

Product Information

DL-Dithiothreitol

Product Number **D9779**

Storage Temperature 2-8 °C

Product Description

Molecular Formula: $C_4H_{10}O_2S_2$

Molecular Weight: 154.3

CAS Number: 3483-12-3

Melting Point: 42-43 °C¹

Redox potential: -0.33 volts (pH 7)¹

Synonyms: Cleland's Reagent,

DL-threo-1,4-Dimercapto-2,3-butanediol,

(±)-threo-1,4-Dimercapto-2,3-butanediol,

1,4-Dithio-DL-threitol, DTT

This product is designated as Molecular Biology grade and is suitable for molecular biology applications. It has been analyzed for the absence of nucleases and proteases.

1,4-Dithiothreitol (DTT) is the threo isomer of 2,3-dihydroxy-1,4-dithiolbutane, and an isomer of 1,4-dithioerythritol.² DTT is used in molecular biology to maintain sulfhydryl (-SH) groups in the reduced state and for quantitative reduction of disulfide (-S-S-) groups, as described by Cleland in his pioneering publication from the 1960's.³ Its usefulness as an reducing agent stems from its water solubility and reduced odor compared to previous thiol compounds.³

DTT is oxidized to the cyclic disulfide, and thereby ensures the reduction of other disulfides in solution. The disulfide reduction is complete in minutes at pH 8. DTT is less pungent and less toxic than 2-mercaptoethanol. Typically, a seven-fold lower concentration of DTT (100 mM) is needed than is used for 2-mercaptoethanol (5% v/v, 700 mM).

Many studies have utilized DTT to investigate disulfide linkages in proteins and immunoglobulins.^{4,5,6,7} DTT has been used to investigate α -ketoglutarate dehydrogenase function, flavin cofactors in proteins and protein moieties involved in peroxide reduction.^{8,9,10}

DTT has been utilized in the evaluation of thiol-disulfide exchange rates in melamine-based multivalent dendrimers.¹¹ The preparation of peptide-amphiphiles capable of self-assembly into nanofibers using DTT has been reported.¹²

Precautions and Disclaimer

For Laboratory Use Only. Not for drug, household or other uses.

Preparation Instructions

This product is soluble in water (50 mg/ml), yielding a clear, colorless solution. DTT is also soluble in water, ethanol, acetone, ethylate, chloroform and ether.¹

Storage/Stability

DTT solutions should be prepared fresh daily. The recorded half-life (hours) of DTT solutions at various pH and temperatures are as follows (all in 0.1 M KPO_4 buffer):¹³

pH	Temperature	Half Life (hrs)
pH 6.5	20 °C	40
pH 7.5	20 °C	10
pH 8.5	20 °C	1.4
pH 8.5	0 °C	11
pH 8.5	40 °C	0.2
pH 8.5	20 °C (+ 0.1 mM Cu^{2+})	0.6
pH 8.5	20 °C (+ 0.1 mM EDTA)	4

References

1. The Merck Index, 12th ed., Entry# 3441.
2. Evans, R. M., et al., Dithiols. Part III. Derivatives of polyhydric alcohols. J. Chem. Soc., 248-255 (1949).
3. Cleland, W. W., Dithiothreitol, a new protective reagent for SH groups. Biochemistry, **3(4)**, 480-482 (1964).
4. Sears, D. W., et al., Relative susceptibilities of the interchain disulfides of an immunoglobulin G molecule to reduction by dithiothreitol. Biochemistry, **16(9)**, 2031-2035 (1977).

5. Ruegg, U. T., and Rudinger, J., Reductive cleavage of cystine disulfides with tributylphosphine. *Methods Enzymol.*, **47**, 111-116 (1977).
6. Thevis, M., et al., Mass spectrometric characterization of transferrins and their fragments derived by reduction of disulfide bonds. *J. Am. Soc. Mass Spectrom.*, **14(6)**, 635-647 (2003).
7. Zhang, W., et al., Complete disulfide bond assignment of a recombinant immunoglobulin G4 monoclonal antibody. *Anal. Biochem.*, **311(1)**, 1-9 (2002).
8. Nulton-Persson, A. C., et al., Reversible inactivation of α -ketoglutarate dehydrogenase in response to alterations in the mitochondrial glutathione status. *Biochemistry*, **42(14)**, 4235-4242 (2003).
9. Wu, C. K., et al., The crystal structure of augmeter of liver regeneration: A mammalian FAD-dependent sulfhydryl oxidase. *Protein Sci.*, **12(5)**, 1109-1118 (2003).
10. Konig, J., et al., Reaction mechanism of plant 2-Cys peroxiredoxin: Role of the C-terminus and the quaternary structure. *J. Biol. Chem.*, **278(27)**, 24409-24420 (2003).
11. Zhang, W., et al., Evaluation of multivalent dendrimers based on melamine: kinetics of thiol-disulfide exchange depends on the structure of the dendrimer. *J. Am. Chem. Soc.*, **125(17)**, 5086-5094 (2003).
12. Hartgerink, J. D., et al., Self-assembly and mineralization of peptide-amphiphile nanofibers. *Science*, **294(5547)**, 1684-1688 (2001).
13. Stevens, R., et al., The stabilities of various thiol compounds used in protein purifications. *Biochemical Education*, **11(2)**, 70 (1983).

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