Organic biological buffers replace mineral buffers advantageously in many applications. Aminoethane and aminopropane sulfonic acids, developed and popularized by Good, are now popular for biological research and analysis. Good’s buffers have the following characteristics:

1) High water-solubility
2) Low cell membrane permeability
3) Consistent acid-base dissociation constants
4) Low metal chelating capability
5) High chemical stability
6) Low absorption spectra in UV and visible regions.

<table>
<thead>
<tr>
<th>Buffering agent (by pHa value order)</th>
<th>MW (g/mol)</th>
<th>useful pH range pH (20°C)</th>
<th>pKa (25°C)</th>
<th>pKa (37°C)</th>
<th>cat.number</th>
</tr>
</thead>
<tbody>
<tr>
<td>MES buffer</td>
<td>213.2(h)</td>
<td>pH 5.2-7.1 pKa=6.16</td>
<td>6.15</td>
<td>5.97</td>
<td>14035</td>
</tr>
<tr>
<td>Bis-Tris buffer</td>
<td>209.2</td>
<td>pH 5.8-7.2</td>
<td>6.5</td>
<td>6.36</td>
<td>36832</td>
</tr>
<tr>
<td>ADA buffer</td>
<td>190.1</td>
<td>pH 6.0-7.2 pKa=6.65</td>
<td>6.59</td>
<td>6.46</td>
<td>N1339</td>
</tr>
<tr>
<td>ACES buffer</td>
<td>182.2</td>
<td>pH 6.1-7.5 pKa=6.88</td>
<td>6.78</td>
<td>6.54</td>
<td>N1234/AH085</td>
</tr>
<tr>
<td>PIPES buffer</td>
<td>243(a)</td>
<td>pH 6.1-7.5 pKa=6.80</td>
<td>6.76</td>
<td>6.66</td>
<td>UP06198</td>
</tr>
<tr>
<td>MOPSO buffer</td>
<td>225.3(f)</td>
<td>pH 6.2-7.6</td>
<td>6.9</td>
<td>6.75</td>
<td>28148/N1420</td>
</tr>
<tr>
<td>Bis-6Tris Propane buffer</td>
<td>282.3</td>
<td>pH 6.3-9.5</td>
<td>6.8-9</td>
<td></td>
<td>24721</td>
</tr>
<tr>
<td>BES buffer</td>
<td>213.2</td>
<td>pH 6.4-7.8 pKa=7.17</td>
<td>7.09</td>
<td>6.90</td>
<td>06200</td>
</tr>
<tr>
<td>MOPS buffer</td>
<td>209.3</td>
<td>pH 6.5-7.9 pKa=7.13</td>
<td>7.20</td>
<td>7.02</td>
<td>N1413</td>
</tr>
<tr>
<td>TES buffer</td>
<td>229.2</td>
<td>pH 6.8-8.2 pKa=7.50</td>
<td>7.40</td>
<td>7.16</td>
<td>06194</td>
</tr>
<tr>
<td>HEPES buffer</td>
<td>238.3</td>
<td>pH 6.8-8.2 pKa=7.55</td>
<td>7.48</td>
<td>7.31</td>
<td>28146</td>
</tr>
<tr>
<td>DIPSO buffer</td>
<td>261.3</td>
<td>pH 7.0-8.2</td>
<td>7.60</td>
<td>7.35</td>
<td>BP361</td>
</tr>
<tr>
<td>MOBS buffer</td>
<td>223.3</td>
<td>pH 6.9-8.3</td>
<td>7.6</td>
<td></td>
<td>28150</td>
</tr>
<tr>
<td>TAPSO buffer</td>
<td>259.3</td>
<td>pH 7.0-8.2</td>
<td>7.6</td>
<td>7.39</td>
<td>28147</td>
</tr>
<tr>
<td>HEPPSO buffer</td>
<td>268.3(a)</td>
<td>pH 7.1-8.5</td>
<td>7.8</td>
<td>6.66</td>
<td>28149</td>
</tr>
<tr>
<td>POPSO buffer</td>
<td>362.4(a)</td>
<td>pH 7.2-8.5</td>
<td>7.8</td>
<td>7.63</td>
<td>N1432</td>
</tr>
<tr>
<td>EPPS (HEPPS) buffer</td>
<td>252.3(a)</td>
<td>pH 7.3-8.7</td>
<td>8.00</td>
<td></td>
<td>70611</td>
</tr>
<tr>
<td>Tricine buffer</td>
<td>380.4(b)</td>
<td>pH 7.4-8.8 pKa=8.16</td>
<td>8.05</td>
<td>7.80</td>
<td>01829</td>
</tr>
<tr>
<td>Gly-Gly buffer</td>
<td>132.1</td>
<td>pH 7.5-8.9</td>
<td>8.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Buffers requirements

In biological experiments, it is important to maintain the pH of the solutions used, i.e. most biological reactions occur at a neutral pH while some reactions (i.e. peroxidase enzyme) or processes (coating on polystyrene) need acidic or alkaline pH. Mixtures of appropriate weak acids and their conjugate bases, known as buffering agents, are usually used.

