

Product Data Sheet

Product Name: Citric acid

Cat. No.: GC14203

Chemical Properties

Cas. No. 77-92-9

Chemical Name 2-hydroxypropane-1,2,3-tricarboxylic acid

SMILES OC(CC(O)=O)(C(O)=O)CC(O)=O

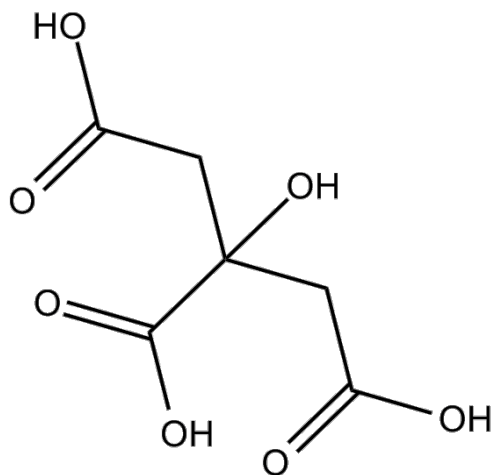
Formula $C_6H_8O_7$ M.Wt 192.12

Solubility $\geq 19.2\text{mg/mL}$ in Water Storage Store at RT

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

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

Cell experiment: HaCaT cells are treated with different concentrations of citric acid (2.5, 5, 7.5, 10, 12.5 mM) for 24 h; 0.5% of DMSO (vehicle) is used as a control. Cells are then centrifuged at 1000 ×g for 5 min, and cell pellets are dissolved with 0.5 mL of Phosphate buffered saline (PBS) containing 5 µg/mL PI and viable cells are determined by using a flow cytometer for determination of viable cells[1].

Animal experiment: Rats: Rats are induced of diabetes and divided randomly into an untreated diabetic group and two treated diabetic groups, receiving citric acid (2 g/L) in the drinking water, or insulin therapy. Insulin-treated rats receive 3 IU of neutral protamine Hagedorn insulin three times per week. Fasting (12 hr) blood samples are obtained from the tail vein two days after insulin injection for measurement of blood glucose, HbA1c and ketone bodies[4]. [2]Mice: Citric acid is prepared in sterile physiological saline. Mice are randomly divided into five equal groups (six mice each). Mice are treated with either 0.2mL of: sterile physiological saline (group 1) or citric acid at doses of 1, 2, and 4 g/kg, orally (groups 2-4). Treatments are given just prior to endotoxin administration (LPS: 200 lg/kg, injected intraperitoneally, 0.1 mL). The fifth group received just the vehicle, no LPS (negative control). Mice are euthanized after 4 h of LPS or vehicle injection by decapitation under ether anesthesia, where the brain and liver of each mouse are then removed for analysis[2].

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

References:

- [1]. Ying TH, et al. Citric acid induces cell-cycle arrest and apoptosis of human immortalized keratinocyte cell line (HaCaT) via caspase- and mitochondrial-dependent signaling pathways. *Anticancer Res.* 2013 Oct;33(10):4411-20.
- [2]. Abdel-Salam OM, et al. Citric acid effects on brain and liver oxidative stress in lipopolysaccharide-treated mice. *J Med Food.* 2014 May;17(5):588-98.
- [3]. Lacour B, et al. Stimulation by citric acid of calcium and phosphorus bioavailability in rats fed a calcium-rich diet. *Miner Electrolyte Metab.* 1997;23(2):79-87.
- [4]. Nagai R, et al. Citric acid inhibits development of cataracts, proteinuria and ketosis in streptozotocin (type 1) diabetic rats. *Biochem Biophys Res Commun.* 2010 Feb 26;393(1):118-22.

Background

Citric acid is a weak organic tricarboxylic acid found in citrus fruits. Citric acid is a natural preservative and food tartness enhancer.

Citric acid induces apoptosis through the mitochondrial pathway in the human keratinocyte cell line HaCaT. It inhibits proliferation of HaCaT cells in a dose-dependent manner, but also induces apoptosis and cell cycle-arrest at the G2/M phase (before 24 h) and S phase (after 24 h)[1].

Citric acid is found in all animal tissues as an intermediary substance in oxidative metabolism. The administration of citric acid (1–2 g/kg) attenuates LPS-induced elevations in brain MDA, nitrite, TNF- α , GPx, and PON1 activity. In the liver, nitrite is decreased by 1 g/kg citric acid. Citric acid (1-2 g/kg) decreases brain lipid peroxidation and inflammation, liver damage, and DNA fragmentation[2]. Citric acid supplementation increases intestinal calcium and phosphorus absorption and the retention/intake ratio only in rats fed the 1% Ca diet. Citric acid supplementation together with a calcium-rich diet allows to obtain an increased retention of calcium and phosphorus in bone. The prolonged administration of calcium citrate supplements may therefore help to increase bone mineral concentration[3]. Oral administration of citric acid ameliorates ketosis and protects against the development of diabetic complications in an animal model of type 1 diabetes[4].

Reference:

- [1]. Ying TH, et al. Citric acid induces cell-cycle arrest and apoptosis of human immortalized keratinocyte cell line (HaCaT) via caspase- and mitochondrial-dependent signaling pathways. *Anticancer Res.* 2013 Oct;33(10):4411-20.
- [2]. Abdel-Salam OM, et al. Citric acid effects on brain and liver oxidative stress in

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

lipopolysaccharide-treated mice. J Med Food. 2014 May;17(5):588-98.

[3]. Lacour B, et al. Stimulation by citric acid of calcium and phosphorus bioavailability in rats fed a calcium-rich diet. Miner Electrolyte Metab. 1997;23(2):79-87.

[4]. Nagai R, et al. Citric acid inhibits development of cataracts, proteinuria and ketosis in streptozotocin (type 1) diabetic rats. Biochem Biophys Res Commun. 2010 Feb 26;393(1):118-22.

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