
**Cigarettes — Determination of
benzo[a]pyrene in cigarette mainstream
smoke — Method using gas
chromatography/mass spectrometry**

*Cigarettes — Dosage du benzo[a]pyrène dans le courant principal de la
fumée de cigarettes — Méthode par couplage de chromatographie en
phase gazeuse/spectrométrie de masse*



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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22634 was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*.

Introduction

Between 1999 and 2003, a task force composed of CORESTA¹⁾ members has studied the existing methodologies for the determination of benzo[a]pyrene (B[a]P) in the mainstream smoke of cigarettes. Several methods have been proposed for this determination, which mainly are based on two types of analytical methodology: HPLC²⁾ with fluorescence detection and GC-MS³⁾. In both cases, it is necessary to purify the smoke condensate extract before performing the chromatography in order to obtain a correct separation of the B[a]P peak.

The task force decided in the first instance to develop a method using HPLC with fluorescence detection. However, after several collaborative experiments it appeared that achieving a significant reduction of the initially observed variability would be technically very difficult. The task force then decided to investigate a GC-MS method as an alternative and was able to demonstrate through collaborative experiments, that a lower variability can be obtained with this methodology.

This International Standard, produced through collaborative experiments involving many laboratories in many countries, provides an optimized procedure for the determination of benzo[a]pyrene in cigarette mainstream smoke. The repeatability and reproducibility of this method have been assessed according to ISO recommendations and are included.

No machine smoking regime can represent all human smoking behaviours:

- it is recommended that cigarettes also be tested under conditions of a different intensity of machine smoking than those specified in this International Standard;
- machine smoking testing is useful to characterize cigarette emissions for design and regulatory purposes, but communication of machine measurements to smokers can result in misunderstandings about differences in exposure and risk across brands;
- smoke emission data from machine measurements may be used as inputs for product hazard assessment, but they are not intended to be nor are they valid measures of human exposure or risks. Communicating differences between products in machine measurements as differences in exposure or risk is a misuse of testing using ISO standards.

1) CORESTA: Cooperation Centre for Scientific Research Relative to Tobacco.

2) High performance liquid chromatography.

3) Gas chromatography-mass spectrometry.

Cigarettes — Determination of benzo[a]pyrene in cigarette mainstream smoke — Method using gas chromatography/mass spectrometry

1 Scope

This International Standard specifies a method for the determination of benzo[a]pyrene (B[a]P) in the total particulate matter of cigarette mainstream smoke.

This method is specified using ISO 3308 smoking parameters, but is technically compatible with other smoking regimes.

2 Normative references

The following referenced documents are indispensable for the application 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 3308, *Routine analytical cigarette-smoking machine — Definitions and standard conditions*

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

ISO 4387 + ISO 4387:2000/Amd.1:2008, *Cigarettes — Determination of total and nicotine-free dry particulate matter using a routine analytical smoking machine*

ISO 8243, *Cigarettes — Sampling*

3 Principle

- Sampling of the test cigarettes.
- Conditioning of the test cigarettes.
- Smoking of the test cigarettes according to the smoking procedure specified in ISO 4387.
- Extraction of the total particulate matter, collected on the glass-fibre filter pad, with methanol.
- Dilution of the methanol extract with water.
- Elution of the water/methanol solution through a Cyclohexyl Solid Phase Extraction (CH SPE) cartridge, followed by the elution of B[a]P with cyclohexane.
- Analytical determination of B[a]P by gas chromatography/mass spectrometry.

4 Apparatus

Usual laboratory apparatus and equipment and in particular the following items.