भारतीय मानक

IS 18250 : 2023

Indian Standard

कृत्रिम मेन्थॉल — विशिष्टि

Synthetic Menthol — Specification

ICS 71.100.60

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
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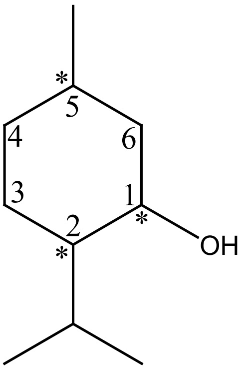
April 2023 **Price Group 7**

Fragrance and Flavour Sectional Committee, PCD 18

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Fragrance and Flavour Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Menthol ($C_{10}H_{20}O$) is an organic compound, made synthetically or obtained from the distillation of the Japanese type oil of mint or menthol mint known as *Mentha arvensis*. It is a clear or white crystalline substance, which is solid at room temperature and melts slightly above. It contains three asymmetric carbon atoms (*see* structure for their positions marked by asterisks in the ring). This cyclic, saturated, secondary alcohol has a total of eight optically active forms called enantiomers.



5-methyl-2-(1-methylethyl)-cyclohexanol
Molecular Weight: 156.27

The main isomeric form of menthol occurring in nature is *l*-Menthol, which is one of the most abundant chiral chemicals in the world. In India, the story of mint cultivation has a long list of achievements starting from varietal development, cultivation; processing and value addition to identifying it as a unique export commodity. Mentha oil is currently listed as one of the Agri commodities in Multi Commodity Exchange of India Limited (MCX), Mumbai. From an importing country of mint oil and natural menthol up-till the early 1980s, India became the largest producer and exporter of mint oil and natural menthol in the world, with an approx. capacity of 60,000 tons annually, and its contributing share now stands at 80 percent to 85 percent of world production. The demand for natural mint and mint products is expected to continue to rise in the future.

However, introduction of an economically motivated adulteration is a serious concern in mint cultivation industry. Various routes for synthetic menthol are available with chemicals in plentiful supply and low price. Such supply makes the synthetic option more financially viable, resulting in damage to the natural mint industry and thereby reducing the socio-economic status of mint farmers or growers.

Chemicals that are derived in whole or in part from biomass resources are known as biobased. The ^{14}C is a weak but radioactive isotope of carbon and present at a known level in all living organisms. Fossil fuels derived chemicals devoid ^{14}C therefore, will be zero biobased.

(*Continued to third cover*)

Indian Standard

SYNTHETIC MENTHOL — SPECIFICATION

1 SCOPE

This standard prescribes the requirements and the methods of sampling and tests for menthol crystals or equivalent synthesized through chemical routes where fossil fuel/ petrochemical are the probable starting material.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All the standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TYPES

There shall be two types of synthetic menthol, namely:

3.1 Type 1 — Synthetic Menthol derived from Fossil (Petroleum Based) as Carbon Source.

3.2 Type 2 — Blended menthol mixture composed of a natural (Bio-Based) and a synthetic (Petroleum Based) as Carbon Source.

4 TERMINOLOGY

For the purpose of this standard, definitions given in IS 6597 shall apply.

5 REQUIREMENTS

5.1 Description

5.1.1 Synthetic Menthol is derived from fossil fuel and further crystallization process gives the high purity crystals.

5.1.2 The menthol crystals are white solid with strong minty odour with cooling effect.

5.1.3 The assessment of odour and appearance shall be subject to agreement between the purchaser and seller. The oil shall be tested olfactorily, especially for by-odours/by-notes, and for the presence of adulterants and impurities, if any, as per IS 2284.

5.2 Solubility

The synthetic menthol shall be soluble in all proportions of ethyl alcohol (90 percent by volume), when tested as prescribed in IS 326 (Part 6).

5.3 The synthetic menthol shall also comply with the requirements given in Table 1 when tested according to the methods given in col (4) of Table 1.

