



BSI Standards Publication

**Essential oils of bergamot, lemon, bitter orange
and lime, fully or partially reduced in bergapten —
Determination of bergapten content by high-
performance liquid chromatography (HPLC)**

National foreword

This British Standard is the UK implementation of ISO 7358:2021.

The UK participation in its preparation was entrusted to Technical Committee AW/54, Essential oils.

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

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2021
Published by BSI Standards Limited 2021

ISBN 978 0 539 12508 5

ICS 71.100.60

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2021.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

INTERNATIONAL
STANDARD

ISO
7358

Second edition
2021-05-25

**Essential oils of bergamot, lemon,
bitter orange and lime, fully or
partially reduced in bergapten —
Determination of bergapten
content by high-performance liquid
chromatography (HPLC)**

*Huiles essentielles de bergamote, de citron, de bigarade et de
limette complètement ou partiellement privées de bergaptène —
Détermination de la teneur en bergaptène par chromatographie
liquide à haute performance (CLHP)*



Reference number
ISO 7358:2021(E)

© ISO 2021



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principle	1
5 Reagents	1
6 Apparatus	2
6.1 Common laboratory equipment.....	2
6.2 HPLC system.....	3
7 Sample preparation	3
8 Procedure	3
8.1 Operating conditions.....	3
8.2 Determination.....	3
8.2.1 HPLC in normal phase.....	3
8.2.2 HPLC in reversed phase.....	5
9 Calculation — Normal phase or reversed phase HPLC	6
9.1 Internal standard method.....	6
9.2 External standard method.....	7
10 Precision — Repeatability	7
11 Test report	7
Annex A (informative) Typical chromatogram of the reference substances using high-performance liquid chromatography (HPLC) of reference compounds in reversed phase	9
Annex B (informative) Bergapten UV-Vis spectrum	10
Bibliography	11

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).

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).

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

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 54, *Essential oils*.

This second edition cancels and replaces the first edition (ISO 7358:2002), which has been technically revised.

The main change to the previous edition is as follows:

- the addition of an alternative method using a reversed phase column.

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.

Essential oils of bergamot, lemon, bitter orange and lime, fully or partially reduced in bergapten — Determination of bergapten content by high-performance liquid chromatography (HPLC)

1 Scope

This document specifies a high-performance liquid chromatographic (HPLC) method, using either an internal standard or external standard, for the determination of the bergapten content in essential oil of bergamot [*Citrus aurantium* ssp. *bergamia* (Risso et Poit.) Wight et Arn. ex Engl.], in essential oil of lemon [*Citrus limon* (L.) Burm. f.], in essential oil of bitter orange (*Citrus bigaradia* Risso) and in essential oil of lime [*Citrus aurantiifolia* (Christm.) Swingle and *Citrus latifolia* Tanaka], all of them fully or partially reduced in bergapten.

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 356](#), *Essential oils — Preparation of test samples*

[ISO 8432](#), *Essential oils — Analysis by high performance liquid chromatography — General method*

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

The bergapten contents of test samples to be measured are determined after dilution by reversed phase HPLC or by normal phase HPLC with gradient elution, using an internal standardization method or an external standardization method and diode-array UV spectrometric detection.

5 Reagents

Use only the following reagents of recognized analytical grade.

5.1 Reference substance: bergapten (5-Methoxypsoralen), $C_{12}H_8O_4$, MW = 216,19 g/mol of known purity ≥ 95 %.

5.2 Internal standard: coumarin (1-Benzopyran-2-one), $C_9H_6O_2$, MW = 146,14 g/mol of known purity ≥ 98 %.

5.3 Solvents.

5.3.1 Solvents for normal phase HPLC.

5.3.1.1 Chloroform, of analytical purity, containing less than 2 % (volume fraction) of ethanol, for use in preparing the sample of essential oil containing the bergapten and internal standard as well as the mobile phase.

