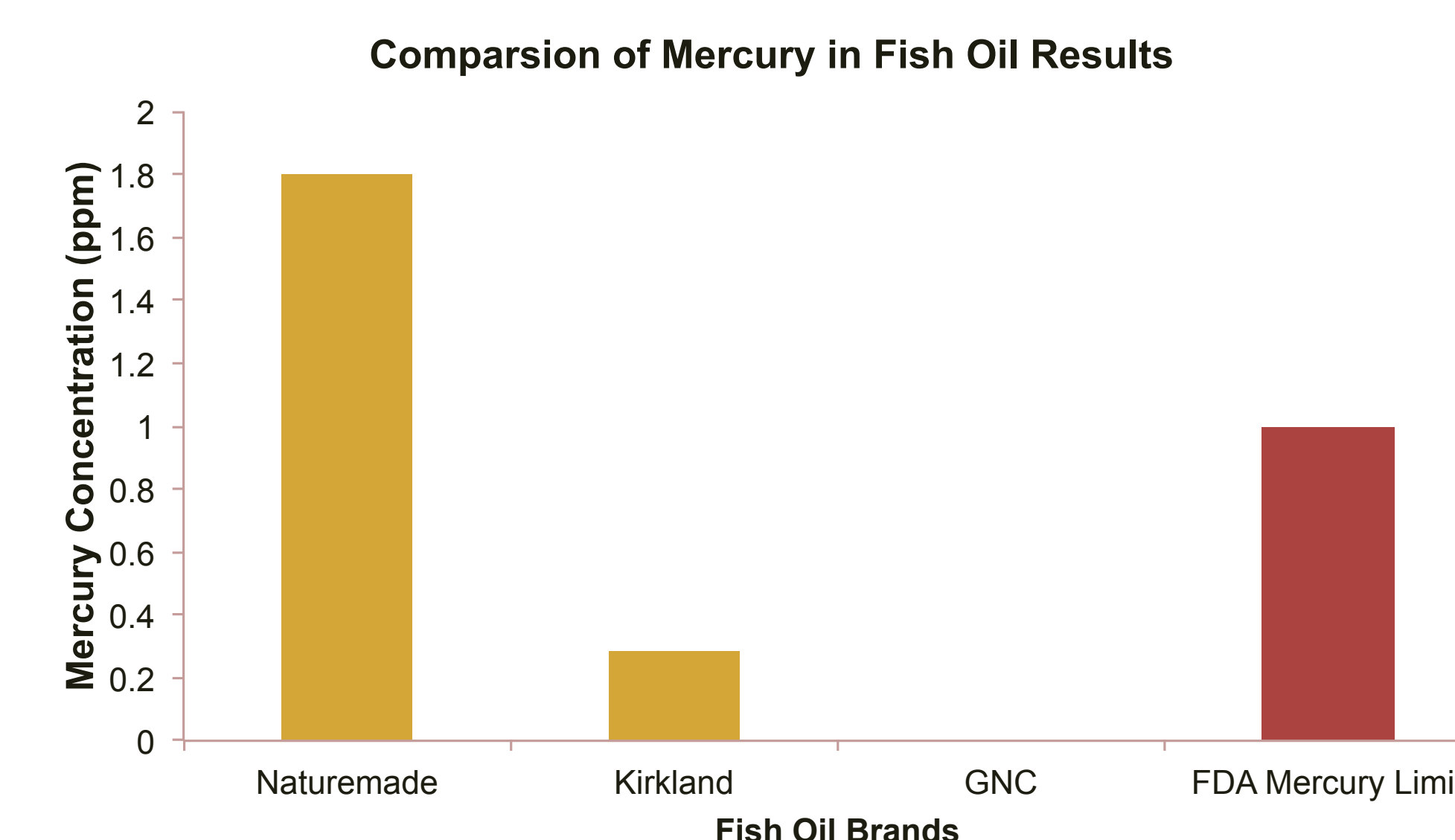
- Filtering Samples**
Filtration of each of the samples was administered using a filtration syringe. Separation of the aqueous and organic layers was done using a buret.

- Calibration Curve of Mercury**
The four standards were run through the ICP to determine an emission intensity, producing a plot of Hg Concentration against the emission intensity (astronomical unit) levels.

Conclusion



The results from ICP show that mercury was detected in each of the samples. Naturemade contained a significant amount mercury.



Brands	Mercury (ppm)
Naturemade	1.799
Kirkland	0.285
GNC	0
FDA Mercury Limit ²	1

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¹O'Connor, A., PhD, ICP (Inductively Coupled Plasma) for the Forensic Determination of Metals. ICP (Inductively Coupled Plasma) for the Forensic Determination of Metals, (accessed 2016).

²U.S. Food and Drug Administration. Mercury In Fish: Cause for Concern? Food and Drug Administration, http://www.fda.gov/ohrms/dockets/ac/02/briefing/3872_advisory_7.pdf (accessed Apr 8, 2016).