Short Review

RIFM fragrance ingredient safety assessment, p-mentha-1,8-dien-7-ol, CAS Registry Number 536-59-4


a Research Institute for Fragrance Materials, Inc., 50 Tice Boulevard, Woodcliff Lake, NJ 07677, USA
b Member RIFM Expert Panel, Columbia University Medical Center, Department of Dermatology, 615 Fort Washington Ave., New York, NY, 10032, USA
c Member RIFM Expert Panel, Malmo University Hospital, Department of Occupational & Environmental Dermatology, Sodra Forstadsgatan 101, Entrance 47, Malmo, SE-20502, Sweden
d Member RIFM Expert Panel, School of Natural Resources & Environment, University of Michigan, Dana Building G110, 440 Church St., Ann Arbor, MI, 58109, USA
e Member RIFM Expert Panel, Fraunhofer Institute for Toxicology and Experimental Medicine, Nikolai-Pasch-Strasse 1, 30625, Hannover, Germany
f Member RIFM Expert Panel, University of Sao Paulo, School of Veterinary Medicine and Animal Science, Department of Pathology, Av. Prof. dr. Orlando Marques de Paiva, 87, Sao Paulo, CEP 05508-900, Brazil
g Member RIFM Expert Panel, University of Wuerzburg, Department of Toxicology, Versbacher Str. 9, 97078, Wuerzburg, Germany
h Member RIFM Expert Panel, Oregon Health Science University, 3181 SW Sam Jackson Park Rd., Portland, OR, 97239, USA
i Member RIFM Expert Panel, Vanderbilt University School of Medicine, Department of Biochemistry, Center in Molecular Toxicology, 638 Robinson Research Building, 2200 Pierce Avenue, Nashville, TN, 37232-0146, USA
j Member of RIFM Expert Panel, The University of Tennessee, College of Veterinary Medicine, Department of Comparative Medicine, 2407 River Dr., Knoxville, TN, 37996-4500, USA
k Member RIFM Expert Panel, Department of Pharmacology, University of Arizona, College of Medicine, 1501 North Campbell Avenue, P.O. Box 245050, Tucson, AZ, 85724-5050, USA
l Member RIFM Expert Panel, The Journal of Dermatological Science (JDS), Editor-in-Chief, Professor and Chairman, Department of Dermatology, Hamamatsu University School of Medicine, 1-20-1 Handayama, Higashi-ku, Hamamatsu, 431-3192, Japan

Version: 050218. This version replaces any previous versions.
Name: p-Mentha-1,8-dien-7-ol
CAS Registry Number: 536-59-4

Abbreviation/Definition List:

2-Box Model - A RIFM, Inc. proprietary in silico tool used to calculate fragrance air exposure concentration
AF - Assessment Factor
BCF - Bioconcentration Factor
Creme RIFM Model - The Creme RIFM Model uses probabilistic (Monte Carlo) simulations to allow full distributions of data sets, providing a more realistic estimate of aggregate exposure to individuals across a population (Comiskey et al., 2015, 2017; Safford et al., 2015a, 2017) compared to a deterministic aggregate approach
DEREK - Derek Nexus is an in silico tool used to identify structural alerts
DST - Dermal Sensitization Threshold
ECHA - European Chemicals Agency
EU - Europe/European Union
GLP - Good Laboratory Practice
IFRA - The International Fragrance Association
LOEL - Lowest Observable Effect Level
MOE - Margin of Exposure
MPPD - Multiple-Path Particle Dosimetry. An in silico model for inhaled vapors used to simulate fragrance lung deposition
NA - North America
NESIL - No Expected Sensitization Induction Level

* Corresponding author.
E-mail address: gsullivan@rifm.org (G. Sullivan).

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The Expert Panel for Fragrance Safety* concludes that this material is safe under the limits described in this safety assessment. This safety assessment is based on the RIFM Criteria Document (Api et al., 2015), which should be referred to for clarifications. Each endpoint discussed in this safety assessment includes the relevant data that were available at the time of writing (version number in the top box is indicative of the date of approval based on a 2-digit month/day/year), both in the RIFM database (consisting of publicly available and proprietary data) and through publicly available information sources (e.g., SciFinder and PubMed). Studies selected for this safety assessment were based on appropriate test criteria, such as acceptable guidelines, sample size, study duration, route of exposure, relevant animal species, most relevant testing endpoints, etc. A key study for each endpoint was selected based on the most conservative endpoint value (e.g., PNEC, NOAEL, LOEL, and NESIL).