5.4 Chromatographic Profile

Enantiomers are non-superimposable on one another and are in mirror image relationship. Configuration (*R*)- and (*S*)- is independent from optical activity (+)- and (-)- or interaction with plane of polarized light. Carry out the Enantioselective Gas Chromatography analysis of the synthetic menthol as per Annex A. The enantiomeric ratio of (+)- and (-)-menthol analyzed using cyclodextrin phase are given in Table 2 as per their elution order. Cyclodextrins (CDs) are cyclic, chiral, toroid macromolecules composed of six or more D(+)-glucose residues bonded through α(1-4)-glycosidic linkages. CDs are classified by the number of glucose units they contain; α-CDs contain six units (cyclohexylamylose), β-CDs contain seven units (cycloheptylamylose) and γ-CDs contain eight units (cyclooctylamylose). Cyclodextrin structure has a hydrophilic exterior surface resulting from the 2, 3- and 6-position hydroxyl (-OH) groups. The interior cyclodextrin cavity is composed of the glucoside oxygens and methylene hydrogens, which gives it a non-polar (hydrophobic) character. Chemical interactions that lead to chiral separations occur on both the exterior and interior surfaces of the cyclodextrin.

5.5 Chiral Selector

The chiral component of the separation system capable of interacting enantio selectively with the enantiomers to be separated.

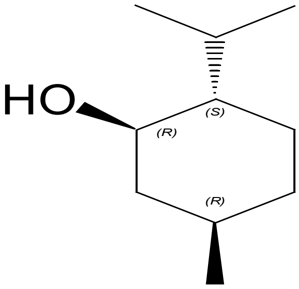
5.6 Chiral Stationary Phase

A stationary phase which incorporates a chiral selector. Chiral selector can be chemically bonded to or immobilized onto the surface of a solid support or column wall or simply dissolved in the liquid stationary phase.

$$\text{Enantiomeric Excess (ee)} = \left[\frac{(\text{predominant enantiomer} - \text{minor enantiomer})}{(\text{Predominant enantiomer} + \text{minor enantiomer})}\right] \times 100$$

5.7 Chemical Name of synthetic Menthol

(1*R*,2*S*,5*R*)-(-)-Menthol (shall be referred as (-)-menthol from onwards in the standard). The other non-natural menthol enantiomer in trace is stereochemically known as (1*S*,2*R*,5*S*)-(+)-menthol.



5.8 Enantiomeric separation (Es) and First Eluted Enantiomer (FEE) of standard compounds on different cyclodextrin derivatives chiral stationary phase.

Table 1 Requirements for Synthetic Menthol
(*Clause* 5.3)

Sl No.	**Characteristics**	**Requirements**		**Method of Test Ref to**
		Type 1	Type 2	
(1)	(2)	(3)		(4)
i)	Colour and appearance	Colourless prismatic crystals	Colourless prismatic crystals	Visual observation
ii)	Melting range, °C	42 to 46	42 to 44	IS 326 (Part 16) : 1989
iii)	Specific rotation at 21 °C (± 1 °C)	(-) 53 to (-) 57 (c 0.020 g/ml; MeOH)	(-) 53 to (-) 67 (c 0.020 g/ml; MeOH)	IS 326 (Part 4) : 2005
iv)	Enantiomeric excess (*ee*) of major enantiomer in synthetic menthol	Not less than 98 %	Not less than 98 %	Annex B
v)	pMC value	0	0 < pMC < 100	Annex C

Table 2 Enantiomeric Ratio and Enantiomeric Excess of Synthetic Menthol
(*Clause* 5.4)

Sl No.	**Chiral Compounds**	**Enantiomeric ratio**	**Enantiomeric Excess (ee)**
(1)	(2)	(3)	(4)
i)	(-)-Menthol	>99.0	>98%
ii)	(+)-Menthol	<1.0	–

NOTE — ee : enantiomeric excess reported with respect to predominant enantiomer

Table 3 First Eluting Enantiomer of Synthetic Menthol in Different Cyclodextrin Phases
(*Clause* 5.4)

Sl No.	**Enantiomers**	**TBDE-ß-CD**	**PM-γ-CD**	**TBDA-γ-CD**
(1)	(2)	(3)	(5)	(6)
i)	Menthol	(-)-	(+)-	(+)-

Enantiomer separation is calculated by using the expression Es = $(T_2-T_0)/(T_1-T_0)$ where T_1 is the retention time of first eluting enantiomer, T_2 is the retention time of second eluting enantiomer and T_0 is the retention time of unretained peak (methane) in the respective methods.

