Docosahexaenoic acid

Cat. No.: HY-B2167

CAS No.: 6217-54-5

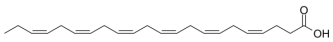
Molecular Formula: $C_{22}H_{32}O_2$

Molecular Weight: 328.49

Target: Endogenous Metabolite

Pathway: Metabolic Enzyme/Protease

Storage: -20°C, protect from light, stored under nitrogen
* In solvent : -80°C, 6 months; -20°C, 1 month (protect from light, stored under nitrogen)



SOLVENT & SOLUBILITY

In Vitro

DMSO : 100 mg/mL (304.42 mM; Need ultrasonic)
Ethanol : 50 mg/mL (152.21 mM; Need ultrasonic)
0.1 M NaOH : 12.5 mg/mL (38.05 mM; Need ultrasonic)

Preparing Stock Solutions

Mass / Solvent / Concentration	1 mg	5 mg	10 mg
1 mM	3.0442 mL	15.2212 mL	30.4423 mL
5 mM	0.6088 mL	3.0442 mL	6.0885 mL
10 mM	0.3044 mL	1.5221 mL	3.0442 mL

Please refer to the solubility information to select the appropriate solvent.

In Vivo

1. Add each solvent one by one: 50% PEG300 >> 50% saline
   Solubility: 33.33 mg/mL (101.46 mM); Suspended solution; Need ultrasonic
2. Add each solvent one by one: 10% EtOH >> 40% PEG300 >> 5% Tween-80 >> 45% saline
   Solubility: ≥ 5 mg/mL (15.22 mM); Clear solution
3. Add each solvent one by one: 10% EtOH >> 90% (20% SBE-β-CD in saline)
   Solubility: 5 mg/mL (15.22 mM); Suspended solution; Need ultrasonic
4. Add each solvent one by one: 10% EtOH >> 90% corn oil
   Solubility: ≥ 5 mg/mL (15.22 mM); Clear solution
5. Add each solvent one by one: 10% DMSO >> 40% PEG300 >> 5% Tween-80 >> 45% saline
   Solubility: ≥ 2.5 mg/mL (7.61 mM); Clear solution
6. Add each solvent one by one: 10% DMSO >> 90% (20% SBE-β-CD in saline)
   Solubility: ≥ 2.5 mg/mL (7.61 mM); Clear solution
7. Add each solvent one by one: 10% DMSO >> 90% corn oil
   Solubility: ≥ 2.5 mg/mL (7.61 mM); Clear solution
8. Add each solvent one by one: 5% DMSO >> 40% PEG300 >> 5% Tween-80 >> 50% saline
   Solubility: ≥ 2.5 mg/mL (7.61 mM); Clear solution

	9. Add each solvent one by one: 5% DMSO >> 95% (20% SBE-β-CD in saline) Solubility: 2.5 mg/mL (7.61 mM); Suspended solution; Need ultrasonic

BIOLOGICAL ACTIVITY

Description	Docosahexaenoic Acid (DHA) is an omega-3 fatty acid abundantly present brain and retina. It can be obtained directly from fish oil and maternal milk.
IC_{50} & Target	Human Endogenous Metabolite
In Vitro	Docosahexaenoic acid (DHA) is essential for the growth and functional development of the brain in infants. DHA is also required for maintenance of normal brain function in adults. The inclusion of plentiful DHA in the diet improves learning ability and memory[1]. DHA is an essential requirement in every step of brain development like neural cell proliferation, migration, differentiation, synaptogenesis. The multiple double bonds and unique structure allow DHA to impart special membrane characteristics for effective cell signaling. Many development disorders like dyslexia, autism spectrum disorder, attention deficit hyperactivity disorder, schizophrenia etc. are causally related to decreased level of DHA[2]. DHA is a potent RXR ligand inducing robust RXR activation already at low micro molar concentrations. The EC_{50} for RXRα activation by DHA is about 5-10 μM fatty acid[3]. MCE has not independently confirmed the accuracy of these methods. They are for reference only.
In Vivo	Docosahexaenoic acid administration over 10 weeks significantly reduces the number of reference memory errors, without affecting the number of working memory errors, and significantly increases the docosahexaenoic acid content and the docosahexaenoic acid/arachidonic acid ratio in both the hippocampus and the cerebral cortex[4]. DHA treatment exerts neuroprotective actions on an experimental mouse model of PD. There is a decrease tendency in brain lipid oxidation of MPTP mice but it does not significantly[5]. MCE has not independently confirmed the accuracy of these methods. They are for reference only.

PROTOCOL

Animal Administration [4][5]	Rats: Wistar rats are fed a fish oil-deficient diet through three generations. The young (five-week-old) male rats of the third generation are randomLy divided into two groups. Over 10 weeks, one group is perorally administered docosahexaenoic acid dissolved in 5% gum Arabic solution at 300 mg/kg/day; the other group receives a similar volume of vehicle alone. Five weeks after starting the administration, the rats are tested for learning ability related to two types of memory, reference memory and working memory, with the partially (four of eight) baited eight-arm radial maze[4]. Mice: An experimental model of Parkinson's disease is created by four intraperitoneal injections of 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) (4×20 mg/kg, at 12 h intervals). Docosahexaenoic acid is given daily by gavage for 4 weeks (36 mg/kg/day). The motor activity of the mice is evaluated via the pole test. The activity of antioxidant enzymes in the brain are determined by spectrophotometric assays and the concentration of thiobarbituric acid-reactive substances (TBARS) are measured as an index of oxidative damage[5]. MCE has not independently confirmed the accuracy of these methods. They are for reference only.

CUSTOMER VALIDATION

- Nat Commun. 2022 Feb 17;13(1):931.
- Gut Microbes. 2023 Dec;15(2):2265578.

- Redox Biol. 2023 Aug 18;66:102857.
- Proc Natl Acad Sci U S A. 2021 Oct 26;118(43):e2104689118.
- Cancer Immunol Res. 2022 Dec 2;10(12):1542-1558.

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REFERENCES

[1]. Horrocks LA, et al. Health benefits of docosahexaenoic acid (DHA). Pharmacol Res. 1999 Sep;40(3):211-25.

[2]. Gharami K, et al. Essential role of docosahexaenoic acid towards development of a smarter brain. Neurochem Int. 2015 Oct;89:51-62.

[3]. Lengqvist J, et al. Polyunsaturated fatty acids including docosahexaenoic and arachidonic acid bind to the retinoid Xreceptor alpha ligand-binding domain. Mol Cell Proteomics. 2004 Jul;3(7):692-703.

[4]. Gamoh S, et al. Chronic administration of docosahexaenoic acid improves reference memory-related learning ability in young rats. Neuroscience. 1999;93(1):237-41.

[5]. Ozsoy O, et al. The influence and the mechanism of docosahexaenoic acid on a mouse model of Parkinson's disease. Neurochem Int. 2011 Oct;59(5):664-70.

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