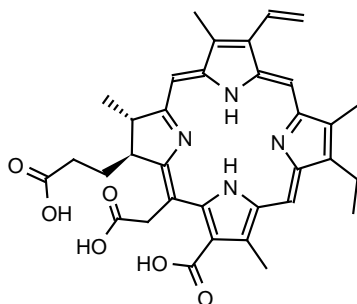


Product Name: Chlorin e6

Catalog Number: Ce6



Synonyms: CE6; ChlorinE6; chlorin e6; Phytochlorin; (2S-trans)-18-Carboxy-20-(carboxymethyl)-13-ethyl-2,3-dihydro-3,7,12,17-tetramethyl-8-vinyl-21H,23H-porphine-2-propionic acid.

IUPAC/Chemical name: 2-[(7S,8S)-3-Carboxy-7-(2-carboxyethyl)-13-ethenyl-18-ethyl-7,8-dihydro-2,8,12,17-tetramethyl-21H,23H-porphin-5-yl]acetic acid

Available Sizes: 100 mg, 1 g, 5g, 500g, kilogram and multi-kilogram quantities available

Molecular Formula: C₃₄H₃₆N₄O₆ **MW:** 596.98 **CAS:** 19660-77-6
MDL: MFCD08669566

Appearance: Black solid powder with characteristic odor

Storage: Store at frozen temperatures (-20 °C) in a dry and dark location.

Purity: >95% (refer to certificate of analysis)

Shipping conditions: Shipped with cold packs as non-hazardous chemical. This product is stable enough for a ordinary shipping and time spent in Customs.

Solubility: Soluble in DMSO and Dimethylformamide, not soluble in neutral water, will dissolve in basic water (pH of 10 or greater).

Stock solution storage: Stock solutions should be stable for short periods of time (less than 1 week) if stored at 0-4 °C and completely protected from light. It is not recommended to store the solution for longer periods of time.

Field of Interest: Natural Product Photodynamic Therapy Agent or Photosensitizer

Background: Chlorin E6 is a natural molecule and a promising photosensitizer. Chlorin E6 is isolated from renewable natural sources. Chlorin E6 is an attractive photodynamic therapy (PDT) drug candidate because of (1) its high absorption in the red spectral region, and (2) its low cost to make compared to other porphyrin-based PDT drugs. Chlorin E6 exhibits advantageous photophysical properties for PDT such as having long lifetimes in their photoexcited triplet states and high molar absorption in the red region of the visible spectrum. Moreover, a 664-nm laser light can penetrate tissue deeper than the 630-nm laser light used for other PDT drugs. Chlorin E6 is an important starting material for making PDT drug Talaporfin sodium (mono-L-aspartyl chlorin e6 or NPe6).

PDT is currently being used as an alternative therapeutic modality for a variety of malignant tumors. Studies have examined antitumor activity of Ce6-induced PDT (Ce6-PDT) both in vitro and in vivo using a rat tumor models. In one study three-week-old male Sprague-Dawley (SD) rats were inoculated s.c. on the right flank with 5×10^6 RK3E-ras cells. The animals were administered i.v. with Ce6 (10 mg/kg) and 24 h later, PDT was performed using a laser diode at a light dose of 100 J/cm². Ce6-PDT generated reactive oxygen species and led to significant growth inhibition in RK3E-ras cell. In addition, Ce6-PDT induced apoptosis through the activation of caspase-3 and its downstream target, PARP cleavage. The protein level of anti-apoptotic bcl-2 was also reduced by Ce6-PDT in RK3E-ras cells. In in vivo experiments, application of Ce6-PDT led to a significant reduction of tumor size. PCNA immunostaining and TUNEL assay revealed that Ce6-PDT inhibited tumor cell proliferation and increased apoptosis. (*source: Oncology Reports, 2009, 22(5). 1085-1091.*)

Bioactivity reported in recent literature

Bioactivity	Literature
Prevents ADP-Induced Platelet Aggregation	Evid Based Complement Alternat Med. 2013;2013:569160.
Cancer detection and diagnosis	Phys Chem Chem Phys. 2013 Oct 14;15(38):15727-33. BMC Med Imaging. 2009 Jan 8;9:1 Cancer Lett. 2007 Jan 8;245(1-2):127-33.
Photokilling of cancer cells.	J Org Chem. 2012 Dec 7;77(23):10638-47. Biopharm Drug Dispos. 2011 Sep;32(6):319-32. Ultrason Sonochem. 2013 Mar;20(2):667-73
Killing bacteria	Lasers Surg Med. 2011 Apr;43(4):313-23. Biol Pharm Bull. 2012;35(4):509-14. Pol J Microbiol. 2005;54(4):305-10. J Antimicrob Chemother. 2002 Dec;50(6):857-64. Ann N Y Acad Sci. 1991;618:383-93.
Nano formulation	Phys Chem Chem Phys. 2013 Oct 14;15(38):15727-33. Biomaterials. 2013 Dec;34(36):9160-70 Lasers Surg Med. 2013 Mar;45(3):175-85. Med Chem. 2013 Feb;9(1):112-7. Photodiagnosis Photodyn Ther. 2012 Mar;9(1):76-82.
Sonodynamic therapy	Cancer Biother Radiopharm. 2013 Nov 9. [Epub ahead of print] Ultrasound Med Biol. 2013 Sep;39(9):1713-24. Ultrason Sonochem. 2013 Mar;20(2):667-73. Biopharm Drug Dispos. 2011 Sep;32(6):319-32.

References:

- 1: Li Q, Wang X, Wang P, Zhang K, Wang H, Feng X, Liu Q. Efficacy of Chlorin e6 Mediated Sono-Photodynamic Therapy on 4T1 Cells. *Cancer Biother Radiopharm*. 2013 Nov 9. [Epub ahead of print] PubMed PMID: 24206161.
- 2: Li Z, Wang C, Cheng L, Gong H, Yin S, Gong Q, Li Y, Liu Z. PEG-functionalized iron oxide nanoclusters loaded with chlorin e6 for targeted, NIR light induced, photodynamic therapy. *Biomaterials*. 2013 Dec;34(36):9160-70. doi: 10.1016/j.biomaterials.2013.08.041. Epub 2013 Sep 3. PubMed PMID: 24008045.
- 3: Skripka A, Valanciunaite J, Dauderis G, Poderys V, Kubiliute R, Rotomskis R. Two-photon excited quantum dots as energy donors for photosensitizer chlorin e6. *J Biomed Opt*. 2013 Jul;18(7):078002. doi: 10.1117/1.JBO.18.7.078002. PubMed PMID: 23864017.
- 4: Wang H, Wang X, Wang P, Zhang K, Yang S, Liu Q. Ultrasound enhances the efficacy of chlorin E6-mediated photodynamic therapy in MDA-MB-231 cells. *Ultrasound Med Biol*. 2013 Sep;39(9):1713-24. doi: 10.1016/j.ultrasmedbio.2013.03.017. Epub 2013 Jul 3. PubMed PMID: 23830103.
- 5: Kimani S, Ghosh G, Ghogare A, Rudshteyn B, Bartusik D, Hasan T, Greer A. Synthesis and characterization of mono-, di-, and tri-poly(ethylene glycol) chlorin e6 conjugates for the photokilling of human ovarian cancer cells. *J Org Chem*. 2012 Dec 7;77(23):10638-47. doi: 10.1021/jo301889s. Epub 2012 Nov 14. PubMed PMID: 23126407; PubMed Central PMCID: PMC3815657.
- 6: Chen B, Zheng R, Liu D, Li B, Lin J, Zhang W. The tumor affinity of chlorin e6 and its sonodynamic effects on non-small cell lung cancer. *Ultrason Sonochem*. 2013 Mar;20(2):667-73. doi: 10.1016/j.ultsonch.2012.09.008. Epub 2012 Oct 2. PubMed PMID: 23073382.
- 7: Saboktakin MR, Tabatabaie RM, Amini FS, Maharramov A, Ramazanov MA. Synthesis and in-vitro photodynamic studies of the superparamagnetic chitosan hydrogel/chlorin E6 nanocarriers. *Med Chem*. 2013 Feb;9(1):112-7. PubMed PMID: 22762166.
- 8: Li P, Zhou G, Zhu X, Li G, Yan P, Shen L, Xu Q, Hamblin MR. Photodynamic therapy with hyperbranched poly(ether-ester) chlorin(e6) nanoparticles on human tongue carcinoma CAL-27 cells. *Photodiagnosis Photodyn Ther*. 2012 Mar;9(1):76-82. doi: 10.1016/j.pdpdt.2011.08.001. Epub 2011 Oct 4. PubMed PMID: 22369732; PubMed Central PMCID: PMC3292741.
- 9: Shim G, Lee S, Kim YB, Kim CW, Oh YK. Enhanced tumor localization and retention of chlorin e6 in cationic nanolipoplexes potentiate the tumor ablation effects of photodynamic therapy. *Nanotechnology*. 2011 Sep 7;22(36):365101. doi: 10.1088/0957-4484/22/36/365101. Epub 2011 Aug 12. PubMed PMID: 21841215.
- 10: Shi H, Liu Q, Qin X, Wang P, Wang X. Pharmacokinetic study of a novel sonosensitizer chlorin-e6 and its sonodynamic anti-cancer activity in hepatoma-22 tumor-bearing mice. *Biopharm Drug Dispos*. 2011 Sep;32(6):319-32. doi: 10.1002/bdd.761. Epub 2011 Aug 3. PubMed PMID: 21815170.
- 11: Tu C, Zhu L, Li P, Chen Y, Su Y, Yan D, Zhu X, Zhou G. Supramolecular polymeric micelles by the host-guest interaction of star-like calix[4]arene and chlorin e6 for photodynamic therapy. *Chem Commun (Camb)*. 2011 Jun 7;47(21):6063-5. doi: 10.1039/c0cc05662f. Epub 2011 Apr 26. PubMed PMID: 21519601.
- 12: Yumita N, Iwase Y, Nishi K, Ikeda T, Komatsu H, Fukai T, Onodera K, Nishi H, Takeda K, Umemura S, Okudaira K, Momose Y. Sonodynamically-induced antitumor effect of mono-l-aspartyl chlorin e6 (NPe6). *Anticancer Res*. 2011 Feb;31(2):501-6. PubMed PMID: 21378330.
- 13: Horibe S, Nagai J, Yumoto R, Tawa R, Takano M. Accumulation and photodynamic activity of chlorin e6 in cisplatin-resistant human lung cancer cells. *J Pharm Sci*. 2011 Jul;100(7):3010-7. doi: 10.1002/jps.22501. Epub 2011 Jan 27. PubMed PMID: 21274848.
- 14: Waidelich R. Comment on "Chlorin e6-polyvinylpyrrolidone mediated photodynamic therapy--A potential bladder sparing option for high risk non-muscle-invasive bladder cancer" by Lui Shiong Lee et al. [*Photodiagn Photodyn Ther* 2010;7:213-20]. *Photodiagnosis Photodyn Ther*. 2010 Dec;7(4):221. doi: 10.1016/j.pdpdt.2010.09.004. Epub 2010 Oct 23. PubMed PMID: 21112543.
- 15: Lee LS, Thong PS, Olivo M, Chin WW, Ramaswamy B, Kho KW, Lim PL, Lau WK. Chlorin e6-polyvinylpyrrolidone mediated photodynamic therapy--A potential bladder sparing option for high risk non-muscle invasive bladder cancer. *Photodiagnosis Photodyn Ther*. 2010 Dec;7(4):213-20. doi: 10.1016/j.pdpdt.2010.08.005. Epub 2010 Sep 29. PubMed PMID: 21112542.
- 16: Gao HJ, Zhang WM, Wang XH, Zheng RN. [Adriamycin enhances the sonodynamic effect of chlorin e6 against the proliferation of human breast cancer MDA-MB-231 cells in vitro]. *Nan Fang Yi Ke Da Xue Xue Bao*. 2010 Oct;30(10):2291-4. Chinese. PubMed PMID: 20965828.
- 17: Zheng R, Zhang W, Wang X, Gao H. [The sonodynamic effects of Chlorin e6 on the proliferation of human lung adenocarcinoma cell SPCA-1]. *Zhongguo Fei Ai Za Zhi*. 2010 Mar;13(3):201-5. doi: 10.3779/j.issn.1009-3419.2010.03.03. Chinese. PubMed PMID: 20673516.
- 18: Chin WW, Praveen T, Heng PW, Olivo M. Effect of polyvinylpyrrolidone on the interaction of chlorin e6 with plasma proteins and its subcellular localization. *Eur J Pharm Biopharm*. 2010 Oct;76(2):245-52. doi: 10.1016/j.ejpb.2010.06.005. Epub 2010 Jun 15. PubMed PMID: 20558287.

