

Product Data Sheet

Product Name: L-Thyroxine

Cat. No.: GC11268

Chemical Properties

Cas. No. 51-48-9

Chemical Name (2S)-2-amino-3-[4-(4-hydroxy-3,5-diiodophenoxy)-3,5-diiodophenyl]propanoic acid

SMILES C1=C(C=C(C(=C1I)OC2=CC(=C(C(=C2)I)O)I)I)CC(C(=O)O)N

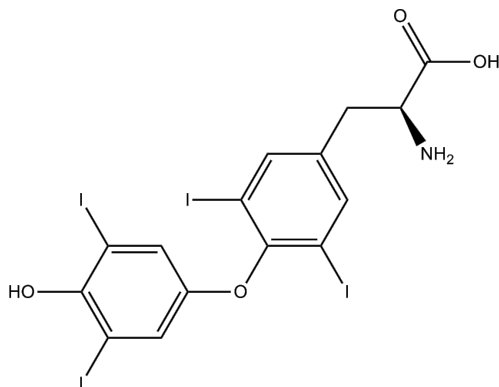
Formula $C_{15}H_{11}I_4NO_4$ M.Wt 776.87

Solubility $\geq 27.35\text{mg/mL}$ in DMSO Storage Store at 2-8°C

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]:

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Cell lines Human airway smooth muscle (ASM) cells

Preparation Method ASM cells were cultured in Dulbecco's modified Eagle's medium (DMEM) supplemented with streptomycin (50U/ml), penicillin (50µg/ml), and fetal bovine serum (10% vol/vol) at 37°C, 5% CO₂. Cells were serum-starved for 72 hours in serum-free DMEM supplemented with streptomycin, penicillin, and 1% ITS (insulin, transferrin, selenium) before treatment. Cell treated with L-Thyroxine (T4) at 100nM in combination with TGF-β1 (2ng/ml) for 28 hours.

Reaction
Conditions 100nM; 28h

Applications L-Thyroxine significantly increased ASM cell proliferation in the presence of TGF-β1. L-Thyroxine also decreased the expression of contractile proteins (smooth muscle α-actin and calponin) in TGF-β1-treated cultures.

Animal experiment [1]:

Animal models Ames dwarf (df/df) mice

Preparation Method Juvenile Ames dwarf mice (both male and female) were treated with a combination of growth hormone (GH, 6µg/g body weight) and L-Thyroxine (0.1µg/g body weight) via subcutaneous injections. GH was administered twice daily, while L-Thyroxine was given three times per week. The treatment started at 2 weeks of age and continued for 6 weeks.

Dosage form 0.1µg/g body weight; subcutaneous injections

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Applications

The combination treatment with GH and L-Thyroxine significantly increased body weight in Ames dwarf mice. GH + L-Thyroxine treatment reduced the expression of genes such as insulin receptor (IR), insulin receptor substrate-1 (IRS-1), phosphoinositide 3-kinase (PI3K), and GLUT4 in these tissues, compared to GH alone.

References:

- [1] Dekkers BG, Naeimi S, Bos IS, et al. L-thyroxine promotes a proliferative airway smooth muscle phenotype in the presence of TGF- β 1. *Am J Physiol Lung Cell Mol Physiol*. 2015 Feb 1;308(3):L301-6.
- [2] Thyroxine modifies the effects of growth hormone in Ames dwarf mice. *Aging (Albany NY)*. 2015 Apr;7(4):241-55.

Background

L-Thyroxine is a synthetic thyroid hormone that mimics the natural thyroxine secreted by the thyroid gland and plays a crucial role in regulating metabolism and promoting growth and development^[1]. L-Thyroxine is commonly used to treat hypothyroidism and other thyroid-related diseases^[2]. Additionally, L-Thyroxine is used in diagnostic tests for thyroid function^[3] and has been shown to protect myocardial function^[4].

In vitro, treatment of U2OS and MG63 osteoblast-like cells with L-Thyroxine (2.5–10 μ M) for 1 hour significantly increased the expression of Angiopoietin-1 (Ang1) in a dose-dependent manner. L-Thyroxine also significantly enhanced alkaline phosphatase (ALP) activity and cell mineralization capacity. Moreover, it significantly upregulated the expression of osteoblast-related protein markers, such as COL1A1, OC, BSP, Dlx5, Runx2, and OSX^[5]. When human bronchial smooth muscle cells (ASM) were treated with L-Thyroxine (1–100nM) in combination with TGF- β 1 (2ng/ml) for 28 hours, L-Thyroxine (100nM) significantly enhanced the proliferative response of ASM cells and reduced the expression of contractile proteins induced by TGF- β 1^[6].

In vivo, L-Thyroxine (1 μ g/kg) was administered subcutaneously to mice, which were then exposed to gamma radiation (6Gy) or intraperitoneally injected with cisplatin (15mg/kg) to induce nephrotoxicity.

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L-Thyroxine significantly improved elevated renal function biomarkers, oxidative stress, and protected renal tissue from subsequent cellular damage^[7]. In Ames dwarf mice, L-Thyroxine (0.1µg/g) in combination with growth hormone (GH, 6µg/g) was administered via subcutaneous injection twice a week starting at 2 weeks of age for 6 weeks. This treatment significantly promoted the growth of Ames dwarf mice^[8].

References:

- [1] Darbinyan L, Simonyan K, Hambardzumyan L, et al. Impact of L-thyroxine on hippocampal activity, morphology, and behavioral performance in thyroidectomized rats. *Metab Brain Dis*. 2025 Mar 10;40(3):140.
- [2] McDermott MT. Hypothyroidism. *Ann Intern Med*. 2020 Jul 7;173(1):ITC1-ITC16.
- [3] Fugazzola L, Persani L, Mannavola D, et al. Recombinant human TSH testing is a valuable tool for differential diagnosis of congenital hypothyroidism during L-thyroxine replacement. *Clin Endocrinol (Oxf)*. 2003 Aug;59(2):230-6.
- [4] Wang Y, Zhu S, Liu H, et al. Thyroxine Alleviates Energy Failure, Prevents Myocardial Cell Apoptosis, and Protects against Doxorubicin-Induced Cardiac Injury and Cardiac Dysfunction via the LKB1/AMPK/mTOR Axis in Mice. *Dis Markers*. 2019 Dec 16;2019:7420196.
- [5] Park SH, Lee J, Kang MA, et al. Potential of l-thyroxine to differentiate osteoblast-like cells via Angiopoietin1. *Biochem Biophys Res Commun*. 2016 Sep 23;478(3):1409-15.
- [6] Dekkers BG, Naeimi S, Bos IS, et al. L-thyroxine promotes a proliferative airway smooth muscle phenotype in the presence of TGF-β1. *Am J Physiol Lung Cell Mol Physiol*. 2015 Feb 1;308(3):L301-6.
- [7] El-Hamoly T, El-Sharawy DM, El Refaye MS, et al. L-thyroxine modifies nephrotoxicity by regulating the apoptotic pathway: The possible role of CD38/ADP-ribosyl cyclase-mediated calcium mobilization. *PLoS One*. 2017 Sep 11;12(9):e0184157.
- [8] Do A, Menon V, Zhi X, Gesing A, et al. Thyroxine modifies the effects of growth hormone in Ames dwarf mice. *Aging (Albany NY)*. 2015 Apr;7(4):241-55.

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