The Expert Panel for Fragrance Safety is an independent body that selects its own members and establishes its own operating procedures. The Expert Panel is comprised of internationally known scientists that provide RIFM with guidance relevant to human health and environmental protection.

Summary: The use of this material under current conditions is supported by existing information.

*p-Mentha-1,8-dien-7-ol was evaluated for genotoxicity, repeated dose toxicity, developmental and reproductive toxicity, local respiratory toxicity, phototoxicity/photoallergenicity, skin sensitization, and environmental safety. Data from read-across analog 2-methyl-4-(2,2,3-trimethyl-3-cyclopenten-1-yl)-4-penten-1-ol (CAS # 104864-90-6) show that p-mentha-1,8-dien-7-ol is not expected to be genotoxic. The skin sensitization endpoint was completed using DST for non-reactive materials (900 µg/cm²); exposure is below the DST. The repeated dose, developmental and reproductive, and local respiratory toxicity endpoints were completed using the TTC for a Cramer Class I material, and the exposure to p-mentha-1,8-dien-7-ol is below the TTC (0.03 mg/kg/day, 0.03 mg/kg/day, and 1.4 mg/day, respectively). The phototoxicity/photoallergenicity endpoint was completed based on UV spectra; p-mentha-1,8-dien-7-ol is not expected to be phototoxic/photoallergenic. The environmental endpoints were evaluated; p-mentha-1,8-dien-7-ol was not found to be PBT as per IFRA environmental standards, and its risk quotients, based on its current volume of use in Europe and North America (i.e., PEC/PNEC), are < 1.

Human Health Safety Assessment

Genotoxicity: Not genotoxic. (RIFM, 2016a; RIFM, 2016b; RIFM, 2006; RIFM, 1999)

Repeated Dose Toxicity: No NOAEL available. Exposure is below the TTC.

Developmental and Reproductive Toxicity: No NOAEL available. Exposure is below the TTC.

Skin Sensitization: No safety concerns at current declared use levels; exposure is below the DST.

Phototoxicity/Photoallergenicity: Not phototoxic/photoallergenic.

Local Respiratory Toxicity: No NOAEL available. Exposure is below the TTC.

Environmental Safety Assessment

Hazard Assessment:

Persistence: Screening-level: 3.02 (BIOWIN 3) (EPI Suite v4.1; US EPA, 2012a)

Bioaccumulation: Screening-level: 57.35 L/kg (EPI Suite v4.1; US EPA, 2012a)

Ecotoxicity: Screening-level: Fish LC50: 13.46 mg/L (Salvito et al., 2002)

Conclusion: Not PBT or vPvB as per IFRA Environmental Standards.

Risk Assessment:

Screening-level: PEC/PNEC (North America and Europe) < 1 (RIFM Framework; Salvito et al., 2002)

Critical Ecotoxicity Endpoint: LC50: 13.46 mg/L (RIFM Framework; Salvito et al., 2002)

RIFM PNEC: 0.01346 µg/L

Revised PEC/PNECs (2011 IFRA VoU): North America and Europe: not applicable; cleared at screening-level

1. Identification

1. Chemical Name: p-Mentha-1,8-dien-7-ol
2. CAS Registry Number: 536-59-4
3. Synonyms: iso-Carduel; 1-Cyclohexene-1-methanol, 4-(1-methyl-ethenyl)-; Dihydrocuminic alcohol; Dihydronecumin alcohol; Hydrocumin alcohol; 1-Hydroxymethyl-4-isopropenyl-1-cyclohexene; 4-Isopropenyl-1-cyclohexene-carboxinol; Perilla alcohol; Perillol; αβγδϵκλμνοπρστυ; (4-Isopropenylcyclohex-1-en-1-yl)methanol; Perillique Alcool; p-Mentha-1,8-dien-7-ol
4. Molecular Formula: C₁₀H₁₆O
5. Molecular Weight: 152.24
6. RIFM Number: 959