5.3.1.2 Hexane, HPLC grade, for use in the mobile phase ([5.3.1.4](#)).

5.3.1.3 Ethyl acetate, HPLC grade, for use in the mobile phase ([5.3.1.4](#)).

5.3.1.4 Mobile phase. Use solvents of a quality compatible with the detection system and prepare sufficient quantities for the complete analysis. Mix, for example, one of the following:

5.3.1.4.1 Hexane ([5.3.1.2](#)) and **ethyl acetate** ([5.3.1.3](#)), mixed in proportions of 80:20 by volume.

5.3.1.4.2 Hexane ([5.3.1.2](#)) and **chloroform** ([5.3.1.1](#)), mixed in proportions of 85:15 by volume.

5.3.2 Solvents for reversed phase HPLC. The solvent used for the mobile phase is a ternary mobile phase prepared with these three solvents as described in [Table 1](#) (see [8.2.2.3](#)).

5.3.2.1 HPLC grade **distilled water**, to be used in the mobile phase ([5.3.1.4](#)).

5.3.2.2 HPLC grade **acetonitrile**, to be used in the mobile phase ([5.3.1.4](#)).

5.3.2.3 HPLC grade **methanol**, to be used in the mobile phase ([5.3.1.4](#)).

5.3.2.4 Dilution solvent, mixture of **methanol** ([5.3.2.3](#)) and **acetonitrile** ([5.3.2.2](#)) in proportions of 80:20 by volume.

6 Apparatus

Use the usual laboratory apparatus and, in particular, the following.

6.1 Common laboratory equipment

6.1.1 Volumetric flasks: 100 ml, 50 ml, 10 ml.

6.1.2 Pasteur pipettes; volumetric pipettes: 1 ml, 5 ml, 10 ml and 20 ml; **micropipette:** 500 µl.

6.1.3 Single-use syringes.

6.1.4 PTFE filter: 0,45 µm.

6.1.5 Vials for HPLC injection.

6.1.6 Precision balance.

6.2 HPLC system

6.2.1 Liquid chromatograph.

6.2.2 Column for HPLC in normal phase, made of stainless steel, of length between 150 mm and 250 mm, having an internal diameter between 4 mm and 5 mm and packed with a stationary phase consisting of granulated silica of HPLC quality, with a grain size of approximately 5 µm.

6.2.3 Column for HPLC in reversed phase, made of stainless steel, of length 150 mm (or 250 mm), having an internal diameter 4,6 mm and packed with a stationary phase C18 type with a grain size of approximately 3,5 µm (or 5 µm), for example Zorbax Eclipse Plus¹⁾ C:18: 3,5 µm (4,6 × 150) mm agilent.

6.2.4 A ternary pump system enabling programmed solvent gradients.

6.2.5 Solvent degassing system (optional), for example ultrasonic tank.

6.2.6 Detection system, adjustable to wavelengths of 254 nm or 312 nm, diode-array UV spectrometric detection system.

6.2.7 Recorder and (optional) **integrator**, suitable for this HPLC system.

7 Sample preparation

Prepare the test sample as specified in [ISO 356](#).

Dissolve any solid deposit by moderate heating.

8 Procedure

8.1 Operating conditions

Adjust the flow rate of the mobile phase ([5.3.1.4](#)) so as to obtain good separation of the peaks corresponding to bergapten and coumarin from other essential oil components detectable by the UV detector ([6.2.6](#)). The flow rate is typically between 1 ml/min and 1,5 ml/min.

Follow the procedure specified in [ISO 8432](#).

8.2 Determination

8.2.1 HPLC in normal phase

8.2.1.1 Internal standard method

8.2.1.1.1 Optimization of HPLC chromatographic conditions in normal phase

8.2.1.1.1.1 Separation

Verify that the bergapten is well separated from the other constituents of the essential oil in the chromatograms obtained. Next, verify that the internal standard, coumarin ([5.2](#)), does not mask or coincide with any constituent of the essential oil. Determine the retention times of the bergapten and coumarin.