5.9 Enantiomer Elution Order Reversal (EoR) for (+)-(-)-Menthol Enantiomers

Elution order of menthol isomers gets changed if cavity size increases. For example, from differently substituted heptakis- or ß- to octakis- or γ-cyclodextrins. Therefore, analysis in order to reconfirm the traces of (+)-menthol in synthetic menthol, sample should be analyzed in two different cyclodextrin phases ß- (A) and γ-cyclodextrins (B). This experiment shall help in tracing the minor chiral menthol isomer i.e., (+)-menthol if present in sample.

6 PACKING AND MARKING

6.1 Packing

The material shall be supplied in well closed containers permitting a minimum of air space, as agreed to between the purchaser and supplier.

6.1.1 The material shall be well protected from light and stored in a cool place.

6.2 Marking

Each container so filled shall be clearly marked with the following information:

6.2.1 *Name of the material*

6.2.2 *Name of Manufacturer and His Recognized Trade mark*

6.2.3 *Net and Gross Mass of the Material*

6.2.4 *Net Volume of the Material*

6.2.5 *Batch No.*

6.2.6 *BIS Certification Marking*

The containers may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian *Standards Act, 2016* and the Rules and Regulations made thereunder. Details of conditions under which a licence for the use of Standard Mark may be granted to manufactures or producers, may be obtained from the Bureau of Indian Standards.

7 SAMPLING

Representative samples of the material shall be drawn as prescribed in IS 326 (Part 1).

8 TEST METHODS

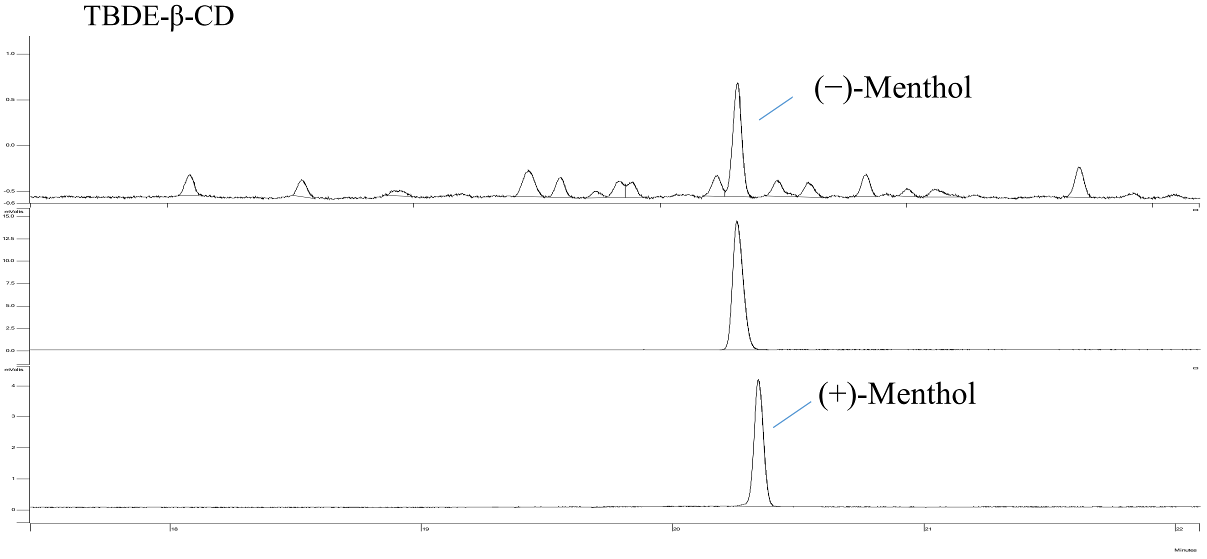
8.1 Tests shall be carried out as prescribed under **5.1**, **5.2, 5.3, 5.4** and the appropriate references specified in col (4) of Table 1.