2. Physical data

1. Boiling Point: 241.19 °C (EPI Suite)
2. Flash Point: > 93 °C (GSH Materials Testing and Inspections), > 200 °F; CC (Fragrance Material Association (FMA))
3. Log Kow: 3.36 (EPI Suite)
4. Melting Point: 11.12 °C (EPI Suite)
5. Water Solubility: 471 mg/L (EPI Suite)
6. Specific Gravity: 0.950 (FMA)
7. Vapor Pressure: 0.00278 mm Hg @ 20 °C (EPI Suite), 0.002 mm Hg
7. Natural occurrence (discrete chemical) or composition (NCS)

p-Mentha-1,8-dien-7-ol is reported to occur in the following foods according to the VCF* and in some natural complex substances (NCS):
- Black currants (Ribes nigrum L.)
- Bullock’s heart (Annona reticulata L.)
- Cardamom (Elettaria cardamomum Maton.)
- Citrus fruits
- Hop (Humulus lupulus)
- Lamb’s lettuce (Valerianella locusta)
- Laurel (Laurus nobilis L.)
- Lemon balm (Melissa officinalis L.)
- Mastic (Pistacia lentiscus)
- Mentha oils
- Raspberry, blackberry, and boysenberry
- Vaccinium species
- Wine


8. IFRA standard

None.

9. REACH dossier

Pre-registered for 2010; no dossier available as of 05/02/2018.

10. Summary

10.1. Human health endpoint summaries

10.1.1. Genotoxicity

Based on the existing data, p-mentha-1,8-dien-7-ol does not present a concern for genotoxicity.

10.1.1.1. Risk assessment. The mutagenic activity of p-mentha-1,8-dien-7-ol has been evaluated in a bacterial reverse mutation assay conducted in compliance with GLP regulations and in accordance with OECD TG 471 using the standard plate incorporation and preincubation methods (OECD, 2015). Salmonella typhimurium strains TA98, TA100, TA1535, TA1537, and Escherichia coli strain WP2uvrA were treated with p-mentha-1,8-dien-7-ol in dimethyl sulfoxide (DMSO) at concentrations up to 5000 μg/plate. No increases in the mean number of revertant colonies were observed at any tested dose in the presence or absence of S9 (RIFM, 2016b). Under the conditions of the study, p-mentha-1,8-dien-7-ol was not mutagenic in the Ames test.

The clastogenic activity of p-mentha-1,8-dien-7-ol was evaluated in an in vitro micronucleus test conducted in compliance with GLP regulations and in accordance with OECD TG 487. Human peripheral blood lymphocytes were treated with p-mentha-1,8-dien-7-ol in DMSO at concentrations up to 1520 μg/mL in the presence and absence of metabolic activation (S9) for 4h and in the absence of metabolic activation for 24h. p-Mentha-1,8-dien-7-ol did not induce binucleated cells with micronuclei when tested up to cytotoxic levels in either non-activated or S9-activated test systems (RIFM, 2016a). Under the conditions of the study, p-mentha-1,8-dien-7-ol was considered to be non-clastogenic in the in vitro micronucleus test.

Based on the data available, p-mentha-1,8-dien-7-ol does not present a concern for genotoxic potential.


10.1.2. Repeated dose toxicity

There are insufficient repeated dose toxicity data on p-mentha-1,8-dien-7-ol or any read-across materials. The total systemic exposure to p-mentha-1,8-dien-7-ol is below the TTC for the repeated dose toxicity endpoint of a Cramer Class I material at the current level of use.
10.1.1. Risk assessment. There are no repeated dose toxicity data on p-mentha-1,8-dien-7-ol or any read-across materials that can be used to support the repeated dose toxicity endpoint. The total systemic exposure to p-mentha-1,8-dien-7-ol (0.047 μg/kg/day) is below the TTC (30 μg/kg bw/day; Kroes et al., 2007) for the repeated dose toxicity endpoint of a Cramer Class I material at the current level of use.

Key Studies: None.

Additional References: NCI, 1996.

Literature Search and Risk Assessment Completed On: 05/01/2017.

10.1.3. Developmental and reproductive toxicity

There are insufficient developmental and reproductive toxicity data on p-mentha-1,8-dien-7-ol or any of the read-across materials. The total systemic exposure to p-mentha-1,8-dien-7-ol is below the TTC for the developmental and reproductive toxicity endpoints of a Cramer Class I material at the current level of use.

10.1.3.1. Risk assessment. There are no developmental toxicity data on p-mentha-1,8-dien-7-ol or any read-across materials that can be used to support the developmental toxicity endpoint. The total systemic exposure to p-mentha-1,8-dien-7-ol is below the TTC for the developmental and reproductive toxicity endpoints of a Cramer Class I material at the current level of use.

There are no reproductive toxicity data on p-mentha-1,8-dien-7-ol or any read-across materials that can be used to support the reproductive toxicity endpoint. The total systemic exposure to p-mentha-1,8-dien-7-ol (0.047 μg/kg/day) is below the TTC (30 μg/kg bw/day; Kroes et al., 2007; Laufersweiler et al., 2012) for the developmental toxicity endpoint of a Cramer Class I material at the current level of use.

Additional References: NCI, 1996.

Literature Search and Risk Assessment Completed On: 05/01/2017.

10.1.4. Skin sensitization

Based on the application of DST, p-mentha-1,8-dien-7-ol does not present a safety concern for skin sensitization under the current declared levels of use.

10.1.4.1. Risk assessment. The chemical structure of this material indicates that it would not be expected to react with skin proteins directly (Roberts et al., 2007; OECD toolbox v3.4). No predictive skin sensitization studies are available for p-mentha-1,8-dien-7-ol. In a human maximization test, no reactions indicative of sensitization were observed with 2760 μg/cm² of p-mentha-1,8-dien-7-ol (RIFM, 1977). Acting conservatively due to the limited data, the reported exposure was benchmarked utilizing the non-reactive DST of 900 μg/cm² (Safford et al., 2015b). The current exposure from the 95th percentile concentration is below the DST for non-reactive materials when evaluated in all QRA categories. Table 1 provides the acceptable concentrations for p-mentha-1,8-dien-7-ol, which presents no appreciable risk for skin sensitization based on the non-reactive DST.

Additional References: Okazaki et al., 1982.

Literature Search and Risk Assessment Completed On: 05/03/2017.

10.1.5. Phototoxicity/photoallergenicity

Based on UV/Vis absorption spectra, p-mentha-1,8-dien-7-ol would not be expected to present a concern for phototoxicity or photoallergenicity.

10.1.5.1. Risk assessment. There are no phototoxicity studies available for p-mentha-1,8-dien-7-ol in experimental models. UV/Vis absorption spectra indicate minor absorbance between 290 and 700 nm. The corresponding molar absorption coefficient is below the benchmark of concern for phototoxicity and photoallergenicity (Henry et al., 2009). Based on lack of significant absorbance in the critical range, p-mentha-1,8-dien-7-ol does not present a concern for phototoxicity or photoallergenicity.

10.1.5.2. UV spectra analysis. UV/Vis absorption spectra (OECD TG 101) for p-mentha-1,8-dien-7-ol were obtained. The spectra indicate minor absorbance in the range of 290–700 nm. The molar absorption coefficient is below the benchmark of concern, 1000 L mol⁻¹ cm⁻¹, for phototoxic effects (Henry et al., 2009).

Additional References: None.


10.1.6. Local Respiratory Toxicity

The margin of exposure could not be calculated due to lack of appropriate data. The exposure level of p-mentha-1,8-dien-7-ol is below the Cramer Class I TTC value for inhalation exposure local effects.

10.1.6.1. Risk assessment. There are no inhalation data available on p-mentha-1,8-dien-7-ol. Based on the Creme RIFM Model, the inhalation exposure is 0.00024 mg/day. This exposure is 5833 times lower than the Cramer Class I TTC value of 1.4 mg/day (based on human lung weight of 650 g; Carthew et al., 2009); therefore, the exposure at the current level of use is deemed safe.

Additional References: None.

10.2. Environmental endpoint summary

10.2.1. Screening-level assessment

A screening-level risk assessment of p-menta-1,8-dien-7-ol was performed following the RIFM Environmental Framework (Salvito et al., 2002), which provides 3 tiered levels of screening for aquatic risk. In Tier 1, only the material’s regional VoU, its log Kow, and its molecular weight are needed to estimate a conservative risk quotient (RQ), expressed as the ratio Predicted Environmental Concentration/Predicted No Effect Concentration (PEC/PNEC). A general QSAR with a high uncertainty factor applied is used to predict fish toxicity, as discussed in Salvito et al. (2002). In Tier 2, the RQ is refined by applying a lower uncertainty factor to the PNEC using the ECOSAR model (US EPA, 2012b), which provides chemical class–specific ecotoxicity estimates. Finally, if necessary, Tier 3 is conducted using measured biodegradation and ecotoxicity data to refine the RQ, thus allowing for lower PNEC uncertainty factors. The data for calculating the PEC and PNEC for this safety assessment are provided in the table below. For the PEC, the range from the most recent IFRA Volume of Use Survey is reviewed. The PEC is then calculated using the actual regional tonnage, not the extremes of the range. Following the RIFM Environmental Framework, p-menta-1,8-dien-7-ol was identified as a fragrance material with no potential to present a possible risk to the aquatic environment (i.e., its screening-level PEC/PNEC < 1).

