

# Method validation for the determination of total mercury in foodstuffs by direct mercury analysis (DMA)

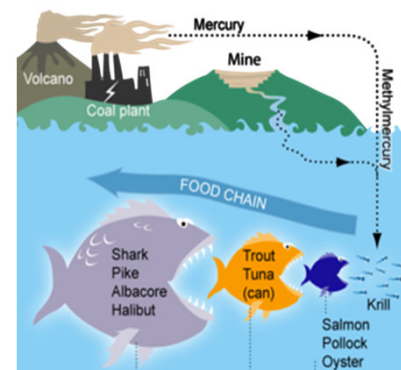


Nascimento, Ana C.<sup>1</sup>; Santiago, Susana<sup>1</sup>; Santos, Mariana<sup>1</sup>  
 Departamento de Alimentação e Nutrição, Instituto Nacional de Saúde Doutor Ricardo Jorge, Lisboa, Portugal  
 \*ana.nascimento@insa.min-saude.pt



## Introduction

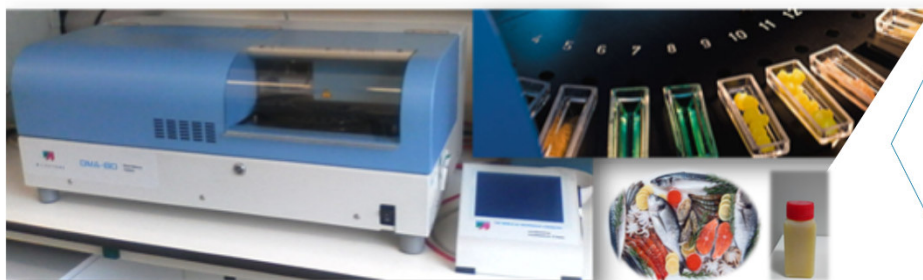
Mercury is a toxic metal with a cumulative effect, which is especially found in water. Once in the environment, mercury can be transformed by bacteria into methylmercury, a more harmful and bioavailable form, which accumulates in the food chain, particularly in fish and shellfish. Monitoring mercury levels is essential for ensuring food safety, namely to protect vulnerable groups, such as pregnant women, due to its potential impact on foetal development and neurological function. The predominance of methylmercury in aquatic food, combined with its known neurotoxicity, highlights the importance of robust and accurate analytical methods for monitoring for effective public health protection.



## Purpose

To validate a method for mercury measurement in food samples, to ensure its accuracy, reliability, and suitability, for applications in food safety, quality control, and regulatory compliance.

## Material and Methods



A method for **total mercury determinations in food matrices** was validated, using a **Direct Mercury Analyser (DMA-80)**, based on thermal decomposition, amalgamation, and atomic absorption spectrometry (AAS).

## Results and Discussion

Two calibration ranges, with two separate calibration curves :

- ✓ 2.5-15 ng
- ✓ 30-1000 ng

Table 1 – Laboratory performance: quality assurance

Limit of detection (LOD)	Limit of quantification (LOQ)	Accuracy ( $\mu\text{g}/\text{Kg}$ )
$\mu\text{g}/\text{kg}$	$\mu\text{g}/\text{kg}$	Certified Value $\pm$ U (i)
1.4	3.8	37.1 $\pm$ 1.3

(i) Nist SRM 1566b Oyster Tissue. National Institutes of Standards and Technology, Gaithersberg, MD, USA.



Trueness, repeatability and intermediate precision (within-laboratory precision) were assessed with certified reference material (CRM), NIST 1566b Oyster Tissue, and interlaboratory comparison tests.

Table 2 – Within-laboratory precision

Trueness	Standard uncertainty ( $\mu\%$ )	
	Repeatability	Intermediate precision
11	5	8

Levels significantly < than maximum levels established by Regulation (EU) 2023/915<sup>1</sup> and close of Tolerable Weekly Intake (TWI), values for mercury established by EFSA.

- **Regulation (EU) 2023/915:** Sets mercury limits of 0.1 mg.Kg-1 for food supplements and salt, 0.3 or 0.5 mg.Kg-1 for most fish, molluscs and bivalves, and 1.0 mg.Kg-1 for large predatory fish.
- **Tolerable Weekly Intake (EFSA):** Sets TWI (amount that can be ingested weekly without causing adverse health effects) for methylmercury (MeHg) and inorganic mercury (Hg): MeHg TWI = 1,3  $\mu\text{g}/\text{kg}$  body weight (bw); Hg TWI: 4  $\mu\text{g}/\text{kg}$  bw.

- ✓ Quality control tools: blanks for contamination checks and two standards measured in each curve, and every experiment, to verify calibration accuracy and instrument stability.
- ✓ CRMs must be within established reference values, and interlaboratory test results must meet a z-score between -2 and 2.
- ✓ Portuguese recommendations for fish consumption: vulnerable groups of the population (pregnant or breastfeeding women and children up to 10 years old): consume species with medium and low mercury levels (4 to 7 servings a week) and avoid the most contaminated species.

## Conclusion

The analytical method is rapid and precise, requires minimal sample preparation, and is suitable for several matrices, with low detection limits and strong analytical performance, making it highly effective for routine mercury determination in food monitoring.

**References:** 1. Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in foodstuffs. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R0915>.