The buffers needs to be effective in the neutral range, typically from 6 to 8 pH, in order to be useful for cell culture in vitro, enzyme assays and some electrophoretic applications at physiological pH. Furthermore, universally applicable buffers for biochemistry must be water soluble, not interfere with biological processes or biological membranes (penetration, solubilization, adsorption on surface, etc.), should not produce chelates or have known complex-forming tendency with metal ions (which are essential in biological systems), be non-toxic and have a very low U.V. absorption at wavelength >260 nm.

To meet these requirements, Dr. Good developed several aminoethane and aminopropane sulfonic acids that are now widely used for biological research and analysis. Good’s buffers have the following characteristics:

<table>
<thead>
<tr>
<th>Buffering agent (by pHa value order)</th>
<th>MW (g/mol)</th>
<th>useful pH range pKa (20°C)</th>
<th>pKa (25°C)</th>
<th>pKa (37°C)</th>
<th>cat.number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicine buffer</td>
<td>163.17(f)</td>
<td>pH 7.6-9.0 pKa=8.35</td>
<td>8.26</td>
<td>8.04</td>
<td>T3162</td>
</tr>
<tr>
<td>HEPBS buffer</td>
<td>263.3(f)</td>
<td>pH 7.6-9.0</td>
<td>-</td>
<td>8.30</td>
<td>S5175</td>
</tr>
<tr>
<td>TAPS buffer</td>
<td>243.3</td>
<td>pH 7.7-9.1 pKa=8.31</td>
<td>8.40</td>
<td>7.18</td>
<td>70501</td>
</tr>
<tr>
<td>AMPD buffer</td>
<td>105.1(f)</td>
<td>pH 7.8-9.7</td>
<td>8.80</td>
<td>-</td>
<td>00188</td>
</tr>
<tr>
<td>TABS buffer</td>
<td>257.3(f)</td>
<td>pH 8.2-9.6</td>
<td>8.9</td>
<td>-</td>
<td>1F688</td>
</tr>
<tr>
<td>AMPDS buffer</td>
<td>249.3</td>
<td>pH 8.3-9.7</td>
<td>9.00</td>
<td>9.10</td>
<td>61281</td>
</tr>
<tr>
<td>CHES buffer</td>
<td>207.3</td>
<td>pH 8.6-10.0 9.3-9.7</td>
<td>9.49</td>
<td>9.36</td>
<td>62519</td>
</tr>
<tr>
<td>CAPSO buffer</td>
<td>237.3</td>
<td>pH 8.9-10.3</td>
<td>9.60</td>
<td>9.43</td>
<td>62519</td>
</tr>
<tr>
<td>AMP buffer</td>
<td>259.3(n)</td>
<td>pH 9.0-10.5</td>
<td>9.70</td>
<td>-</td>
<td>06190</td>
</tr>
<tr>
<td>CAPS buffer</td>
<td>221.3(f)</td>
<td>pH 9.7-11.1 pka=10.24</td>
<td>10.40</td>
<td>10.78</td>
<td>1F687</td>
</tr>
<tr>
<td>CABS buffer</td>
<td>235.3(f)</td>
<td>pH 10.0-11.40</td>
<td>10.70</td>
<td>-</td>
<td>1F687</td>
</tr>
</tbody>
</table>

(a): MW of anhydrous compound  (b) hydrated compound  (f) free acid compound  (n) Na salt compound

Please inquire for specification, and other salt forms or solutions..

Storage: Room temperature (R)

Introduction to buffers

Biological buffers allow the pH of an aqueous solution to remain constant while the concentration of hydrogen ions may change.

Traditional buffering systems, like carbonate and phosphate buffers, are widely used, but are often not appropriate for many biological systems. These reagents do not buffer effectively above pH 7.5, and can interfere with some biological reactions. Some of the early alternatives, such as Tris and glycylglycine, buffers are effectively at higher pH levels but often show cytotoxic effects or interfere with chemical reactions (e.g. Tris/acylation).

Dr. Norman Good et al. addressed the above limitations. In 1966 he described a series of zwitterionic buffers, so-called "Good's buffers", that are thus very useful in research in biology and biochemistry.


Henderson-Hasselbach Equation:

\[ \text{pH} = \text{pKa} + \log \left( \frac{[A^-]}{[HA]} \right) \]
**Good's buffers characteristics**

Typically, the "Good's buffers" have pKa values at or near physiological pH, are non-toxic to cells, and are not absorbed through cell membranes. The concentration, temperature, and ionic composition of the medium has minimal affect on the buffering capacity. These buffers are resistant to enzymatic and non-enzymatic degradation. Furthermore, they are essentially transparent to visible and ultraviolet light, and they are relatively inexpensive. These Good’s Buffers are widely used in cell culture and other biological applications. Since then, additional zwitterionic buffers (AMPSO, CAPSO, DIPSO, HEPPSO, MOPSO, and POPSO) have been developed. These compounds offer even further improvements in water solubility, high chemical stability, and compatibility in a number of biological systems (Ferguson et al., 1980).

**Characteristics of Good's Buffers:**
- pKa value between 6 and 10
- high solubility
- non toxicity
- limited effect on biochemical reactions
- very low absorbance between 240 nm and 700 nm
- enzymatic and hydrolytic stability
- minimal changes due to temperature and concentration
- limited effects due to ionic or salt composition of the solution
- limited interaction with mineral cations, and limited permeability of biological membranes.

**Buffer choice**

To choose a buffering agent, the pKa value (pH at which the acid and the base forms are equimolar, hence giving a neutral total charge) should be near the pH range in which the biological reaction should be carried. Secondarily, the compatibility of the buffer with the biological system, if already documented, should be considered.

**Products specifications**

(by alphabetic order)

### ACES, High purity grade

**ACES** is used to buffer at pH 6.1-7.5 (pKa:6.88)

N-(2-Acetamido)-2-aminoethanesulfonic acid; CAS:[7365-82-4], MW:182.2 (Z)

Soluble at 0.1M in water at 20°C

Abs. @280nm (5%, Water) 0.02  
PH (1%, Water) @25C 3.6 - 4.4  
PKa @25C 6.58 - 6.98  
Purity (%) 99.0  
Water (Karl Fisher) (%) 1.0

**ACES K salt**

**ADA** is useful to buffer at pH 6.0-7.2 (pKa:6.65).

CAS:[26239-55-4], N-(2-Acetamido)iminodiacetic acid, N-(Carbamoylmethyl)iminodiacetic acid

MW: 190.16 (Z)

Soluble at 0.5M in 1M NaOH at 20°C

Heavy Metals (ppm) < 10  
Loss on Drying (%) 1.0  
PKa (@ 20 Deg C) 6.10 - 7.10  
Purity (%) 99.0  
Residue after Ignition (%) 0.1  
Solubility (10%, 1N NaOH) (P/F)

**AMPD (2-amino-2-methyl-1,3-propanediol)**

AMPD is a useful buffer at pH 7.8-9.7, in a SDS-gradient gel electrophoresis system for polypeptide of 1500 to 100000 Da, as a spacer in isotachophoresis of proteins, and as a buffer for the determination of alkaline phosphatase activity.

CAS:[115-69-5], EC:[ 204-100-7];2-amino-2-methyl-1,3-propanediol; MW:105.15(Z)

Purity >99%

**Products specifications**

(by alphabetic order)

- **N1234A, 100g**
- **N1234B, 500g**
- **N1339A, 25g**
- **N1339B, 100g**
- **00188A, 25g**
- **00188B, 100g**
AMPSO buffers in the pH 8.3-9.7 range (pKa: 9.0 at 25°C).

AMPSO free acid
N-(1,1-Dimethyl-2-hydroxyethyl)-3-amino-2-hydroxypropanesulfonic acid

AMPSO, sodium salt
N-(1,1-Dimethyl-2-hydroxyethyl)-3-amino-2-hydroxypropanesulfonic acid Na salt
CAS: [102029-60-7] EC: [ ] MW: 249.3 (Z)

BES
BES is used to buffer at pH 6.4-7.8 (pKa:7.1)

BES, Na salt
N,N-Bis(2-hydroxyethyl)-2-aminoethanesulfonic acid sodium salt
CAS: [66992-27-6] EC: [ ] MW: 235.23 Xi
Soluble at 1M in water

Heavy Metals (as Pb): <5ppm
Loss on Drying: <1.0%
Purity (anhydrous): >99%

BES, free acid
CAS: [10191-18-1] EC: [ ] MW: 213.25 (Z)

Bicine, high purity grade
Bicine is a low temperature electrophoresis buffer; buffer of stable substrate of serum guanase. It is used to buffer at pH 5.8-7.2 (pKa: 8.35).