A screening-level hazard assessment using EPI Suite v4.1 did not identify p-menta-1,8-dien-7-ol as possibly persistent or bioaccumulative based on its structure and physical–chemical properties. This screening-level hazard assessment considers the potential for a material to be persistent and bioaccumulative and toxic, or very persistent and very bioaccumulative as defined in the Criteria Document (Api et al., 2015). As noted in the Criteria Document, the screening criteria applied are the same as those used in the EU for REACH (ECHA, 2012). For persistence, if the EPI Suite model BIOWIN 3 predicts a value < 2.2 and either BIOWIN 2 or BIOWIN 6 predicts a value < 0.5, then the material is considered potentially persistent. A material would be considered potentially bioaccumulative if the EPI Suite model BCFBAF predicts a fish BCF ≥ 2000 L/kg. Ecotoxicity is determined in the above screening-level risk assessment. If, based on these model outputs (Step 1), additional assessment is required, a WoE-based review is then performed (Step 2). This review considers available data on the material’s physical–chemical properties, environmental fate (e.g., OECD Guideline biodegradation studies or die-away studies), fish bioaccumulation, and higher-tier model outputs (e.g., US EPA’s BIOWIN and BCFBAF found in EPI Suite v4.1). Data on persistence and bioaccumulation are reported below and summarized in the Environmental Safety Assessment section prior to Section 1.

10.2.2. Risk assessment

Based on the current Volume of Use (2011), p-menta-1,8-dien-7-ol does not present a risk to the aquatic compartment in the screening-level assessment.

10.2.2.1. Biodegradation. No data available.

10.2.2.2. Ecotoxicity. No data available.

10.2.2.3. Other available data. p-Mentha-1,8-dien-7-ol has been pre-registered for REACH with no additional data available at this time.

10.2.3. Risk assessment refinement

Ecotoxicological data and PNEC derivation (all endpoints reported in mg/L; PNECs in μg/L). Endpoints used to calculate PNEC are underlined.

Based on available data, the RQ for this material is < 1. No further assessment is necessary.

The RIFM PNEC is 0.01346 μg/L. The revised PEC/PNECs for EU and NA: not applicable; cleared at screening-level; therefore, the material does not present a risk to the aquatic environment at the current reported volumes of use.

Literature Search and Risk Assessment Completed On: 5/2/17.

11. Literature Search*

- RIFM Database: Target, Fragrance Structure Activity Group materials, other references, JECFA, CIR, SIDS
- ECHA: http://echa.europa.eu/
- OECD Toolbox
- SciFinder: https://scifinder.cas.org/scifinder/view/scifinder/scifinderExplore.jsf
- EPA ACToR: https://actor.epa.gov/actor/home.xhtml
- US EPA HPVIS: https://ofmpub.epa.gov/opthpvis/public_search.publicdetails?submission_id=24959241&ShowComments=Yes&sqlstr=null&recordcount=0&User_title=DetailQuery%20Results&EndPointRpt=Y#submission
- Japan Existing Chemical Data Base (JECDB): http://dra4.nis.go.jp/mlhw_data/jsp/SearchPageENG.jsp
- Google: https://www.google.com

Search keywords: CAS number and/or material names.

*Information sources outside of RIFM’s database are noted as appropriate in the safety assessment. This is not an exhaustive list.

Conflicts of interest

The authors declare that they have no conflicts of interest.
References


IFRA (Research Institute for Fragrance Materials, Inc), 1999. 2-Methyl-4-(2,2,3-trimethyl-3-cyclopenten-1-yl)-4-penten-1-ol: Chromosome Aberration Test in Human Lymphocytes in Vitro. Unpublished Report from Firmenich Incorporated. RIFM report number 36907. RIFM, Woodcliff Lake, NJ, USA.


IFRA (Research Institute for Fragrance Materials, Inc), 2016a. In vitro mammalian cell micronucleus assay in human peripheral blood lymphocytes (HPBL) with p-Mentha-1,8-dien-7-ol (para mentha-1,8-dien-7-ol). Unpublished report from Roy. S. RIFM report number 72299. RIFM, Woodcliff Lake, NJ, USA.

IFRA (Research Institute for Fragrance Materials, Inc), 2016b. p-Mentha-1,8-dien-7-ol (para-mentha-1,8-dien-7-ol): Bacterial reverse mutation with an independent repeat assay. Unpublished report from Wagner. V.O. RIFM report number 72302. RIFM, Woodcliff Lake, NJ, USA.