8.2 Quality of Reagents

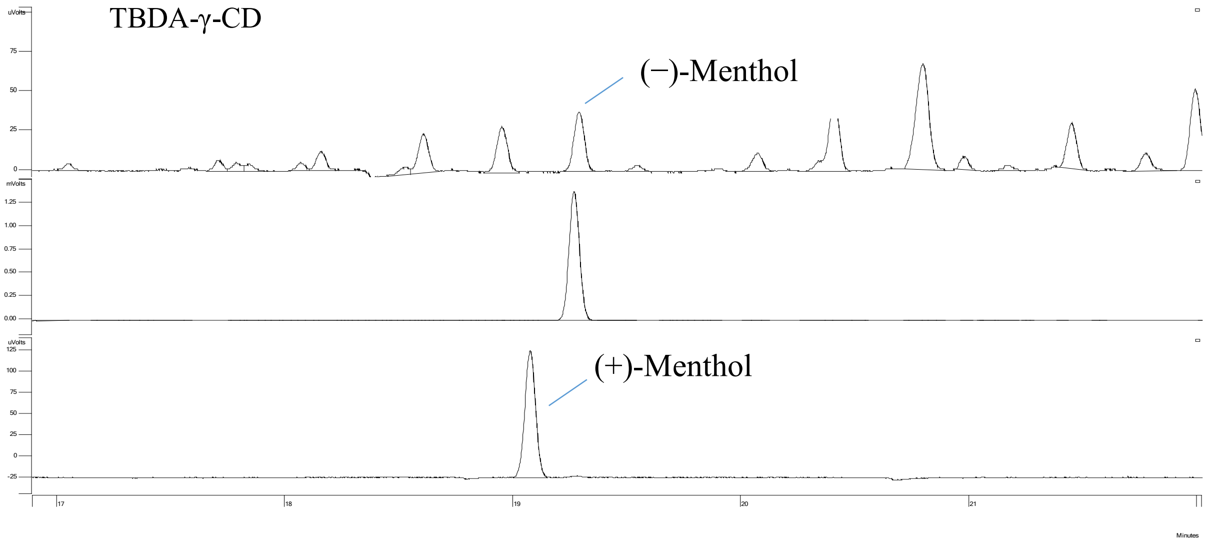
Unless specified otherwise, pure chemicals and distilled water [*see* IS 1070] shall be employed in the tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the result of analysis.

(A)



(**B**)


TBDA-γ-CD
(−)-Menthol
(+)-Menthol
uVolts
75
50
25
0
mVolts
1.25
1.00
0.75
0.50
0.25
0.00
uVolts
125
100
75
50
25
0
-25
17
18
19
20
21
Minutes

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 326	Methods of sampling and test for natural and synthetic perfumery materials
Part 1 : 2022	Sampling (*fourth revision*)
Part 2 : 1980	Preliminary examination of perfumery materials and samples (*second revision*)
Part 3 : 2006	Determination of relative density (*third revision*)
Part 4 : 2005	Determination of optical rotation (*third revision*)
Part 5 : 2006	Determination of refractive index (*third revision*)
Part 6 : 2005	Evaluation of miscibility in ethanol (*third revision*)
Part 12 : 2005	Determination of phenols(*third revision*)
Part 26 : 2017	General guidance on determination of flashpoint
IS 2284 : 1988	Method for olfactory assessment of natural and synthetic perfumery materials (*first revision*)
IS 6597 : 2001	Glossary of terms relating to fragrance and flavour industry (*second revision*)

ANNEX B

[*Clause* 5.3, *Table* 1, *Sl No.* (iv)]

ENANTIOSELECTIVE GAS CHROMATOGRAPHIC ANALYSIS OF SYNTHETIC MENTHOL ENANTIOMERS

B-1 GENERAL

The chromatographic conditions given here are for information and for guidance only.

B-2 OUTLINE OF THE METHOD

A representative port of the material is dissolved in a suitable solvent, if required, and the injected into gas chromatograph equipped with capillary column and flame ionization detector. On completion of chromatographic run, the chromatogram is acquired and area percent of each peak is automatically calculated and presented in the peak table.

B-3 APPARATUS

B-3.1 An electronic controlled gas chromatograph (GC) equipped with split/ splitless or PSS injector, cyclodextrin capillary column and Flame Ionization Detector (FID). Please read instructions before installing the cyclodextrin column in GC system.

