

## Product Data Sheet

Product Name: 3,4-Dihydroxybenzoic acid (Protocatechuic acid)

Cat. No.: GN10369

### Chemical Properties

Cas. No. 99-50-3

Chemical Name 3,4-dihydroxybenzoic acid

SMILES C1=CC(=C(C=C1C(=O)O)O)O

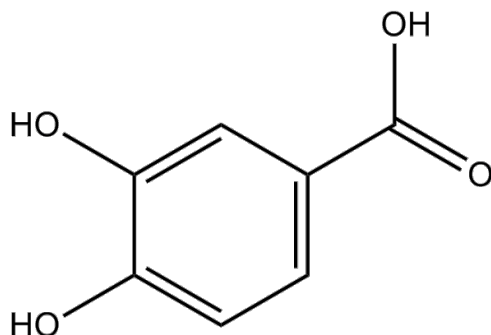
Formula  $C_7H_6O_4$  M.Wt 154.03

Solubility  $\geq 4.9\text{mg/mL}$  in DMSO Storage  $-20^\circ\text{C}$

General tips For obtaining a higher solubility, please warm the tube at  $37^\circ\text{C}$  and shake it in the ultrasonic bath for a while. Stock solution can be stored below  $-20^\circ\text{C}$  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 U87 and U251 cells (human glioma cell lines)

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

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**Preparation Method** Cells were maintained in Dulbecco's Modified Eagle Medium (DMEM) supplemented with 10% fetal bovine serum (FBS) and 1% penicillin-streptomycin at 37°C, 5% CO<sub>2</sub>. Cells were treated with 3,4-Dihydroxybenzoic acid at concentrations of 2.5–10µM for 24–48 hours.

**Reaction Conditions** 2.5-10µM; 24–48 hours

**Applications** 3,4-Dihydroxybenzoic acid significantly suppressed cell viability, invasion, and migration in a dose-dependent manner. 3,4-Dihydroxybenzoic acid induced pyroptosis by upregulating NLRP3, caspase-1, and GSDMD expression, leading to increased GSDMD positivity.

### Animal experiment [2]:

**Animal models** C57BL/6NTac mice

**Preparation Method** Mice were implanted with osmotic minipumps to continuously infuse Isoproterenol (80mg/kg) for 14 days to induce heart failure. 3,4-Dihydroxybenzoic acid (100mg/kg) was administered via daily intramuscular injections from day 6 to day 14 of isoproterenol infusion.

**Dosage form** 100mg/kg; i.m.

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### Applications

3,4-Dihydroxybenzoic acid significantly attenuated isoproterenol-induced cardiac hypertrophy, as evidenced by reduced heart-weight-to-body-weight ratio, decreased cardiomyocyte cross-sectional area, and downregulated expression of hypertrophy markers. 3,4-Dihydroxybenzoic acid improved cardiac function by increasing ejection fraction and fractional shortening, and reduced pulmonary edema.

### References:

- [1] Zhang W, Cai Y, Zheng H. Protective Role of Protocatechuic Acid in Glioma: Modulation of Cell Growth, Migration, and Pyroptosis via NLRP3/Caspase-1/GSDMD Axis. *Discov Med*. 2025 Apr;37(195):659-668.
- [2] Bai L, Han X, Kee HJ, et al. Protocatechuic acid prevents isoproterenol-induced heart failure in mice by downregulating kynurenine-3-monooxygenase. *J Cell Mol Med*. 2023 Aug;27(16):2290-2307.

### Background

3,4-Dihydroxybenzoic acid (Protocatechuic acid) is a natural polyphenolic compound found in many edible and medicinal plants<sup>[1]</sup>. 3,4-Dihydroxybenzoic acid exhibits significant antioxidant activity<sup>[2]</sup>, neuroprotective effects<sup>[3]</sup>, and anticancer properties<sup>[4]</sup>.

In vitro, treatment of human HepG2 hepatocellular carcinoma cells with 3,4-Dihydroxybenzoic acid (100μM) for 4 days induced cell death through a mechanism dependent on c-Jun N-terminal kinase (JNK) and p38 mitogen-activated protein kinase (MAPK)<sup>[5]</sup>. Treatment of human glioma cell lines U87 and U251 with 3,4-Dihydroxybenzoic acid (2.5–10μM) for 24–48 hours significantly inhibited cell proliferation, invasion, and migration, and induced pyroptosis via a mechanism dependent on the NLRP3/caspase-1/GSDMD signaling axis<sup>[6]</sup>.

In vivo, dietary supplementation with 3,4-Dihydroxybenzoic acid (0.025–0.1%w/w) for 12 weeks in high-fat diet-fed C57BL/6J mice significantly ameliorated metabolic-associated fatty liver disease (MAFLD) by inhibiting the growth of *Enterococcus faecalis* in the gut and modulating insulin signaling pathways<sup>[7]</sup>. Intramuscular administration of 3,4-Dihydroxybenzoic acid (100mg/kg/day) for 9 days in

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an isoproterenol (80mg/kg/day)-induced heart failure model using C57BL/6 mice significantly improved cardiac function and attenuated cardiac hypertrophy and fibrosis<sup>[8]</sup>.

### References:

- [1] Khan AK, Rashid R, Fatima N, et al. PHARMACOLOGICAL ACTIVITIES OF PROTOCATECHUIC ACID. Acta Pol Pharm. 2015 Jul-Aug;72(4):643-50.
- [2] Zhang X, Luo J, Bharati L, Hua Z, et al. Protocatechuic acid suppresses ferroptosis to protect against hypoxic-ischemic encephalopathy by targeting the HIF-1 $\alpha$ /VEGFA axis. Phytomedicine. 2025 Jul 25;143:156900.
- [3] Krzysztoforska K, Mirowska-Guzel D, Widy-Tyszkiewicz E. Pharmacological effects of protocatechuic acid and its therapeutic potential in neurodegenerative diseases: Review on the basis of in vitro and in vivo studies in rodents and humans. Nutr Neurosci. 2019 Feb;22(2):72-82.
- [4] Cadena-Iñiguez J, Santiago-Osorio E, Sánchez-Flores N, et al. The Cancer-Protective Potential of Protocatechuic Acid: A Narrative Review. Molecules. 2024 Mar 23;29(7):1439.
- [5] Yip EC, Chan AS, Pang H, et al. Protocatechuic acid induces cell death in HepG2 hepatocellular carcinoma cells through a c-Jun N-terminal kinase-dependent mechanism. Cell Biol Toxicol. 2006 Jul;22(4):293-302.
- [6] Zhang W, Cai Y, Zheng H. Protective Role of Protocatechuic Acid in Glioma: Modulation of Cell Growth, Migration, and Pyroptosis via NLRP3/Caspase-1/GSDMD Axis. Discov Med. 2025 Apr;37(195):659-668.
- [7] Tan J, Hu R, Gong J, et al. Protection against Metabolic Associated Fatty Liver Disease by Protocatechuic Acid. Gut Microbes. 2023 Jan-Dec;15(1):2238959.
- [8] Bai L, Han X, Kee HJ, et al. Protocatechuic acid prevents isoproterenol-induced heart failure in mice by downregulating kynurenine-3-monooxygenase. J Cell Mol Med. 2023 Aug;27(16):2290-2307.

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