1) Zorbax Eclipse Plus is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

8.2.1.1.1.2 Quantity of internal standard

The amount of coumarin (internal standard) added to the sample is considered suitable when the peak areas for the bergapten (in the essential oil) and the coumarin are approximately equal in the chromatograms. To determine this amount, inject a solution (e.g. 10 µl) containing a given amount (e.g. 10 mg) of coumarin (5.2) dissolved in chloroform (5.3.1.1, e.g. 10 ml) into the HPLC. Then inject the same volume of a solution of the essential oil analyte diluted in chloroform (5.3.1.1). Adjust the mass concentrations of both of these solutions so as to obtain comparable peak areas.

8.2.1.1.2 Response factor K

Prepare a calibration solution as follows. In a volumetric flask (6.1.1) of suitable volume, weigh, to the nearest 0,1 mg, about 20 mg of coumarin (5.2). In the same volumetric flask, weigh, to the nearest 0,1 mg, about 10 mg of bergapten (5.1) and dissolve both compounds in approximately 20 ml of chloroform (5.3.1.1).

Inject a suitable amount (see 8.2.1.1) of the calibration solution so as to remain within the detector sensitivity range.

Measure the peak areas of the chromatogram. A typical chromatogram of the reference substances is given in Annex A, Figure A.1, and the absorbance spectrum of bergapten is given in Annex B, Figure B.1.

Calculate the response factor K using Formula (1):

$$K = \frac{m_R \cdot A_{IS}}{m_{IS} \cdot A_R} \quad (1)$$

where

- m_R is the mass, expressed in milligrams, of bergapten (reference substance) (5.1) added to the solution;
- m_{IS} is the mass, expressed in milligrams, of coumarin (internal standard) (5.2) added to the solution;
- A_R is the peak area, expressed in integrator units, corresponding to bergapten (reference substance) (5.1);
- A_{IS} is the peak area, expressed in integrator units, corresponding to coumarin (internal standard) (5.2).

NOTE In ISO 8432 this formula is equivalent to the following:

$$K = \frac{m_R A_E}{m_E A_R}$$

where

- m_R is the mass, expressed in milligrams, of bergapten (reference substance) (5.1) added to the solution;
- m_E is the mass, expressed in milligrams, of coumarin (internal standard) (5.2) added to the solution;
- A_R is the peak area, expressed in integrator units, corresponding to bergapten (reference substance) (5.1);
- A_E is the peak area, expressed in integrator units, corresponding to coumarin (internal standard) (5.2).

8.2.1.1.3 Determination of bergapten

In a volumetric flask (6.1.1) of suitable volume (e.g. 15 ml) prepare the test solution. Weigh, to the nearest 0,1 mg, a suitable amount of coumarin (m_{IS}) (approximately 10 mg), as determined in 8.2.2.1, and a portion of the essential oil (m_S) so as to obtain a chromatogram with equal peak areas for bergapten and coumarin.

Add chloroform (5.3.1.1, approximately 8 ml) and shake carefully to dissolve the coumarin.

It can be necessary to prepare several dilutions of the test solution to obtain a chromatogram with comparable peak areas for bergapten and coumarin because the bergapten content in the essential oils is unknown (fully or partially reduced in bergapten). Choose the volume of the volumetric flask, the quantities of coumarin and the volume of chloroform so as to meet this requirement.

Using the same HPLC operating conditions established in [8.2.1.1.1](#), inject a suitable amount of the test solution so as to remain within the detector sensitivity range.

Measure the peak areas of the chromatogram.

Measure and record the peak areas of the chromatogram corresponding to bergapten (A_x) and coumarin (A_{IS}).

8.2.1.2 External standard method

Follow the procedure for the external standard method as specified in [ISO 8432](#).

8.2.2 HPLC in reversed phase

8.2.2.1 Preparation of the reference solutions for calibration

8.2.2.1.1 General

For each calibration, use the stock solutions of bergapten and coumarin to prepare the standard solution. Store the standard solution in a cool place at 4 °C.

8.2.2.1.2 Stock solutions

As accurately as possible weigh 50 mg of bergapten into a 100 ml flask and make up to volume with the dilution solvent. Homogenize the solution then leave it for 3 min in the ultrasonic bath to get stock solution. This stock solution contains almost exactly 500 mg/l of bergapten.