B-3.2 Gas Chromatographic Conditions for Non-Polar Column

Sample size	0.5 µl (prepared in dichloromethane)
Capillary column:	β-Cyclodextrin Fused silica capillary column (30 m x 0.25 mm, 0.25 µm)
Chiral Stationary phase	(6-O-*tert*-butyldimethylsiliyl-2,3-di-O-ethyl-β-cyclodextrin)
Material	14 % cyanopropylphenyl/86 % dimethylpolysiloxane
Length	30 m
Internal diameter	0.25 mm
Film thickness	0.25 µm
Carrier gas	Hydrogen (1.8 ml/min)
Flow split ratio	1 : 140
Injector Type	split/splitless/PSS
Injection temperature	220°C
Flow Control	Electronic/Automatic
Detector:	
Type	Flame Ionization Detector
Temperature	230 °C
Flow Control	Electronic/ Automatic
Oven Temperature Programming:	
Temperature 1	70 °C (3 min hold)
Ramp 1	3 °C/min
Temperature 2	120 °C
Ramp2	5°C/min
Temperature 3	230 °C

B-4 CALCULATION

B-4.1 Area percent (%) of each baseline separated peaks is automatically calculated and presented in result section of acquired gas chromatogram.

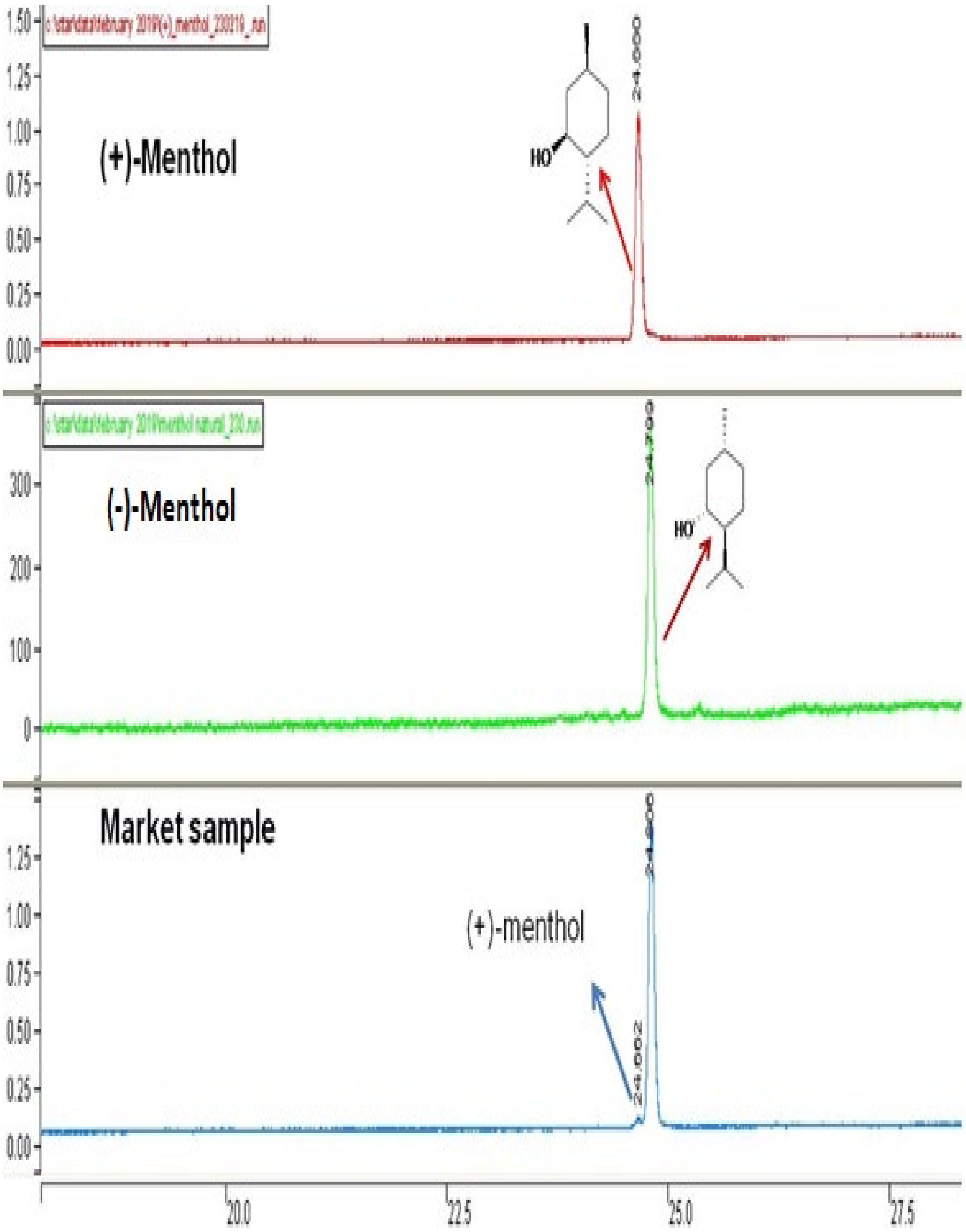


FIG. 1 – TYPICAL CHROMATOGRAM OF (+) - AND (-) -MENTHOL ACQUIRED ON A CD COLUMN

Peaks are marked in Fig. 1 to highlight the minor menthol enantiomer.

ANNEX C

[*Clause* 5.3, *Table* 1, *Sl No.* (v)]

ACCELERATOR MASS SPECTROMETRY (AMS)

C-1 BIOBASED ^{14}C TESTING FOR DIFFERENTIATION OF NATURAL MENTHOL FROM FOSSIL DERIVED OR SYNTHETIC MENTHOL USING ACCELERATOR MASS SPECTROMETRY METHOD

The living carbon-based materials (present day) have a strong ^{14}C signature because it has not yet undergone significant radioactive decay and will yield a biobased index of 100 %. When a plant or animal dies, the amount of ^{14}C in its composition begins to slowly decrease over time at a known rate. For fossil material, the quantities of ^{14}C are much lower, since life activity ceased in the distant past and will therefore be 0 % biobased. Measuring ^{14}C content of any natural products is an accurate tool to determine if adulterated with any fossil-derived materials.

C-2 APPARATUS AND REAGENTS

C-2.1 Accelerator Mass Spectrometer (AMS) Apparatus

Biobased evaluation of the samples was done by quantification of ^{14}C content as per the standard protocol ASTM D6866–22 (Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis). It is noteworthy that ISO 16620-2 is equivalent to this standard.

Ion accelerater (500kV) based Compact ^{14}C Accelerator Mass Spectrometer (AMS) system shall be used for the quantification of $^{14}C/^{12}C$ present in each of the sample.

NOTE — A Pelletron accelerator (500 kV) based Compact ^{14}C Accelerator Mass Spectrometer or NEC XCAMS (National Electrostatic Corp. 1.5SDH tandem accelerator) was used for $^{14}C/^{12}C$ ratio measurements in samples and results are normalized to the standard sample OX II.

C-2.2 Sample Preparation

Processed sample were combusted in automated graphitization equipment (AGE) and converted into graphite powder for enabling AMS measurements to quantify $^{14}C/^{12}C$ ratio. Method B of ASTM D6866–22 can be used for preparation of graphite prior to dating measurements.

C-2.3 Analysis, Interpretation, and Reporting

$^{14}C/^{12}C$ and $^{13}C/^{12}C$ isotopic ratios are measured using AMS. The isotopic ratios of $^{14}C/^{12}C$ or $^{13}C/^{12}C$ are determined relative to a standard traceable to the NIST SRM 4990C (oxalic acid) modern reference standard. The calculated “fraction of modern” (fM) represents the amount of ^{14}C in the product or material relative to the modern standard. This is most commonly referred to as percent modern carbon (pMC), the percent equivalent to fM (for example, fM 1 = 100 pMC).

All pMC values obtained from the radiocarbon analyses must be corrected for isotopic fractionation using stable isotope data. Correction shall be made using $^{13}C/^{12}C$ values determined directly within the AMS where possible.

C-3 pMC CALCULATIONS

The pMC can be greater than 100 % due to the continuing, but diminishing effects from injection of ^{14}C into the atmosphere with atmospheric nuclear testing programs.

The first version of this standard (ASTM D6866-04) in 2004 referenced a value of 107.5 pMC and the ASTM D6866-10 version (2010) cited 105 pMC. These data points equate to a decline of 0.5 pMC per year. Therefore, on January 2 of each year, the values in Table 4 are used as:

REF through 2015, reflecting the same 0.5 pMC decrease per year.

It is calculated by dividing pMC by REF and multiplying the result by 100 for example, [102 (pMC)/102 (REF)] × 100 = 100 % biobased carbon.

Results are reported as % biobased carbon content or % biogenic carbon content rounded to the nearest 1 unit with an applied error of 3 % absolute (Table 4).

C-4 DATA INTERPRETATION

C-4.1 Zero pMC

Represents the entire lack of measurable ^{14}C atoms in a material above background signals thus indicating a fossil (for example, petroleum based) carbon source. Therefore, fossil derived menthol will give a zero pMC value.

C-4.2 If it is a Mixture

A pMC value between 0 and 100 indicates a proportion of carbon derived from fossil vs. modern source.

C-4.3 Naturally Derived Menthol

Contained a value of 100 (one hundred) pMC indicates an entirely modern carbon source.

Sl No. (1)	**Year** (2)	**Ref (pMC)** (3)
i)	2015	102.0
ii)	2016	101.5
iii)	2017	101.0
iv)	2018	100.5
v)	2019	100.0
vi)	2020	99.5
vii)	2021	99.0
viii)	2022	98.5 1)

NOTE — 1) Expected value for the year 2022.

Measured results for all the samples are normalized to the standard sample OX II.

C-4.3.1 AMS delta ^{13}C values are used for the isotopic fractionation correction.

C-4.3.2 Background value during the measurement should be clearly reported. For example, (0.694 ± 0.0242) pMC (Percentage modern carbon) and that corresponds to $^{14}C/^{12}C$ ratio $(7.6341 \pm 0.2657) \times 10^{-15}$.

C-4.3.3 Data quality must be monitored with secondary standard sample (IAEA-C7). For example, during measurement, its consensus values (pMC = 49.53 ± 0.12) should match with its experimental result (pMC= 49.46 ± 0.25) and should be within the error range.

ANNEX D
(*Foreword*)

COMMITTEE COMPOSITION

Fragrance and Flavour Sectional Committee, PCD 18

Organization	*Representative*(*s*)
CSIR — Central Institute of Medical and Aromatic Plants, Lucknow	Dr Prabodh K. Trivedi **(*Chairperson*)**
All India Agarbathi Manufacturers Association, Bengaluru	Shri Sarath Babu P. S.
Aroma Sales Corporation, New Delhi	Shri Sunil Kumar Jain
Central Drugs Standard Control Organization, New Delhi	Shri Aseem Sahu
Central Drugs Testing Laboratory, Chennai	Shrimati C. Vijayalakshmi
Central Revenue Control Laboratory, New Delhi	Shri Suneel Mathur Shri Praful Dalal (*Alternate*)
Centre for Aromatic Plants, Dehradun	Shri Nirpendra K. Chauhan Ms Hema Lohani (*Alternate*)
CKC Fragrance and Flavours Pvt Ltd, Kolkata	Shri Rishab Kothari Shri Chandrakant Kothari (*Alternate*)
Consumer Voice, New Delhi	Shri B. K. Mukhopadhyay
CSIR — Central Food Technological Research Institute, Mysore	Shri Giridhar P. Shri Nagarajan S. (*Alternate*)
CSIR — Central Institute of Medical and Aromatic Plants, Lucknow	Dr Sudeep Tandon Dr Chandan S. Chanotiya (*Alternate*)
CSIR — Indian Institute of Integrative Medicine, Jammu	Shri Rajneesh Anand
CSIR — Indian Institute of Toxicology Research, Lucknow	Dr Alok Dhawan Shri Somendu Kumar Roy (*Alternate* I) Dr Sheelendra Pratap Singh (*Alternate* II)
CSIR — Institute of Himalayan Bio-Resource Technology, Palampur	Dr Vijai Kant Agnihotri
CSIR — North East Institute of Science and Technology, Jorhat	Dr Samit Chattopadhyay Dr Mohan Lal (*Alternate*)
D.V. Deo Industries, Cochin	Shri Aditya Deo
Essential Oil Association of India, Delhi	Shri Ajay K. Jain Shri Pradeep Kumar Jain (*Alternate*)
Fab Flavours and Fragrances Pvt Ltd, Delhi	Shri Gurnish Singh
Forest Research Institute (FRI), Dehradun	Dr V. K. Varshney

