Product Information

3-Isobutyl-1-methylxanthine

≥99% (HPLC), powder

I5879

Product Description

CAS Registry Number: 28822-58-4

Synonyms: IBMX, 1-Methyl-3-isobutylxanthine, 3,7-Dihydro-1-methyl-3-(2-methylpropyl)-1H-purine-2,6-dione, 3-Isobutyl-1-methyl-2,6(1H,3H)-purinedione

Molecular Formula: $C_{10}H_{14}N_4O_2$

Molecular Weight: 222.2

Methylxanthines such as caffeine and theophylline inhibit adenosine 3',5'-cyclic monophosphate phosphodiesterase (cAMP PDE).[1]

3-Isobutyl-1-methylxanthine (IBMX) has been shown to be a potent inhibitor of cAMP PDE, significantly more effective than theophylline.[2-6] IBMX inhibits cyclic nucleotide PDE with subsequent inhibition of cyclic nucleotide hydrolysis, leading to accumulation of cyclic AMP and cyclic GMP.[7,8] In a study of cyclic AMP and insulin release by islets of Langerhans, IBMX at 1 mM caused a marked increase in the intracellular concentration of cyclic AMP in the presence of glucose.[4]

For lipolysis stimulation in fat cells, IBMX was 20-fold more effective than theophylline, used at 0.05 mM.[3] IBMX has been shown to promote the conversion of fibroblast cells into adipose cells.[9] As a PDE inhibitor, IBMX was shown to inhibit the growth of carcinoma cells both *in vivo* and *in vitro* in mice.[10]

Various publications have cited use of this specific IBMX product in different systems, such as:

- Mouse adipocyte cultures[11]
- Mesenchymal stem cells, in adipogenic differentiation medium[12]
- Transfected HEK 293 cells[13]

Several theses[14] and dissertations[15-23] have cited use of product I5879 in their protocols.

Precautions and Disclaimer

For R&D use only. Not for drug, household, or other uses. Please consult the Safety Data Sheet for information regarding hazards and safe handling practices.

Preparation Instructions

IBMX is soluble in different organic solvents, as follows:

- Warm methanol: 50 mg/mL
- Ethanol:
  - 10 mg/mL[12,24]
  - 25 mg/mL (only with sonication)[24]
- DMSO:
  - 200 mM[13]
  - 110 mg/mL[25]

A 10 mM aqueous solution can be prepared by warming in a boiling water bath.[26]

Storage/Stability

- One publication reports storage of IBMX solutions in ethanol at 0.125 mg/mL at 4 °C for at least three months.[24]
- Aqueous solutions can be frozen in aliquots, then thawed for use by heating in a boiling water bath. These aliquots are stable for several months.[26]
- Solutions in DMSO may be stored at -20 °C.[25]

References

1. Chasin, M, and Harris, D.N., *Adv. Cyclic Nucleotide Res.*, **7**, 225-228 (1976).
2. Dawson, R.M.C. *et al*. (eds.), *Data for Biochemical Research*, 3rd edition. Oxford University Press (Oxford, UK), pp. 326-327 (1986).

3. Beavo, J.A. *et al.*, *Mol. Pharmacol.*, **6(6)**, 597-603 (1970).
4. Montague, W., and Cook, J.R., *Biochem. J.*, **122(1)**, 115-120 (1971).
5. Peytreman, A. *et al.*, *Endocrinology*, **92(2)**, 525-530 (1973).
6. Ashcroft, S.J.H. *et al.*, *FEBS Lett.*, **20(3)**, 263-266 (1972).
7. Klotz, U. *et al.*, *Naunyn-Schmiedebergs Archives Pharmacol.*, **296(2)**, 187-190 (1977).
8. Spaulding, S.W. and Burrow, G.N., *Biochem. Biophys. Res. Commun.*, **59(1)**, 386-391 (1974).
9. Russell, T.R., *Proc. Natl. Acad. Sci. USA*, **76(9)**, 4451-4454 (1979).
10. Janik, P. *et al.*, *Cancer Res.*, **40(6)**, 1950-1954 (1980).
11. Sustarsic, E.G. *et al.*, *Cell Metab.*, **28(1)**, 159-174.e11 (2018).
12. Delorme, B., and Charbord, P., *Methods Mol. Med.*, **140**, 67-81 (2007).
13. Plouffe, B. *et al.*, *Methods Enzymol.*, **484**, 295-328 (2010).
14. Burnett, Dave A., "Investigation of the potential role of Relaxin-3 in steroidogenesis in the ovarian follicles of *Fundulus heteroclitus*". Acadia University, B.Sc. Honours thesis, p. 33 (2006).
15. Mak, Jason K.C., "Regulation of cAMP Signalling to Phospholemman by Phosphodiesterases". King's College London, Ph.D. dissertation, p. 68 (2013).
16. Udwari, Daniel, "A photoactivated adenylyl cyclase as an optogenetic tool to manipulate neuronal signaling and synaptic plasticity". Universität Hamburg, Dr. rer. nat. dissertation, p. 76 (2014).
17. Matthies, Levi, "The Role of Tgif1 in Bone Anabolic Signal Transduction". Universität Hamburg, Dr. med. dissertation, p. 35 (2018).
18. Wojda, Samantha J., "Efficacy of locally delivered parathyroid hormone for treatment of critical size bone defects". Colorado State University, Ph.D. dissertation, pp. 197, 198 (2018).
19. Kim, Allen Kyung, "Rational Design of Protein Kinase A Phosphorylation Switches". Johns Hopkins University, Ph.D. dissertation, p. 7 (2019).
20. Kim, James, "STAT3 – the switch of melanoma-associated NRAS mutations". Ruprecht-Karls-Universität Heidelberg, Dr. med. dissertation, p. 22 (2020).
21. Wang, Ou, "Novel Approaches for Enhancing Cell Survival and Function *in vivo*". University of Nebraska Lincoln, Ph.D. dissertation, p. 64 (2021).
22. Kannabiran, Sukanya A., "Compartmentalisation of cAMP in Brown Adipocytes". Rheinischen Friederich-Wilhelms-Universität Bonn, Dr. rer. nat. dissertation, p. 14 (2022).
23. Zhuge, Zhengbing, "Nitric Oxide in Cardiovascular and Renal Disease: Role of Organic Nitrates, Inorganic Nitrate and Red Blood Cells". Karolinska Institute, Ph.D. dissertation, p. 13 (2022).
24. Schwertner, H.A. *et al.*, *Anal. Chem.*, **48(13)**, 1875-1878 (1976).
25. Eckel, J., *The Cellular Secretome and Organelle Crosstalk*. Academic Press/Elsevier, p. 167 (2018).
26. Salomon, Y., *Methods Enzymol.*, **195**, 22-28 (1991).

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