As accurately as possible weigh 50 mg of coumarin into a 50 ml flask and make up to volume with the elution solvent. Homogenize the solution then leave it for 3 min in the ultrasonic bath to get stock solution. This solution contains almost exactly 1 000 mg/l of coumarin.

8.2.2.1.3 Working solutions

Using the stock solutions, prepare a standard range of eight calibration points for bergapten concentration: 1 mg/l, 2,5 mg/l, 5 mg/l, 10 mg/l, 25 mg/l, 50 mg/l, 100 mg/l and 200 mg/l.

- 1 mg/l standard solution: into a 50 ml flask, transfer 100 µl of bergapten stock solution and 5 ml of coumarin stock solution then make up to volume with the dilution solvent.
- 2,5 mg/l standard solution: into a 50 ml flask, transfer 250 µl of bergapten stock solution and 5 ml of coumarin stock solution then make up to volume with the dilution solvent.
- 5 mg/l standard solution: into a 50 ml flask, transfer 500 µl of bergapten stock solution and 5 ml of coumarin stock solution then make up to volume with the dilution solvent.
- 10 mg/l standard solution: into a 50 ml flask, transfer 1 ml of bergapten stock solution and 5 ml of coumarin stock solution then make up to volume with the dilution solvent.
- 25 mg/l standard solution: into a 50 ml flask, transfer 2,5 ml of bergapten stock solution and 5 ml of coumarin stock solution then make up to volume with the dilution solvent.
- 50 mg/l standard solution: into a 50 ml flask, transfer 5 ml of bergapten stock solution and 5 ml of coumarin stock solution then make up to volume with the dilution solvent.

- 100 mg/l standard solution: into a 50 ml flask, transfer 10 ml of bergapten stock solution and 5 ml of coumarin stock solution then make up to volume with the dilution solvent.
- 200 mg/l standard solution: into a 50 ml flask, transfer 20 ml of bergapten stock solution and 5 ml of coumarin stock solution then make up to volume with the dilution solvent.

Homogenize each prepared standard solution by stirring then pass through a 0,45 µm PTFE filter into a vial before injection in the HPLC.

8.2.2.2 Preparation of citrus essential oils samples

To determine the content of citrus essential oils with the standard range created previously (8.2.2.1.3), it is necessary to dilute the samples before injection in the HPLC.

Into a 10 ml flask, accurately weigh 0,3 g of essential oil of bergamot and 1 ml of coumarin stock solution (8.2.2.1.2). Make up to volume with the dilution solvent (5.3.2.4).

For the essential oils with low bergapten content, adapt the test portion. For example, in a 10-ml flask, weigh accurately about 4 g of bergamot essential oil partially reduced in bergapten and weigh accurately about 1 ml of coumarin stock solution. Fill to volume with dilution solvent (5.3.2.4).

Homogenize each prepared sample by stirring then pass through a 0,45 µm PTFE filter into a vial before injection in the HPLC.

8.2.2.3 Determination by HPLC and internal standardization of bergapten content in essential oils of bergamot

The HPLC experimental conditions are:

- Injection volume: 10 µl.
- Oven temperature: 25 °C.
- Eluent flow rate: 1 ml/min.
- UV detection conditions: diode-array UV detection system, wavelength = 312 nm.

Elution solvent is described in [Table 1](#).

Table 1 — Mobile phase: the elution solvent is a ternary mixture

Time min	Water %	Methanol %	Acetonitrile %
0	65	30	5
25	32	63	5
35	0	63	37
37	65	30	5
40	65	30	5

9 Calculation — Normal phase or reversed phase HPLC

9.1 Internal standard method

Using the response factor K determined in 8.2.1.1.2, calculate the mass fraction, expressed as a percentage, of bergapten, w_x , in the essential oil using [Formula \(2\)](#):

$$w_x = K \left(\frac{m_{IS} \cdot A_x}{m_s \cdot A_{IS}} \right) \times 100 \% \quad (2)$$

where

K is the response factor calculated as in [Formula \(1\)](#) (see [8.2.1.1.2](#));

m_{IS} is the mass, expressed in milligrams, of the coumarin added as the internal standard in the test sample (see [8.2.1.1.3](#));

m_s is the mass, expressed in milligrams, of the essential oil in the test sample (see [8.2.1.1.3](#));

A_x is the peak area, expressed in integrator units, corresponding to bergapten in the test sample (see [8.2.1.1.3](#));

A_{IS} is the peak area, expressed in integrator units, corresponding to the coumarin (see [8.2.1.1.3](#)).

NOTE In [ISO 8432:1987](#), 10.1, the mass fraction, expressed as a percentage, of bergapten, c_x , in the essential oil is equivalent to [Formula \(2\)](#) as follows:

