

Thujone

CAS-No.:	546-80-5 471-15-8 76231-76-0 1125-12-8 The scope of this Standard includes, but is not limited to the CAS number(s) indicated above; any other CAS number(s) used to identify this fragrance ingredient should be considered in scope as well.	Molecular formula:	C ₁₀ H ₁₆ O
Structure:			
Synonyms:	1-Isopropyl-4-methylbicyclo[3.1.0]hexan-3-one 3-Thujanone, (1s,4r,5r)-(-)- α-Thujone β-Thujone		

History:	Publication date:	2020 (Amendment 49)	Previous Publications:	Not applicable.
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Implementation dates:	For new submissions*:	February 10, 2021
	For existing fragrance compounds*:	February 10, 2022
*These dates apply to the supply of fragrance mixtures (formulas) only, not to the finished consumer products in the marketplace.		

RECOMMENDATION:

RESTRICTION

RESTRICTION LIMITS IN THE FINISHED PRODUCT (%):			
Category 1	0.11 %	Category 7A	0.24 %
Category 2	0.21 %	Category 7B	0.24 %
Category 3	0.032 %	Category 8	0.0053 %
Category 4	1.4 %	Category 9	0.13 %
Category 5A	0.095 %	Category 10A	0.13 %

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Category 5B	0.032 %	Category 10B	0.22 %
Category 5C	0.016 %	Category 11A	0.0053 %
Category 5D	0.0053 %	Category 11B	0.0053 %
Category 6	0.095 %	Category 12	9.5 %

FLAVOR REQUIREMENTS:

Due to the possible ingestion of small amounts of fragrance ingredients from their use in products in Categories 1 and 6, materials must not only comply with IFRA Standards but must also be recognized as safe as a flavoring ingredient as defined by the IOFI Code of Practice (www.iofi.org). For more details see chapter 1 of the Guidance for the use of IFRA Standards.

CONTRIBUTIONS FROM OTHER SOURCES:
SEE ANNEX I

ANNEX I

Natural Complex Substances (NCS) containing Thujone

Concentration in NCS (%)	CAS number of ingredient	Name of NCS	Botanical name	CAS number of NCS	Essential oil category
50	546-80-5	Armoise vulgaris oil	<i>Artemisia vulgaris</i> L.	68991-20-8	E2.12
7.5	471-15-8	Armoise vulgaris oil	<i>Artemisia vulgaris</i> L.	68991-20-8	E2.12
50	546-80-5	Artemesia afra oil	<i>Artemesia afra</i> L. Jacq. Ex Willd.	91745-71-0	E2.12
10	471-15-8	Artemesia afra oil	<i>Artemesia afra</i> L. Jacq. Ex Willd.	91745-71-0	E2.12
0.1	546-80-5	Artemisia arborescens extract	<i>Artemisia arborescens</i> L.	92113-09-2	E2.13
39	546-80-5	Artemisia herba-alba oil	<i>Artemisia herba alba</i> Asso	84775-75-7	E2.12
10	471-15-8	Artemisia herba-alba oil	<i>Artemisia herba alba</i> Asso	84775-75-7	E2.12
55	546-80-5	Cedar leaf oil	<i>Thuja occidentalis</i> L.	8007-20-3	E2.12
10	471-15-8	Cedar leaf oil	<i>Thuja occidentalis</i> L.	8007-20-3	E2.12
2.3	546-80-5	Cedar leaf oil, China	<i>Platyclusus orientalis</i> (L.)	91770-83-0	E2.12

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			Franco		
10	471-15-8	Cedar leaf oil, China	Platyclusus orientalis (L.) Franco	91770-83-1	E2.12
0.2	546-80-5	Hyssop oil	Hyssopus officinalis L.	8006-83-5	E2.12
0.2	471-15-8	Hyssop oil	Hyssopus officinalis L.	8006-83-5	E2.12
0.05	471-15-8	Juniper berry oil	Juniperus communis L.	8002-68-4	G2.12
7.1	546-80-5	Mentha longifolia oil	Mentha longifolia (L.) Huds.	90063-99-3	E2.12
1	471-15-8	Mentha longifolia oil	Mentha longifolia (L.) Huds.	90063-99-3	E2.12
0.2	471-15-8	Olibanum absolute	Boswellia spp.	8016-36-2	K2.1
0.4	471-15-8	Olibanum carterii oil	Boswellia carterii	8016-36-2	K2.12
0.1	546-80-5	Olibanum oil	Boswellia spp.	8016-36-2	K2.12
0.4	471-15-8	Olibanum oil	Boswellia spp.	8016-36-2	K2.12
0.1	546-80-5	Olibanum sacra oil	Boswellia sacra	89957-98-2	K2.12
0.2	471-15-8	Olibanum sacra oil	Boswellia sacra	89957-98-2	K2.12
25	546-80-5	Sage Dalmatian oil	Salvia officinalis L.	8022-56-8	E2.12
8	471-15-8	Sage Dalmatian oil	Salvia officinalis L.	8022-56-8	E2.12
7.3	546-80-5	Sage Dalmatian oleoresin	Salvia officinalis L.	84082-79-1	E2.21
2.7	471-15-8	Sage Dalmatian oleoresin	Salvia officinalis L.	84082-79-1	E2.21
0.01	546-80-5	Sage oil, Spanish	Salvia lavandifolia Vahl	8022-56-8	E2.12
0.1	471-15-8	Sage oil, Spanish	Salvia lavandifolia Vahl	8022-56-8	E2.12
7.5	546-80-5	Sage oleoresin	Salvia officinalis L.	8022-56-8	E2.21
2.5	471-15-8	Sage oleoresin	Salvia officinalis L.	8022-56-8	E2.21
1.5	546-80-5	Savory summer oil	Satureja hortensis L.	8016-68-0	E2.12
0.5	471-15-8	Savory summer oil	Satureja hortensis L.	8016-68-0	E2.12
0.17	546-80-5	Spruce oil, Black	Picea mariana (Mill.) Britton	8008-80-8	E2.12
0.5	471-15-8	Tagetes erecta oil	Tagetes erecta L.	8016-84-0	E2.12
0.5	546-80-5	Tansy oil	Tanacetum vulgare L.	8016-87-3	F2.12
71	471-15-8	Tansy oil	Tanacetum vulgare L.	8016-87-3	F2.12
0.2	471-15-8	Thyme oil, wild	Thymus serpyllum L.	8007-46-3	E2.12
3	546-80-5	Wormwood oil	Artemisia absinthium L.	8008-93-3	E2.12

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42	471-15-8	Wormwood oil	Artemisia absinthium L.	8008-93-3	E2.12
2	546-80-5	Yarrow oil	Achillea millefolium L.	8022-07-9	E2.12
0.6	471-15-8	Yarrow oil	Achillea millefolium L.	8022-07-9	E2.12
57.5	76231-76-0; 1125-12-8	Armoise vulgaris oil	Artemisia vulgaris L.	68991-20-8	E2.12
60	76231-76-0; 1125-12-8	Artemesia afra oil	Artemesia afra L. Jacq. Ex Willd.	91745-71-0	E2.12
49	76231-76-0; 1125-12-8	Artemesia herba-alba oil	Artemesia herba alba Asso	84775-75-7	E2.12
65	76231-76-0; 1125-12-8	Cedar leaf oil	Thuja occidentalis L.	8007-20-3	E2.12
12.3	76231-76-0; 1125-12-8	Cedar leaf oil, China	Platycladus orientalis (L.) Franco	91770-83-1	E2.12
0.4	76231-76-0; 1125-12-8	Hyssop oil	Hyssopus officinalis L.	8006-83-5	E2.12
8.1	76231-76-0; 1125-12-8	Mentha longifolia oil	Mentha longifolia (L.) Huds.	90063-99-3	E2.12
0.5	76231-76-0; 1125-12-8	Olibanum oil	Boswellia spp.	8016-36-2	K2.12
0.3	76231-76-0; 1125-12-8	Olibanum sacra oil	Boswellia sacra	89957-98-2	K2.12
33	76231-76-0; 1125-12-8	Sage Dalmatian oil	Salvia officinalis L.	8022-56-8	E2.12
10	76231-76-0; 1125-12-8	Sage Dalmatian oleoresin	Salvia officinalis L.	84082-79-1	E2.21
0.11	76231-76-0; 1125-12-8	Sage oil, Spanish	Salvia lavandifolia Vahl	8022-56-8	E2.12
10	76231-76-0; 1125-12-8	Sage oleoresin	Salvia officinalis L.	8022-56-8	E2.21
2	76231-76-0; 1125-12-8	Savory summer oil	Satureja hortensis L.	8016-68-0	E2.12
71.5	76231-76-0; 1125-12-8	Tansy oil	Tanacetum vulgare L.	8016-87-3	F2.12
45	76231-76-0; 1125-12-8	Wormwood oil	Artemisia absinthium L.	8008-93-3	E2.12
2.6	76231-76-0; 1125-12-8	Yarrow oil	Achillea millefolium L.	8022-07-9	E2.12

