

Product Data Sheet

Product Name: Citicoline sodium salt

Cat. No.: GC31186

Chemical Properties

Cas. No. 33818-15-4

SMILES O[C@H]1[C@H](N(C=CC(N)=N2)C2=O)O[C@H](COP(OP(OCC[N+](C)(C)C)([O-])=O)(O)=O)[C@H]1O.[Na]

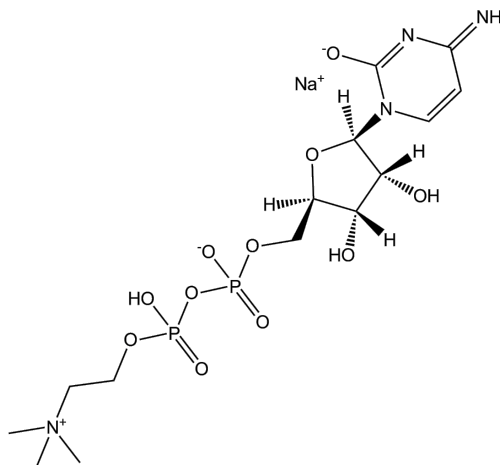
Formula $C_{14}H_{25}N_4NaO_{11}P_2$ M.Wt 510.31

Solubility Water : 300 mg/mL (586.73 mM) Storage Store at -20°C, sealed storage, away from moisture

General tips For obtaining a higher solubility , please warm the tube at 37 °C and shake it in the ultrasonic bath for a while. Stock solution can be stored below -20°C for several months.

Shipping Condition Evaluation sample solution : ship with blue ice All other available size: ship with RT , or blue ice upon request.

Structure



Protocol

Cell experiment [1]:

Cell lines HEI-OC-1 cells

Caution: Product has not been fully validated for medical applications. For research use only.

Tel: (909) 407-4943 Fax: (626) 353-8530 E-mail: tech@glpbio.com

Address: 10292 Central Ave. #205, Montclair, CA, USA

Product Data Sheet

HEI-OC-1 cells were seeded into 96-well plates at a concentration of 2,000 cells per well and cultured for 24h. The cells were then treated with different concentrations (0, 1, 10, 100μM, 1mM, and 2mM) of Citicoline sodium salt for 6, Preparation Method 12, and 24 hours respectively. After treatment, the cells were exposed to 10mM neomycin together with Citicoline sodium salt (same concentration as pre-treatment) for 24 hours, followed by recovery in culture medium for an additional 12 hours.

Reaction
Conditions 0, 1, 10, 100μM, 1mM, and 2mM; 24h

Applications Citicoline sodium salt significantly protects HEI-OC-1 cells from neomycin-induced apoptosis by reducing reactive oxygen species (ROS) accumulation and maintaining mitochondrial membrane potential.

Animal experiment [2]:

Animal models Male NMRI mice

Preparation Method Arsenic-induced hepatotoxicity and diabetes were established by exposing mice to sodium arsenite (NaAsO₂) at a concentration of 50ppm via drinking water for 8 weeks. Citicoline sodium salt (CTC) was administered orally at doses of 250, 500, and 1000mg/kg during the last 2 weeks of the study. At the end of the experiment, blood and liver samples were collected for analysis of biochemical markers, gene expression, and histopathological changes.

Dosage form 250, 500, and 1000 mg/kg for 2 weeks; p.o.

Caution: Product has not been fully validated for medical applications. For research use only.

Tel: (909) 407-4943 Fax: (626) 353-8530 E-mail: tech@glpbio.com

Address: 10292 Central Ave. #205, Montclair, CA, USA

Product Data Sheet

Applications Citicoline sodium salt significantly reduced levels of liver enzymes (ALT and AST), serum triglycerides (TG), and total cholesterol (TC) in arsenic-intoxicated mice. Citicoline sodium salt also increased the activity of antioxidant enzymes (CAT, SOD, and GPx) and total thiol content, while decreasing oxidative stress markers (ROS and TBARS).

References:

- [1] Zhong Z, Fu X, Li H, et al. Citicoline Protects Auditory Hair Cells Against Neomycin-Induced Damage. *Front Cell Dev Biol.* 2020 Aug 31;8:712.
- [2] Nikraves M, Mahdavinia M, Neisi N, et al. Citicoline ameliorates arsenic-induced hepatotoxicity and diabetes in mice by overexpression of VAMP2, PPAR- γ , As3MT, and SIRT3. *Pestic Biochem Physiol.* 2023 May;192:105391.