$$c_x = \frac{A_x m_E K}{A_E m_x} \times 100 \%$$

where

A_x is the peak area, expressed in integrator units, corresponding to bergapten in the test sample (see [8.2.1.1.3](#));

A_E is the peak area, expressed in integrator units, corresponding to the coumarin (see [8.2.1.1.3](#));

m_x is the mass, expressed in milligrams, of the essential oil in the test sample (see [8.2.1.1.3](#));

m_E is the mass, expressed in milligrams, of the coumarin added as the internal standard in the test sample (see [8.2.1.1.3](#));

K is the response factor calculated as in [Formula \(1\)](#) (see [8.2.1.1.2](#)).

9.2 External standard method

Calculate the bergapten content in accordance with [ISO 8432](#).

10 Precision — Repeatability

For K and for the expression of results (%), take the mean value of several tests (at least three) carried out on the same sample. The different values (K or %) used to calculate this mean shall not differ by more than $\pm 5 \%$.

11 Test report

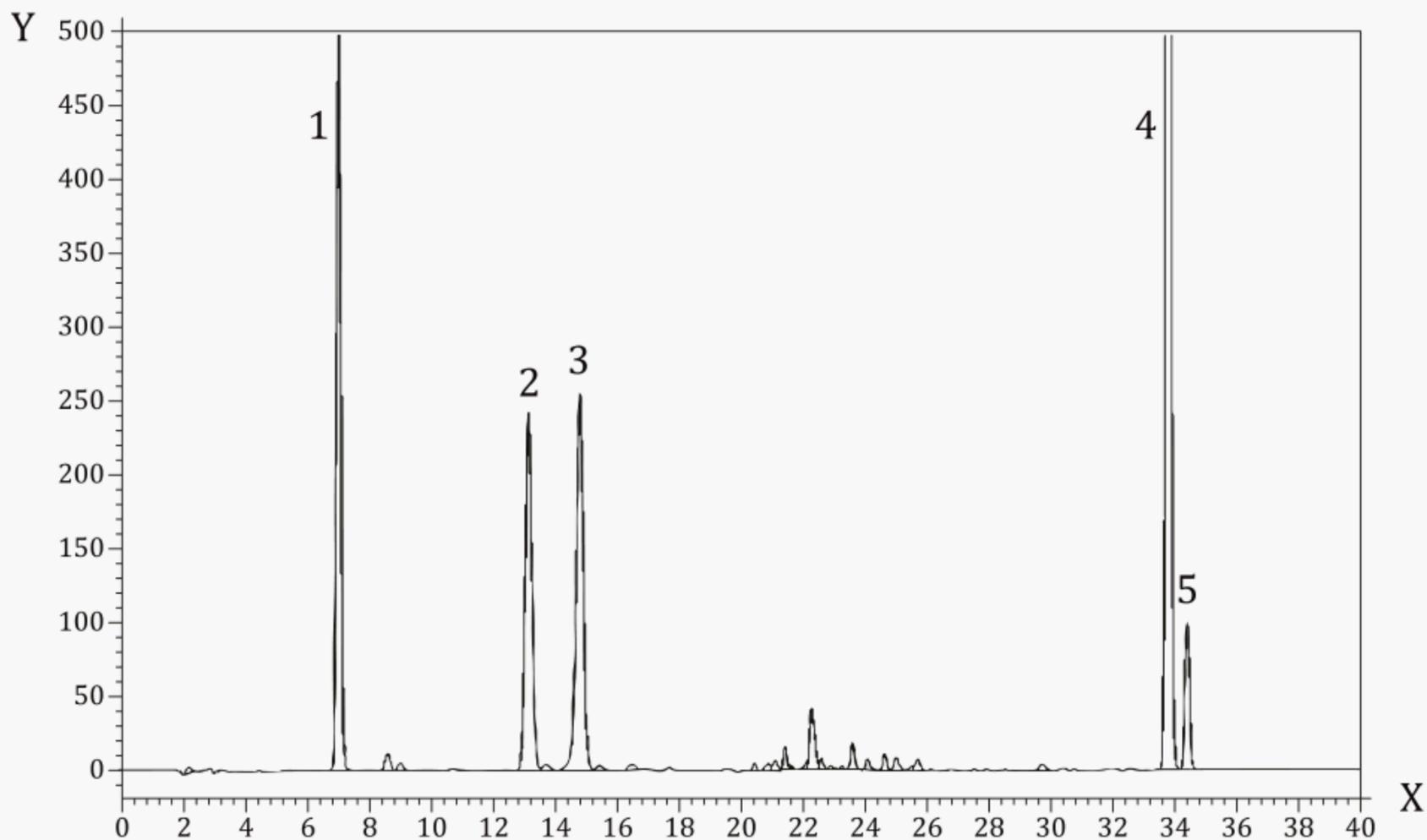
The test report shall include the following information:

