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BSI Standards Publication

**Cigarettes — Determination of selected volatile organic compounds in the mainstream smoke of cigarettes — Method using GC/MS**

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## National foreword

This British Standard is the UK implementation of ISO 21330:2018.

The UK participation in its preparation was entrusted to Technical Committee AW/40, Tobacco and tobacco products.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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## **Cigarettes — Determination of selected volatile organic compounds in the mainstream smoke of cigarettes — Method using GC/MS**

*Cigarettes — Dosage de composés organiques volatils  
sélectionnés dans le courant principal de la fumée de cigarette —  
Méthode par CG-SM*



Reference number  
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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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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

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](http://www.iso.org/members.html).

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## Introduction

The CORESTA ([www.coresta.org](http://www.coresta.org)) Special Analytes Sub-Group (since 2017 the Sub-Group changed its name to Smoke Analytes) carried out a collaborative study in 2005 to compare smoke analyte yield data obtained from different laboratories using their own preferred methodologies. This study have shown significant and unacceptable differences in volatiles yields, especially for 1,3-butadiene and acrylonitrile and suggested that further work was required to understand factors influencing the yield variability. Key parameters of existing methodologies have been reviewed and further studies have been carried out on selected volatiles between 2008[1] and 2009[2]. These studies investigated critical method steps that required optimization before incorporation into a CORESTA Recommended Method (CRM).

These studies have shown that similar yields were obtained when comparing data from Tedlar bag trapping with those from cooled impinger traps, the latter method being used by the majority of laboratories. It has been decided that the CRM would be based on collecting the selected volatiles from mainstream cigarette smoke in cryogenically cooled impinger traps containing methanol. The impinger solutions were fortified with benzene-D<sub>6</sub> and analysed by gas chromatography/mass spectrometry (GC-MS).

This document was produced after a 2009 collaborative study involving 20 laboratories from 12 countries using the ISO 3308 smoking regime[2]. Further data were provided for the same selected volatile substances from 10 samples with different tar yields from a 2012 collaborative study, which involved 16 laboratories from 11 countries[3]. The method includes recommendations about critical steps that should be controlled to provide data as robust and consistent as the repeatability and reproducibility data provided in the ISO standard. Statistical evaluations carried out according to ISO 5725-1 and ISO 5725-2 are included.

No machine smoking regime can represent all human smoking behaviour.

- It is recommended that cigarettes also be tested under conditions of a different intensity of machine smoking than those specified in this document.
- 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 as 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.

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# Cigarettes — Determination of selected volatile organic compounds in the mainstream smoke of cigarettes — Method using GC/MS

**WARNING** — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of any other restrictions prior to use.

## 1 Scope

This document specifies a method for the quantification of selected volatile organic compounds (VOCs: 1,3-butadiene, isoprene, acrylonitrile, benzene and toluene) by GC-MS in mainstream cigarette smoke using ISO 3308 smoking parameters.

This method is applicable to cigarettes with nicotine-free dry particulate matter (NFDPM) yields between 1 mg/cigarette and 15 mg/cigarette.

## 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 3308, *Routine analytical cigarette-smoking machine — Definitions and standard conditions*

ISO 3402, *Tobacco and tobacco products — Atmosphere for conditioning and testing*

ISO 8243, *Cigarettes — Sampling*

## 3 Terms and definitions

No terms and definitions are listed in this document.

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 <http://www.electropedia.org/>

## 4 Principle

Selected volatiles are collected by passing the mainstream smoke of cigarettes through a glass fibre filter pad as specified in ISO 3308 (e.g. Cambridge filter pad, CFP) into cryogenic traps containing methanol.

The impinger solutions are fortified with internal standard and analysed by GC-MS.

## 5 Apparatus

The usual laboratory apparatus for use in preparation of samples, solutions and standards and, in particular, the following: