

Development of the First Yerba Mate Certified Reference Material (CRM), A Significant Milestone in the Field of Food Safety Metrology



COLOMBO, Gimena; GEISENBLOSEN, Cecilia; FERREIRA, Elizabeth.
Chemical Metrology Department, Technological Laboratory of Uruguay (LATU). Montevideo, Uruguay.
mgeisenb@latu.org.uy

INTRODUCTION

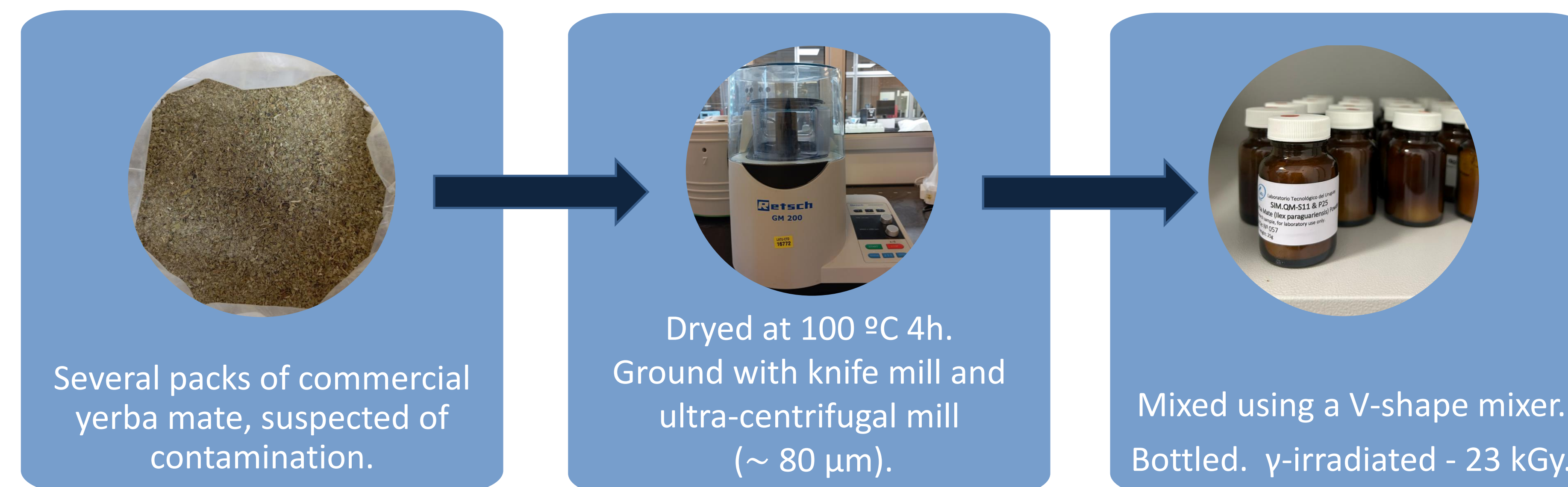
Yerba mate (*Ilex paraguariensis*), a native plant from the subtropical regions of South America (Paraguay, Brazil, Argentina, and Uruguay), is widely consumed as an infusion known as "mate" and is increasingly popular as a tea worldwide. As global demand for yerba mate continues to grow, it is essential to ensure its safety and quality through accurate and reliable measurements. This includes monitoring the mass fractions of potentially harmful elements, such as arsenic (As), cadmium (Cd), and lead (Pb), as well as essential nutrients like sodium (Na) and phosphorus (P), which are crucial for nutritional labeling. Until now, no Certified Reference Material (CRM) has been available for elements in yerba mate. The need for such material is urgent, as it would provide analytical laboratories worldwide with the necessary tools to ensure the reliability of measurements. In response to this, LATU (Technological Laboratory of Uruguay) prepared a batch of candidate samples for a yerba mate CRM using commercial products.

OBJECTIVES

Development of a Certified Reference Material (CRM) of As, Cd, Pb, Na and P in Yerba Mate.

DEVELOPMENT

Production



Homogeneity

Ten bottles were selected: the first one, the last one and the rest by stratified random sampling. The study was carried out according to ISO GUIDE 35:2017, using one-way ANOVA at 95 % level of confidence. Determination of Cd and Pb were evaluated by ID-ICP-SFMS, As by SA-ICP-SFMS and Na and P by SA-ICP-AES in three subsamples per bottle.

Element	F	F-critical
Arsenic	2.20	2.39
Cadmium	0.96	2.39
Sodium	1.67	2.39
Phosphorus	1.75	2.39
Lead	1.01	2.39

ANOVA Estimate	Arsenic	Cadmium	Sodium	Phosphorus	Lead
Within-packet, CV_{wth} :	2.0 %	0.90 %	0.93 %	0.54 %	7.16 %
Between-packet, CV_{btw} :	2.9 %	0.88 %	1.20 %	0.72 %	7.20 %
Total analytical variability, CV:	2.3 %	0.89 %	1.03 %	0.60 %	7.17 %

Short-term stability

To evaluate a possible sample's instability during transportation due to temperature effect, an isochronous study designed for a period of three weeks at 40 °C was carried out. Two randomly selected bottles were removed from the oven each week. Three subsamples were taken from each bottle and analyzed using the same methods employed for homogeneity.

Measurand	Student's t-test		p-value
	Calculated test statistics	Critical value	
Arsenic	0.676	2.571	0.529
Cadmium	1.196	2.571	0.285
Sodium	0.176	2.571	0.867
Phosphorous	1.038	2.571	0.347
Lead	0.604	2.145	0,556

Long-term stability

Long term stability was assessed, using the classical approach, for a period that encompassed the sample dispatch and the completion of the supplementary comparison. Three bottles were randomly selected, from which three subsamples were taken. These subsamples were analyzed using the same methods as those employed for homogeneity

Measurand	Student's t-test		p-value
	Calculated test statistics	Critical value	
Arsenic	1.415	2.776	0.529
Cadmium	0.138	2.365	0.894
Sodium	1.547	2.776	0.197
Phosphorous	1.925	2.365	0.096
Lead	1,081	2.201	0.303

Key Comparison

The CRM candidate was used as a sample in the Supplementary Comparison SIM.QM-S11, titled "Supplementary Comparison for Elements in Yerba Mate (*Ilex paraguariensis*)", organized by LATU. This comparison involved the participation of fifteen National Metrology Institutes (NMIs) and Designated Institutes (DIs), which provided valuable data on the mass fractions of arsenic, cadmium, sodium, and phosphorus in Yerba Mate. Once Draft B is approved, participants will be able to demonstrate their measurement capabilities in this matrix.

CONCLUSION

The study material was found to be sufficiently homogeneous.

The sample showed no significant instability after being exposed to 40 °C for 3 weeks, nor in the long-term study conducted over a period of approximately 4 years.

REFERENCES

International Organization for Standardization.
ISO GUIDE 35:2017 Guidance for characterization and assessment of homogeneity and stability
ISO 17034:2016 General requirements for the competence of reference material Producers