- the details of the HPLC system;
- a reference to this document, i.e. ISO 7358:2021;
- the characteristics of the column (material, dimensions, packing, stationary phase);
- the characteristics of the detector (optional) and the operating conditions;
- the characteristics of the mobile phase (flow rate and nature);
- identification of the test sample (quantity injected and final dilution);

- g) the results obtained;
- h) the date of the test.

Annex A (informative)

Typical chromatogram of the reference substances using high-performance liquid chromatography (HPLC) of reference compounds in reversed phase



Peak identification

- 1 Coumarin
- 2 Citropten
- 3 Bergapten
- 4 Bergamottin
- 5 5-Geranyloxy-7 methoxycoumarin

Operating conditions

According to the HPLC experimental conditions in [8.2.2.3](#)

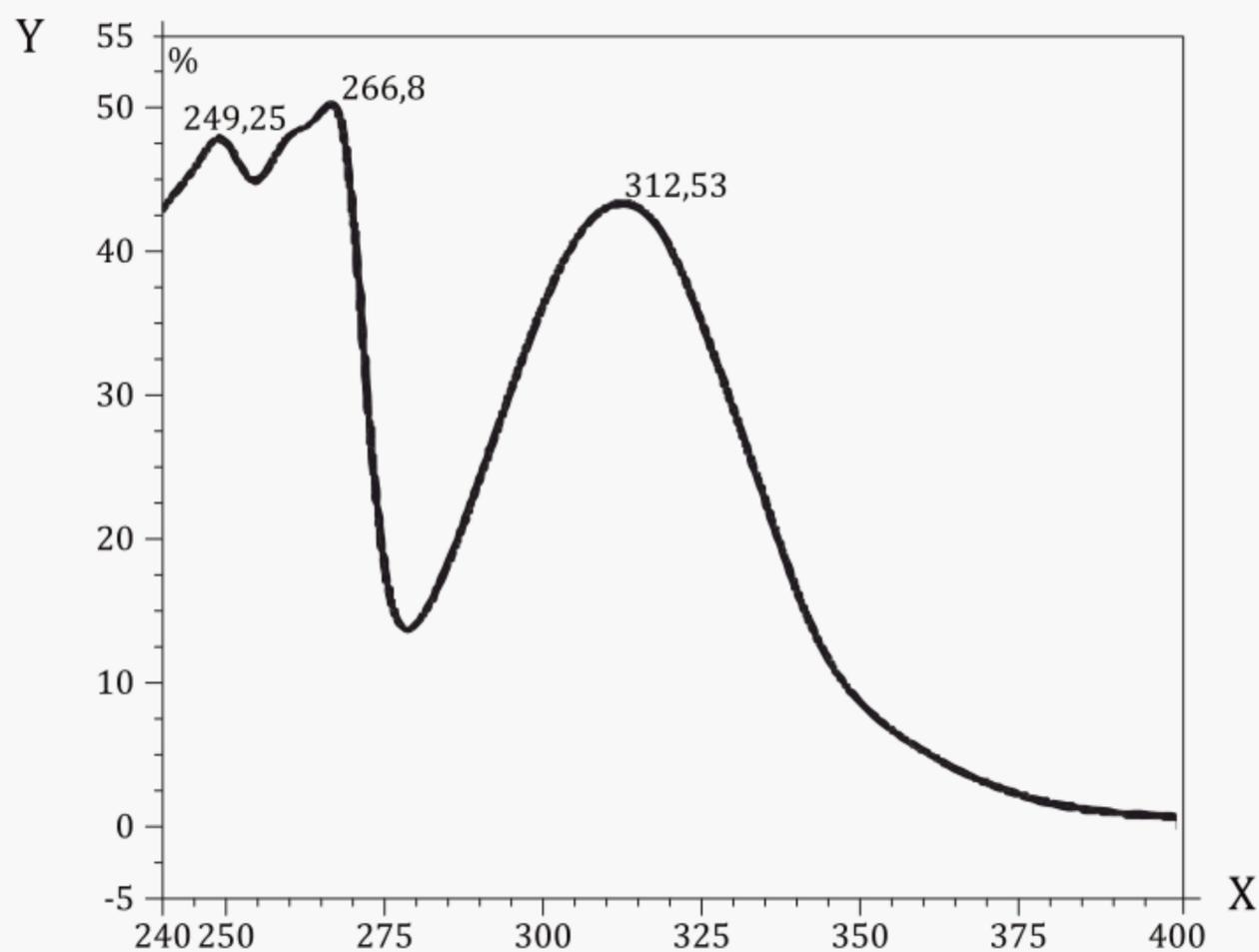
Key

- X time (min)
Y absorbance (mAU)

Figure A.1 — Typical chromatogram of the reference substances using high-performance liquid chromatography (HPLC) of reference compounds in reversed phase

Annex B (informative)

Bergapten UV-Vis spectrum



Key

Y normalized absorbance (%)

X wavelength (nm)

Figure B.1 — Bergapten UV-Vis spectrum

Bibliography

- [1] [ISO 3218](#), *Essential oils — Principles of nomenclature*
- [2] [ISO 4720](#), *Essential oils — Nomenclature*
- [3] ISO/TR 11018, *Essential oils — General guidance on the determination of flashpoint*
- [4] ISO/TR 21092, *Essential oils — Characterization*
- [5] MACMASTER AP, OWEN N, BREVARD H, HISERODT R, LEIJS H, BAST N, WEBER B, LOESING G, SHERLOCK A, SCHIPPA C, VEY M, FREROT E, TISSOT E, CHAINTREAU AA Quantification of selected furocoumarins by high-performance liquid chromatography and UV detection: Capabilities and limits. *Journal of chromatography*. 2012, 1257, 34–40

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards-based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

- user for personal or internal company use only.
- The standard may be stored on more than one device provided that it is accessible by the sole named user only and that only one copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than one copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright and Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email cservices@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services

Tel: +44 345 086 9001

Email: cservices@bsigroup.com

Subscriptions

Tel: +44 345 086 9001

Email: subscriptions@bsigroup.com

Knowledge Centre

Tel: +44 20 8996 7004

Email: knowledgecentre@bsigroup.com

Copyright & Licensing

Tel: +44 20 8996 7070

Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK