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BORIC ACID
Sigma Prod. Nos. B0252, B7660, B0394, and B7901

CAS NUMBER: 10043-35-3
SYNONYMS: boracic acid; orthoboric acid[1]

Physical Description
Molecular formula: H_3BO_3
Molecular weight: 61.83
Melting point: ~171°C[1]
Boric acid volatizes in steam. When heated to 100°C, the solid loses water and is slowly converted into metaboric acid (HBO_2); tetraboric acid ($H_2B_4O_7$) is formed at 140°C and boron trioxide (B_2O_3) at higher temperatures.[3]
pK_a = 9.23 at 25°C; $\Delta pK/\Delta T$ = -0.008 [4]
Useful buffering range is pH 8.2-10.1

Sigma offers several different boric acid products, slightly different in quality control descriptions:[2]

Stability / Storage as Supplied
Boric acid is a very stable dry solid at room temperature. It should be stable indefinitely, but should be evaluated for continued suitability in user application every three to five years.

Solubility / Solution Stability
Boric acid dissolves in water: 1 gram in 18 mL cold water, in 4 mL boiling water, 6 mL boiling alcohol. Sigma tests B0252 at 40 g/mL, and B7660 at 1 M (62 g/mL), obtaining clear solutions. Powdered boric acid may dissolve more slowly in water than a crystalline product, but with gentle warming will dissolve to give a clear solution.

A 1 M solution of B7660 will have a pH of 3.5-6.0 in water at 20°C. Solutions of boric acid are stable at room temperature. They can be sterile-filtered or autoclaved.

General Remarks
Boric acid has in years past been used as a mild bacteriostatic and fungistatic agent, but has been mainly superseded by more effective disinfectants.[4] It has been used as an insecticide, either alone or mixed with a sweetening agent, but its toxicity makes this use inappropriate around children or pet animals.[1,3]

Borate buffers are commonly used in biochemistry, with some confusion as to what reagents should be used. Boric acid has a single boron; its salt forms complex equilibria in solution, with the ion $B_4O_7^{-2}$ being the predominant species. Many procedures do not give a method of preparation for the borate buffer intended; it is important to express the ionic strength in terms of *boron molarity*. One can titrate a 0.1 M solution of boric acid with sodium hydroxide to pH 9.0. If ionic strength is of no concern, titrating a solution of sodium tetraborate (borax) with HCl will also yield a buffer of pH 9.0, which contains NaCl. A 0.1 M solution of sodium tetraborate is 0.4 M in "boron ion." Several references give "recipes" for preparing borate buffers.[4-6]

B0252 is reagent grade; B7660, SigmaUltra, has been tested for trace metals; B0394, ACS Reagent, meets criteria set by the American Chemical Society; B7901 grade, Electrophoresis grade, has been tested in an electrophoresis system.

REFERENCES:

1. *Merck Index*, 12th ed., #1354 (1996).
2. Sigma quality control.
3. *Martindale: The Extra Pharmacopoeia*, 30th Ed., 1343 (1993).
4. Stoll, V.S. and Blanchard, J.S., "Buffers: Principles and Practice" in *Methods in Enzymology*, 182, 24 (1990).
5. *Data for Biochemical Research*, 3rd Ed., Dawson, R.M.C. et al., (Clarendon Press, 1987) pp 438-439.
6. *Molecular Cloning: A Laboratory Handbook* , 2nd Ed., eds. Sambrook, Maniatis et al., Vol. 3 appendices.