



Product Information

TES FREE ACID

Sigma Prod. Nos. T1375 and T6541

CAS NUMBER: 7365-44-8

SYNONYMS: N-tris(hydroxymethyl)methyl-2-aminoethanesulfonic acid; 2-(2-[hydroxy-1,1-bis(hydroxymethyl)ethyl]amino)ethane sulfonic acid; TES

PHYSICAL DESCRIPTION:

Appearance: white powder (crystalline)

Molecular formula: $C_6H_{15}NO_6S$

Molecular weight: 229.2

$pK_a = 7.4$ at $25^\circ C^1$

Effective buffering range pH 6.8-8.2

$\Delta pK/\Delta T = -0.02^2$

Melting point: $226-228^\circ C^{1,3}$

Metal ion binding: negligible¹

STORAGE / STABILITY AS SUPPLIED:

TES free acid is stable at room temperature for at least three years.

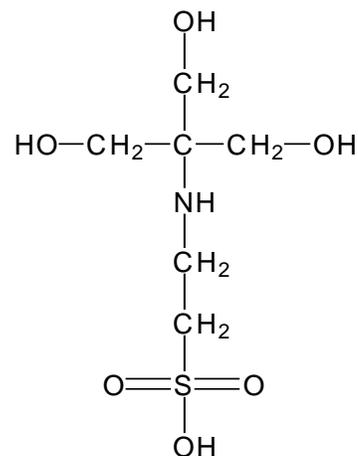
SOLUBILITY / STABILITY OF SOLUTIONS:

TES free acid is very soluble in water; T1375, routinely tested for solution appearance at 33% (w/v), gives a clear colorless solution. T6541, SigmaUltra, gives a clear colorless solution at 1 M, with a pH range of 3.5-5.0.³

Solutions should be stable at $2-8^\circ C$ for at least six months. Sterilization should be done by filtration through $0.2 \mu m$ filters, since generally autoclaving is not recommended for any sulfonic acid buffers. However, autoclavability was checked on 0.5M solutions at pH 6.7, 7.45 and 8.5, and at 0.05M at pH 7.4. The pH was the same between autoclaved and non-autoclaved samples and solutions remained colorless.

GENERAL REMARKS:

TES is a structural analog to Trizma buffer, one of the ethanesulfonic acid series of biological buffers developed by Good et al., to meet these criteria: midrange pK_a , maximum water solubility and minimum solubility in all other solvents, minimal salt effects, minimal change in pK_a with temperature, chemically and enzymatically stable, minimal absorption in visible or UV spectral range, and easily synthesized.¹ Although the structure above is drawn as a neutral molecule, it probably exists in solution as a zwitterion.



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GENERAL REMARKS: (continued)

Because the pK_a is 7.4 (physiological pH) this buffer has considerable potential for a variety of biological applications. In many culture media that require metal cations, many buffers cannot be used due to chelation or precipitation (citrate or phosphate, for example.) TES was found to be particularly beneficial in a study of succinate oxidation.¹

A buffer using TES free acid can be prepared by titrating the free acid (T1375 or SigmaUltra T6541) with sodium hydroxide to the desired pH, using about a half-equivalent of NaOH. Alternatively, solutions of equimolar TES free acid and TES sodium (T0772) can be mixed to attain a buffer of the desired pH. Titrating a solution of TES sodium with HCl is not recommended since the resulting solution will contain a half-equivalent of NaCl.

Sigma offers a number of TES buffer products: T1375 (reagent grade), T6541 (SigmaUltra tested for trace metal impurities), T6022 (cell culture-tested), and T4152 (molecular biology-tested). T1030, a hemisodium TES, dissolves in water to produce a buffer with pH approximately 7.4. Please check current catalog listings.

REFERENCES:

1. Good, N.E. et al., *Biochemistry*, 5, 467-477 (1966).
2. *Methods in Enzymology*, 104, 404 (1984).
3. Sigma quality control.