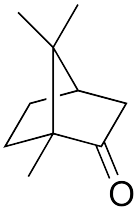
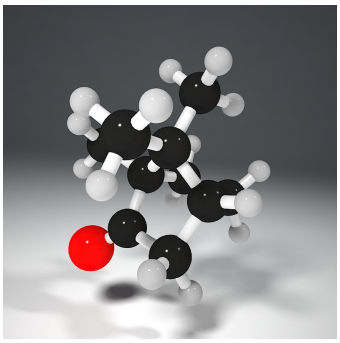
Camphor

Camphor[1] [2]




Identifiers	
CAS number	76-22-2 [3] ✓, [464-49-3] ((1*R*)-Camphor) [464-48-2] ((1*S*)-Camphor}
PubChem	2537 [4] ✓
ChemSpider	2441 [5]
UNII	5TJD82A1ET [6] ✓
IUPHAR ligand	2422 [7] ✓
RTECS number	EX1260000 (*R*) EX1250000 (*S*)
SMILES	
InChI	
InChI key	
Properties	
Molecular formula	$C_{10}H_{16}O$

Molar mass	152.23
Appearance	White or colorless crystals
Density	0.990 (solid)
Melting point	179.75 °C (452.9 K)
Boiling point	204 °C (477 K)
Solubility in water	0.12 g in 100 ml
Solubility in chloroform	~100 g in 100 ml
Chiral rotation $[\alpha]_D$	+44.1°
Hazards	
R-phrases	11-20/21/22-36/37/38
S-phrases	16-26-36
NFPA 704	
Related compounds	
Related Ketones	Fenchone Thujone
Related compounds	Camphene Pinene Borneol Isoborneol Camphorsulfonic acid
✓ (what is this?) (verify) [8] Except where noted otherwise, data are given for materials in their standard state (at 25 °C, 100 kPa)	
Infobox references	

Camphor is a waxy, white or transparent solid with a strong, aromatic odor.[9] It is a terpenoid with the chemical formula $C_{10}H_{16}O$. It is found in wood of the **camphor laurel** (*Cinnamomum camphora*), a large evergreen tree found in Asia (particularly in Borneo and Taiwan) and also of *Dryobalanops aromatica*, a giant of the Bornean forests. It also occurs in some other related trees in the laurel family, notably *Ocotea usambarensis*. It can also be synthetically produced from oil of turpentine. It is used for its scent, as an ingredient in cooking (mainly in India), as an embalming fluid, for medicinal purposes, and in religious ceremonies. A major source of camphor in Asia is camphor basil.

Norcamphor is a camphor derivative with the three methyl groups replaced by hydrogen.

History

The word camphor derives from the French word *camphre*, itself from Medieval Latin *camfora*, from Arabic *kafur*, from Sanskrit, *karpoor*.[10] Barus was the port on the western coast of the Indonesian island of Sumatra where foreign traders would call to buy camphor, hence in Malay it became *kapur Barus*. Camphor was known in Arabia in pre-Islamic times, as it is mentioned in the Quran 76:5 as a flavoring for drinks. In the 9th century, the Arab chemist, Al-Kindi (known as *Alkindus* in Europe), provided the earliest recipe for the production of camphor in his *Kitab Kimiya' al-'Itr* (*Book of the Chemistry of Perfume*). By the 13th century, it was used in recipes everywhere in the Muslim world, ranging from main dishes such as tharid, stew, and desserts.[11]

Already in the 19th century, it was known that with nitric acid, camphor could be oxidized into camphoric acid. Haller and Blanc published a semisynthesis of camphor from camphoric acid, which, although demonstrating its structure, would not prove it. The first complete total synthesis for camphoric acid was published by Gustaf Komppa

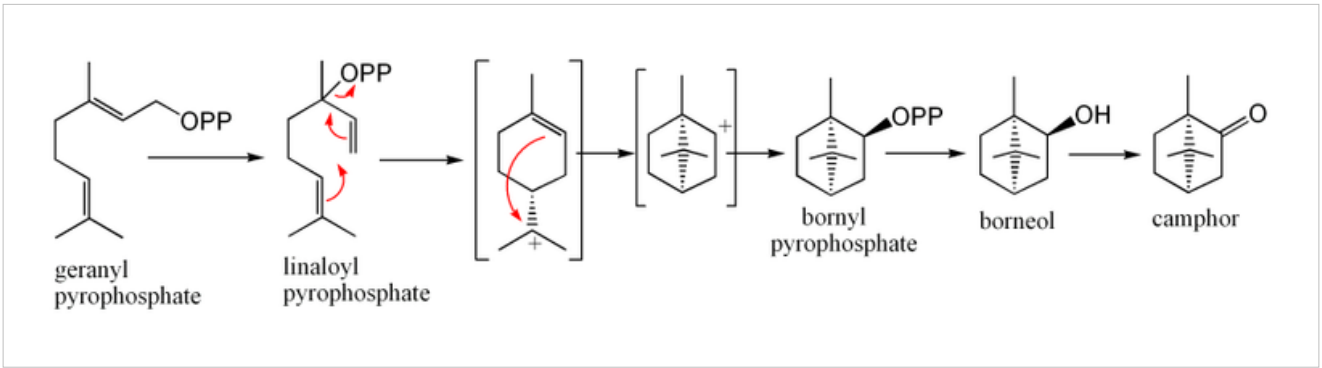
in 1903. Its starting materials were diethyl oxalate and 3,3-dimethylpentanoic acid, which reacted by Claisen condensation to give diketocamphoric acid. Methylation with methyl iodide and a complicated reduction procedure produced camphoric acid. William Perkin published another synthesis a short time later. Previously, some organic compounds (such as urea) had been synthesized in the laboratory as a proof of concept, but camphor was a scarce natural product with a worldwide demand. Komppa realized this and began industrial production of camphor in Tainionkoski, Finland, in 1907.

