
**Cosmetics — Analytical methods —
Direct determination of traces of
mercury in cosmetics by thermal
decomposition and atomic absorption
spectrometry (mercury analyser)**

*Cosmétiques — Méthodes d'analyse — Dosage direct des traces
de mercure dans les cosmétiques par décomposition thermique et
spectrométrie d'absorption atomique (analyseur de mercure)*





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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 217, *Cosmetics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 392, *Cosmetics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document has been developed in parallel with ISO 23821^[1]. Knowing this, an interlaboratory test using either one or the other method was performed on same tailor-made cosmetic products in order to establish that both methods fulfilled the same requirements (see [Annex B](#)).

Cosmetics — Analytical methods — Direct determination of traces of mercury in cosmetics by thermal decomposition and atomic absorption spectrometry (mercury analyser)

1 Scope

This document specifies an analytical procedure for direct determination of traces of mercury in finished cosmetic products by thermal decomposition – atomic absorption spectrometry (mercury analyser).

This document aims to provide a procedure of quantification of mercury traces in cosmetic products that consumers can be exposed to in their usage. This method describes the determination of mercury traces in cosmetics by direct solid analysis with no need of prior digestion. Total mercury (both inorganic and organic species) can be quantified either in solid or liquid samples.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

validation range

range from the upper to the lower concentration of samples used for the method evaluation

3.2

validated range

range of concentrations between the upper and lower levels that the method performance has been demonstrated to be compliant with the method requirements

Note 1 to entry: The validated range shall not be confused with the *validation range* (3.1); it can be smaller.

4 Principle

The described method uses integrated instruments allowing mercury traces quantification. Samples are weighed with no need of any chemical sample preparation as they are thermally decomposed in the instrument (burned or ashed) in an oxygen flow at high temperature (between 650 °C and 900 °C). The combustion gases travel through a catalyst tube set at about 615 °C. This step ensures conversion of interfering components to forms that do not interfere and that are subsequently flushed. The resulting mercury vapour is enriched on a downstream gold amalgamator and is then released as atomic vapour by rapid heating of the amalgamator at a temperature of 800 °C to 900 °C. The atomic vapour

is passed through a measuring cuvette system. The quantification occurs thanks to absorption at 253,7 nm. A wide dynamic range may be achieved by simultaneously passing mercury vapours through measurement cells of different lengths.

5 Reagents

WARNING — The use of this document can involve hazardous materials, operations and equipment. This document does not address all the safety risks associated with its use. It is the responsibility of the analyst to take all appropriate measures for ensuring the safety and health of the personnel prior to application of the document.

5.1 Water, conforming to Grade 1 of ISO 3696 (conductivity below $0,1 \mu\text{S}\cdot\text{cm}^{-1}$ at 25 °C).

5.2 Hydrochloric acid, minimum mass fraction $w = 30 \%$, density = 1,15 g/ml, suitable for elemental analysis.

5.3 Diluted hydrochloric acid, produced by mixing hydrochloric acid (5.2) with ultrapure water (5.1) at a ratio of approximately 1+9 parts, respectively.

5.4 Diluted nitric acid, prepared by diluting nitric acid of minimum mass fraction $w=60 \%$, density = 1,15 g/ml, suitable for ICP-MS with pure water (5.1) at a ratio of 1+9 respectively.

If diluted nitric acid^[2] is chosen to dilute the analyte stock solutions, it is recommended to add L-cysteine at 0,1 g/l^[3].

5.5 Analyte standard stock solutions (mercury), 1 000 $\mu\text{g}/\text{ml}$ (commercially available).

5.6 Analyte standard stock solutions (mercury), 10 $\mu\text{g}/\text{ml}$ [commercially available or freshly prepared by dilution in the same dilution medium as calibration solutions (5.3 or 5.4) of a more concentrated solution for example at 1 000 $\mu\text{g}/\text{ml}$ such as 5.5].

Analyte standard stock solutions 5.5 or 5.6 can be used for this document according to their availability on the local market. Recommendations from the supplier of stock solutions regarding stability (expiry date and storage conditions) shall be followed to avoid mercury loss.

6 Apparatus and equipment

All apparatus and equipment that come into direct contact with samples or solutions should be pre-cleaned with diluted hydrochloric acid (5.3) and rinsed with ultrapure water (5.1) to ensure the lowest analytical background. To prevent contamination and adsorption, do not use laboratory materials made up of borosilicate glass. The use of diluted nitric acid (5.4) is also permitted. To check the efficiency of the cleaning step, a blank measurement can be performed prior to the analytical sequence.

Elemental mercury analyser with instrument control unit and sample containers made of suitable materials (e.g. nickel, quartz glass or ceramic) are used. The sample containers usually have a capacity of approximately 500 mg of solid sample or 500 μl , 1 000 μl and 1 500 μl of liquids. Mercury analysers are equipped with an element-specific lamp for mercury. The mercury line of 253,7 nm is used.

Many instruments from several brands are available on the market and often marketed as “mercury analysers”. The list of instruments that have been used for the interlaboratory test validating this document is given in [Annex A](#).