The natural contribution of Thujone is determined by the sum of the natural contributions of each of its isomers.

This is a non-exhaustive indicative list of typical natural presence for Thujone and is intended to be used in the absence of own analytical data. If analysis has shown that the level of the restricted ingredient in a natural complex substance is different from what is provided in this Annex I, then the analytically determined level should be used in place of the indicative level.

It should further be noted that natural complex substances themselves can be restricted by an IFRA Standard.

For a detailed list of natural contributions, please refer to the Annex I of IFRA Standards, publicly available on the IFRA website (www.ifragrance.org).

INTRINSIC PROPERTY DRIVING RISK NEUROTOXICITY

Thujone**MANAGEMENT:****RIFM SUMMARIES:**

Recommended concentration levels are based on a comprehensive safety assessment, considering various endpoints. Depending on the outcome of the safety assessment, it might be one or more endpoint(s) that will drive the derivation of the concentration levels. If more than one endpoint is of relevance, the recommended concentration levels for each product category is derived from comparing maximum permitted level per endpoint consideration (dermal sensitization and/or systemic toxicity). Such recommended concentration levels correspond to the lowest level obtained per category.

Additional information is available in the RIFM safety assessment for Thujone, which can be downloaded from the RIFM Safety Assessment Sheet Database: <http://fragrancematerialsafetyresource.elsevier.com/>.

EXPERT PANEL FOR FRAGRANCE SAFETY RATIONALE / CONCLUSION:

The Expert Panel for Fragrance Safety reviewed all the available data for Thujone and recommends the limits for the 12 different product categories, which are the acceptable use levels of Thujone in the various product categories.

REFERENCES:

The IFRA Standard on Thujone is based on at least one of the following publications:

- The RIFM Safety Assessment on Thujone if available at the RIFM Safety Assessment Sheet Database: <http://fragrancematerialsafetyresource.elsevier.com>
- Api A.M., Belsito D., Bruze M., Cadby P., Calow P., Dagli M. L., Dekant W., Dent M., Ellis G., Fryer A. D., Fukayama M., Griem P., Hickey C., Kromidas L., Lalko J., Liebler D.C., Miyachi Y., Politano V.T., Renskers K., Ritacco G., Salvito D., Schultz T.W., Sipes I. G., Smith B., Vitale D., Wilcox D.K. (2015). Criteria for the Research Institute for Fragrance Materials, Inc. (RIFM) safety evaluation process for fragrance ingredients. *Food Chem Toxicol.* 2015 Aug;82 Suppl:S1-S19 (http://fragrancematerialsafetyresource.elsevier.com/sites/default/files/Criteria_Document_Final.pdf).
- IDEA project (International Dialogue for the Evaluation of Allergens) Final Report on the QRA2: Skin Sensitisation Quantitative Risk Assessment for Fragrance Ingredients, September 30, 2016 (<http://www.ideaproject.info/uploads/Modules/Documents/qra2-dossier-final--september-2016.pdf>).
- Salvito D.T., Senna R. J., Federle T.W. (2002). A framework for prioritizing fragrance materials for aquatic risk assessment. *Environ Toxicol Chem.* 2002;21:1301-1308 (<https://www.ncbi.nlm.nih.gov/pubmed/12069318>).

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Additional information on the application of IFRA Standards is available in the Guidance for the use of IFRA Standards, publicly available at www.ifrafragrance.org.