19: Moon YH, Kwon SM, Kim HJ, Jung KY, Park JH, Kim SA, Kim YC, Ahn SG, Yoon JH. Efficient preparation of highly pure chlorin e6 and its photodynamic anti-cancer activity in a rat tumor model. *Oncol Rep.* 2009 Nov;22(5):1085-91. PubMed PMID: 19787225.

20: Chin WW, Heng PW, Lim PL, Lau WK, Olivo M. Membrane transport enhancement of chlorin e6-polyvinylpyrrolidone and its photodynamic efficacy on the chick chorioallantoic model. *J Biophotonics.* 2008 Oct;1(5):395-407. doi: 10.1002/jbio.200810005. PubMed PMID: 19343663.

Hazardous Properties and Cautions: The toxicological and pharmacological properties of this compound are not fully known. For further information see the MSDS on request. **Chlorin e6** is manufactured, shipped according to standard practices, and intended for research and development in a laboratory utilizing prudent procedures for handling chemicals of unknown toxicity, under the supervision of persons technically qualified to evaluate potential risks and authorized to enforce appropriate health and safety measures. As with all research chemicals, precautions should be taken to avoid unnecessary exposures or risks.

Warranty and Disclaimer: Frontier Scientific, Inc. warrants the product conforms to the specifications stated herein. In the event of nonconformity, Frontier will replace products or refund purchase price, at its sole option, and Frontier shall not be responsible for any other loss or damage, whether known or foreseeable to Frontier. No other warranties apply, express or implied, including but not limited to warranty of fitness for any purpose or implied warranty of merchantability. Purchaser is solely responsible for all consequences of its use of the product and Frontier assumes no responsibility therefore, including success of purchaser's research and development, or health or safety of any uses of the product.

Frontier Scientific 日本総代理店 ヒドラス化学株式会社

TEL.03-3258-5031 FAX.03-3258-6535

info@hydrus.co.jp www.hydrus.co.jp