Organization	*Representative*(*s*)
Fragrance and Flavour Development Centre, Kannauj	SHRI S. V. SHUKLA SHRI NADEEM AKBAR (*Alternate*)
Fragrances and Flavours Association of India, Mumbai	SHRI RISHABH C. KOTHARI SHRI JAIDEEP GANDHI (*Alternate*)
Givaudan India Pvt Ltd, Mumbai	SHRI AJIT PAL SHRI ARSHDEEP K JOSHI (*Alternate*)
Indian Beauty and Hygiene Association, Mumbai	MS MALATHI NARAYANAN DR MANAS V. VYAS (*Alternate*)
Indian Pharmacopoeia Commission, Ghaziabad	DR JAI PRAKASH DR MANOJ KUMAR PANDEY (*Alternate*)
Indian Society of Cosmetic Chemists, Mumbai	MS MONISHA MULLICK DR BENEDICT MASCARENHAS (*Alternate*)
ITC Life Sciences and Technology Centre, Bengaluru	SHRI AVISEK MUKHOPADHYAY DR VIJAYAN PADMANABHAN (*Alternate*)
Jagat Aroma Oils Distillery, Kannauj	SHRI PRADEEP KAPOOR SHRI VIBHU KAPOOR (*Alternate*)
Karnataka Soaps and Detergents Ltd, Bengaluru	SHRI A. E. SHANKARE GOWDA DR MOKASHI (*Alternate*)
L Liladhar and Company, Mumbai	SHRI MADHUSOODAN MODY
Lalji Aromatics Pvt Ltd, Lucknow	SHRI RAHUL MEHROTRA
MSME Testing Center, New Delhi	SHRI MANOJ KUMAR SHRI VIPUL GAIKWAD (*Alternate* I) SHRI L. B. S. YADAV (*Alternate* II)
Nishant Aromas, Mumbai	SHRI RAMAKANT HARLALKA
Rakesh Sandal Industries, Kanpur	SHRI YOGESH DUBEY
S.H. Kelkar and Company Pvt Ltd, Mumbai	SHRI AMIT GULATI SHRI AVANI MAINKAR (*Alternate*)
Seth Brothers (Perfumers) Pvt Ltd, Delhi	SHRI ROHIT SETH SHRI VINOD KUMAR SETH (*Alternate*)
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Ultra International Ltd, Ghaziabad	SHRI SANT SANGANERIA SHRIMATI BHUVANA NAGESHWARAN (*Alternate*)

Organization	*Representative*(*s*)
Voluntary Organization in Interest of Consumer Education (VOICE), New Delhi	SHRI M. A. U. KHAN
In Personal Capacity (*Flat No. 201, Vishakha CHS Ltd, off, Swami Netyanand Marg, Near Gokhale Bridge, Andheri East — 400006*)	SHRI G. S. RANADE
BIS Director General	SHRIMATI MEENAL PASSI, SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (PETROLEUM, COAL AND RELATED PRODUCTS) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI SOURAV MONDAL
SCIENTIST 'B'/ASSISTANT DIRECTOR
(PETROLEUM, COAL AND RELATED PRODUCTS), BIS

(*Continued from second cover*)

In accordance with ASTM D6866-05, radiocarbon measurements can be performed using accelerator mass spectrometry (AMS), benzene synthesis, or CO_2 absorption. AMS and benzene synthesis are two primary methods used for determining the ^{14}C activity in a sample. The half-life of radioactive ^{14}C is 5,730 years. ISO 16620-2 determines biobased content (carbon) in Flavor and Fragrance samples using ^{14}C analysis. Potential presence of fossil-based menthol in natural menthol products can be detected using ^{14}C calculation. By measuring the ^{14}C levels in a material, one can determine the percentage of carbon that is biobased. This biobased assay, described as the ratio plant-derived C/fossil-derived C, can clarify how renewable a product really is. No International Standard is available on synthetic menthol.

Clause **5.1.3** includes purchaser and seller agreement.

The composition of the committee, responsible for the formulation of this standard is listed in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: PCD 18 (20615).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	2821 8093

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