Production

Camphor can be produced from alpha-pinene, which is abundant in the oils of coniferous trees and can be distilled from turpentine produced as a side product of chemical pulping. With acetic acid as the solvent and with catalysis by a strong acid, alpha-pinene readily rearranges into camphene, which in turn undergoes Wagner-Meerwein rearrangement into the isobornyl cation, which is captured by acetate to give isobornyl acetate. Hydrolysis into isoborneol followed by dehydrogenation gives camphor.

Biosynthesis

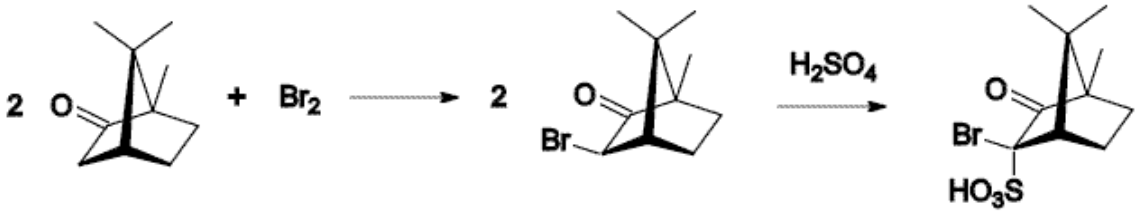
In biosynthesis camphor is produced from geranyl pyrophosphate, via cyclisation of linaloyl pyrophosphate to bornyl pyrophosphate, followed by hydrolysis to borneol and oxidation to camphor.



Reactions

Typical camphor reactions are

- bromination,



- oxidation with nitric acid,
- conversion to isonitrosocamphor.

Camphor can also be reduced to isoborneol using sodium borohydride.

In 2007, carbon nanotubes were successfully synthesized using camphor in chemical vapor deposition process.[12]

Uses

Modern uses include camphor as a plasticizer for nitrocellulose (see Celluloid), as a moth repellent, as an antimicrobial substance, in embalming, and in fireworks. Solid camphor releases fumes that form a rust-preventative coating and is therefore stored in tool chests to protect tools against rust.[13]

Camphor crystals are also used to prevent damage to insect collections by other small insects. Some folk remedies state that camphor will deter snakes and other reptiles due to its strong odor. Similarly, camphor is believed to be toxic to insects and is thus sometimes used as a repellent.[14]

Culinary

In ancient and medieval Europe camphor was used as an ingredient in sweets. It was also used as a flavoring in confections resembling ice cream in China during the Tang dynasty (AD 618–907). It was used in a wide variety of both savory and sweet dishes in medieval Arabic language cookbooks, such as *al–Kitab al–Ṭabikh* compiled by ibn Sayyâr al-Warrâq in the 10th century[15] and An Anonymous Andalusian Cookbook of the 13th Century.[16] And it appears in sweet and savory dishes in a book written in the late 15th century for the sultans of Mandu, the *Ni'matnama*.[17]

Currently, camphor is used as a flavoring, mostly for sweets, in Asia. It is widely used in cooking, mainly for dessert dishes, in India where it is known as *Kachha(raw/crude) Karpooram* ("crude camphor" in Tamil:பச்சைக் கற் பூரம்), and is available in Indian grocery stores where it is labeled as "Edible Camphor".

Medicinal

Camphor is readily absorbed through the skin and produces a feeling of cooling similar to that of menthol and acts as slight local anesthetic and antimicrobial substance. There are anti-itch gels and cooling gels with camphor as the active ingredient. Camphor is an active ingredient (along with menthol) in vapor-steam products, such as Vicks VapoRub, and it is effective as a cough suppressant. It may also be administered orally in small quantities (50 mg) for minor heart symptoms and fatigue.[18]

In the 18th century, it was used by Auenbrugger in the treatment of mania.[19]

Hindu religious ceremonies

Camphor is widely used in Hindu religious ceremonies. Hindus worship a holy flame by burning camphor, which forms an important part of many religious ceremonies. Camphor is used in the Mahashivratri celebrations of Shiva, the Hindu god of destruction and (re)creation. As a natural pitch substance, it burns cool without leaving an ash residue, which symbolizes consciousness. Of late, most temples in southern India have stopped lighting camphor in the main Sanctum Sanctorium because of the heavy carbon deposits it produces; however, open areas still burn it.