Background

Citicoline sodium salt is the water-soluble form of citicoline, which is a natural intermediate in the biosynthesis of phosphatidylcholine. Citicoline sodium salt serves as a precursor to acetylcholine and phosphatidylcholine in the brain and has biological functions that include inhibiting the production of reactive oxygen species (ROS) and apoptosis^[1]. Citicoline promotes the synthesis of phosphatidylcholine, a major component of cell membranes, thereby supporting the integrity and function of neuronal membranes^[2]. Additionally, citicoline enhances the release of neurotransmitters such as dopamine and norepinephrine, which helps improve cognitive function and provides neuroprotection^[3]. Citicoline has also been shown to increase cerebral blood flow and glucose metabolism, both of which are crucial for maintaining brain health and cognitive performance^[4].

In vitro, pre-treatment of auditory hair cell-like HEI-OC-1 cells with Citicoline sodium salt (10 μ M) for 12 hours, followed by co-treatment with 10mM neomycin for 24 hours and subsequent recovery in culture medium containing Citicoline sodium salt for 12 hours, significantly reduced neomycin-induced apoptosis, decreased ROS levels, inhibited the decline in mitochondrial membrane potential (MMP), and upregulated the expression of antioxidant genes (Gsr, Sod1, and Glrx) while downregulating the expression of the pro-oxidant gene Alox15. These effects protected the cells from

Caution: Product has not been fully validated for medical applications. For research use only.

Tel: (909) 407-4943 Fax: (626) 353-8530 E-mail: tech@glpbio.com

Address: 10292 Central Ave. #205, Montclair, CA, USA

Product Data Sheet

neomycin-induced damage^[5]. In a primary retinal cell neurotoxicity model exposed to glutamate and high glucose, combined treatment with Citicoline sodium salt (100 μ M) and homotaurine significantly reduced apoptosis induced by glutamate and high glucose and synergistically enhanced cell survival, demonstrating stronger neuroprotective effects than either compound alone^[6].

In vivo, oral administration of Citicoline sodium salt (200mg/kg, 500mg/kg, and 1000mg/kg) to mice exposed to sodium arsenite (NaAsO₂, 50ppm) for 2 weeks significantly reduced ALT and AST levels in mice, decreased ROS and TBARS levels, and increased the activities of CAT, SOD, and GPx. Additionally, Citicoline sodium salt lowered pro-inflammatory cytokine levels (TNF- α and IL-6), improved insulin secretion function, and alleviated sodium arsenite-induced hepatotoxicity and impaired glucose tolerance^[7]. In a mice model of intracerebral hemorrhage (ICH), intraperitoneal injection of Citicoline sodium salt (500mg/kg) three times before and at 24 and 48 hours after ICH induction significantly improved neurological function scores and reduced the volume of ischemic injury surrounding the hemorrhagic area^[8].

References:

- [1] Bermejo PE, Dorado R, Zea-Sevilla MA. Role of Citicoline in Patients With Mild Cognitive Impairment. *Neurosci Insights*. 2023 Feb 16;18:26331055231152496.
- [2] Gareri P, Castagna A, Cotroneo AM, et al. The role of citicoline in cognitive impairment: pharmacological characteristics, possible advantages, and doubts for an old drug with new perspectives. *Clin Interv Aging*. 2015 Sep 3;10:1421-9.
- [3] Saver JL. Citicoline: update on a promising and widely available agent for neuroprotection and neurorepair. *Rev Neurol Dis*. 2008 Fall;5(4):167-77.
- [4] Mulè S, Ferrari S, Rosso G, et al. The Combined Effect of Green Tea, Saffron, Resveratrol, and Citicoline against Neurodegeneration Induced by Oxidative Stress in an In Vitro Model of Cognitive Decline. *Oxid Med Cell Longev*. 2024 Oct 1;2024:7465045.
- [5] Zhong Z, Fu X, Li H, et al. Citicoline Protects Auditory Hair Cells Against Neomycin-Induced Damage. *Front Cell Dev Biol*. 2020 Aug 31;8:712.
- [6] Davinelli S, Chiosi F, Di Marco R, et al. Cytoprotective Effects of Citicoline and Homotaurine against Glutamate and High Glucose Neurotoxicity in Primary Cultured Retinal Cells. *Oxid Med Cell Longev*. 2017;2017:2825703.
- [7] Meyer N, Brodowski L, Richter K, et al. Pravastatin Promotes Endothelial Colony-Forming Cell Function, Angiogenic Signaling and Protein Expression In Vitro. *J Clin Med*. 2021 Jan 6;10(2):183.
- [8] Clark W, Gunion-Rinker L, Lessov N, et al. Citicoline treatment for experimental intracerebral

Caution: Product has not been fully validated for medical applications. For research use only.

Tel: (909) 407-4943 Fax: (626) 353-8530 E-mail: tech@glpbio.com

Address: 10292 Central Ave. #205, Montclair, CA, USA

Product Data Sheet

hemorrhage in mice. Stroke. 1998 Oct;29(10):2136-40.

Caution: Product has not been fully validated for medical applications. For research use only.

Tel: (909) 407-4943 Fax: (626) 353-8530 E-mail: tech@glpbio.com

Address: 10292 Central Ave. #205, Montclair, CA, USA