In Hindu pujas and ceremonies, camphor is burned in a ceremonial spoon for performing aarti. This type of camphor, the processed white crystalline kind, is also sold at Indian grocery stores. However it is not suitable for cooking and is hazardous to health if eaten.

Toxicology

In larger quantities, it is poisonous when ingested and can cause seizures, confusion, irritability, and neuromuscular hyperactivity. In extreme cases, even topical application of camphor may lead to hepatotoxicity.[20] [21] Lethal doses in adults are in the range 50–500 mg/kg (orally). Generally, 2 g causes serious toxicity and 4 g is potentially lethal.

In 1980, the United States Food and Drug Administration set a limit of 11% allowable camphor in consumer products and totally banned products labeled as camphorated oil, camphor oil, camphor liniment, and camphorated liniment (except "white camphor essential oil", which contains no significant amount of camphor). Since alternative treatments exist, medicinal use of camphor is discouraged by the FDA, except for skin-related uses, such as medicated powders, which contain only small amounts of camphor.

See also

- 1,4-Dichlorobenzene
- Citral
- Eucalyptol
- Lavender
- Vaporizer

References

[1] *The Merck Index*, 7th edition, Merk & Co, Rahway, New Jersey, USA, 1960

[2] *Handbook of Chemistry and Physics*, CRC Press, Ann Arbor, Michigan

[3] http://www.commonchemistry.org/ChemicalDetail.aspx?ref=76-22-2

[4] http://pubchem.ncbi.nlm.nih.gov/summary/summary.cgi?cid=2537

[5] http://www.chemspider.com/2441

[6] http://fdasis.nlm.nih.gov/srs/srsdirect.jsp?regno=5TJD82A1ET

[7] http://www.iuphar-db.org/DATABASE/LigandDisplayForward?ligandId=2422

[8] http://en.wikipedia.org/wiki/%3Acamphor

[9] Mann JC, Hobbs JB, Banthorpe DV, Harborne JB (1994). *Natural products: their chemistry and biological significance*. Harlow, Essex, England: Longman Scientific & Technical. pp. 309–11. ISBN 0-582-06009-5.

[10] http://www.etymonline.com/index.php?search=camphor

[11] Anonymous Andalusian cookbook of the 13th century (http://www.daviddfriedman.com/Medieval/Cookbooks/Andalusian/andalusian_contents.htm)

[12] Kumar M, Ando Y (2007). "Carbon Nanotubes from Camphor: An Environment-Friendly Nanotechnology" (http://www.iop.org/EJ/abstract/1742-6596/61/1/129). *J Phys Conf Ser.* **61**: 643–6. doi:10.1088/1742-6596/61/1/129. .

[13] Tips for Cabinet Making Shops (http://www.cabinetshoptips.com/)

[14] The Housekeeper's Almanac, or, the Young Wife's Oracle! for 1840!. No. 134. New-York: Elton, 1840. Print.

[15] Nasrallah, Nawal (2007). *Annals of the Caliphs' Kitchens: Ibn Sayyâr al-Warrâq's Tenth-century Baghdadi Cookbook*. Islamic History and Civilization, 70. Leiden, The Netherlands: Brill. ISBN 978-0-415-35059-4.

[16] An Anonymous Andalusian cookbook of the 13th century, translated by Charles Perry (http://www.daviddfriedman.com/Medieval/Cookbooks/Andalusian/andalusian_contents.htm)

[17] Titley, Norah (2004). *The Ni'matnama Manuscript of the Sultans of Mandu: The Sultan's Book of Delights*. Routledge Studies in South Asia. London, UK: Routledge. ISBN 978-0-415-35059-4.

[18] National Agency for Medicines (http://spc.nam.fi/indox/english/html/nam/humspc/1/90151.shtml)

[19] Pearce, J M S (2008). "Leopold Auenbrugger: camphor-induced epilepsy - remedy for manic psychosis". *Eur. Neurol.* (Switzerland) **59** (1–2): 105–7. doi:10.1159/000109581. PMID 17934285.

[20] Martin D, Valdez J, Boren J, Mayersohn M (Oct 2004). "Dermal absorption of camphor, menthol, and methyl salicylate in humans". *J Clin Pharmacol* **44** (10): 1151–7. doi:10.1177/0091270004268409. PMID 15342616.

[21] Uc A, Bishop WP, Sanders KD (Jun 2000). "Camphor [[hepatotoxicity (http://meta.wkhealth.com/pt/pt-core/template-journal/lwwgateway/media/landingpage.htm?issn=0038-4348&volume=93&issue=6&spage=596)]"]. *South Med J.* **93** (6): 596–8. PMID 10881777. .

External links

- Camphor Evidence-based Monograph (http://www.naturaldatabase.com/ce/ceNDMono.aspx?mono_id=709&view=m) from *Natural Medicines Comprehensive Database*
- INCHEM (http://www.inchem.org/documents/pims/pharm/camphor.htm) at IPCS (International Programme on Chemical Safety)

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