CAS: [150-25-6], N,N-Bis(2-hydroxyethyl)glycine, Bis(2-hydroxyethyl)amino-tris(hydroxymethyl) methane; MW: 163.17 (Z) Xi
Soluble at 1M in water

Moisture (Karl Fischer) (%) 1.0
O.D. @ 260nm (0.1M, Water) 0.05
pH (1.0%, Water) @ 25°C: 8.8 - 9.6
pKa @ 25°C: 6.45 - 6.65

BisTris, Ultrapure
Bis-[2-Hydroxyethylamino-tris(Hydroxymethyl)Methane
CAS: [6976-37-0], MW: 209.2 (Z) GSH07
Ultrapure grade (>99.0%; no DNase, Protease)

DNase (P/F): NONE
Melting Point: 102 - 106°C
pH (1.0%, Water) @ 25°C: 8.8 - 9.6
pKa @ 25°C: 6.45 - 6.65

BisTris, Ultrapure
BisTris propane
1,3-Bis[tris(hydroxymethyl)methylamino]propane
CAS: [64431-96-5]; EC: [264-899-3]; MW: 282.33 (Z)

DNase (P/F): NONE
Melting Point: 102 - 106°C
Protease (P/F): NONE
RNase (P/F): NONE

pKa @ 25°C: 6.45 - 6.65
Purity (Titration): 99.0%
Solubility (1.0%, Water) (P/F): PASS
<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>CAS Number</th>
<th>MW</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CABS</strong></td>
<td>4-(Cyclohexylamino)-1-butanesulfonic acid</td>
<td>CAS: [161308-34-5]; MW: 235.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CAPS</strong></td>
<td>N-cyclohexyl-3-aminopropanesulfonic acid</td>
<td>CAS: [1135-40-6]; EC: [214-492-1]; MW: 221.32</td>
<td></td>
<td>Theoretical melting point: &gt;300 °C (lit.)</td>
</tr>
<tr>
<td><strong>CAPSO</strong></td>
<td>3-(Cyclohexylamino)-2-hydroxy-1-propanesulfonic acid sodium salt</td>
<td>CAS: [102601-34-3]; MW: 259.30 (Z)</td>
<td>&gt;99% pure; Soluble 10% in water</td>
<td></td>
</tr>
<tr>
<td><strong>CHES</strong></td>
<td>N-Cyclohexyl-2-aminoethanesulfonic acid; N-Cyclohexyltaurine</td>
<td>CAS: [103-47-9]; EC: [203-115-6]; M:207.28 (Z)</td>
<td>Purity &gt;99%; Soluble 1% in water</td>
<td></td>
</tr>
<tr>
<td><strong>DIPSO</strong></td>
<td>N,N-Bis(2-hydroxyethyl)-3-amino-2-hydroxypropanesulfonic acid</td>
<td>CAS: [68399-80-4]; EC: [269-992-2 ]; MW:261.3 (Z)</td>
<td>&gt;98% pure; Soluble at 0.1M in water at 20°C</td>
<td>Heavy Metals (as Pb): &lt;0.0005%</td>
</tr>
<tr>
<td><strong>EPPS</strong></td>
<td>N-(2-Hydroxyethyl)piperazine-N′-(4-butanesulfonic acid)</td>
<td>CAS: [161308-36-7]; MW: 266.36 (Z)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gly-Gly</strong></td>
<td>Diglycine; Glycyl-glycine</td>
<td>CAS: [556-50-3]; EC: [2091278]; MW: 132.12 (Z)</td>
<td>Soluble at 1M in water at 20°C</td>
<td></td>
</tr>
<tr>
<td><strong>HEBPS</strong></td>
<td>N-(2-Hydroxyethyl)ppiperazine-N′-(4-butanesulfonic acid)</td>
<td>CAS: [161308-36-7]; MW: 266.36 (Z)</td>
<td></td>
<td>Used to buffer at pH 7.6-9.0</td>
</tr>
</tbody>
</table>
HEPES

HEPES is an organic chemical buffering agent that is widely used to maintain physiological pH (range pH 6.8-8.2; pKa at 20°C: 7.45-7.65), i.e. in cell culture. HEPES is recommended for the protection of frozen solutions of enzymes from freezing-induced pH changes. Fears that HEPES may serve as a nutrient source for aerobic bacteria have been shown to be unfounded.

4-(2-Hydroxyethyl)-1-piperazineethanesulfonic acid; 2-(4-morpholino)ethanesulfonic acid; morpholine-4-ethanesulfonic acid hydrate. CAS:7365-45-9; MW:238.30 (Z)
Mp: >234-238°C. Soluble at 40 g/100 ml (20°C)

HEPES free acid, Ultrapure
CAS:[7365-45-9]; MW: 238.30 (Z)
Purity > 99%; 40 g/100 ml (20°C)

HEPES Sodium salt, Ultrapure
CAS [75277-39-3]; MW: 260.28 (Z)
Purity (dry basis): >99%
Heavy Metals (as Pb): <0.0005%
Iron: <0.0005%
Residue on ignition: Not detected
DNAse activity: Not detected
Protease activity: Not detected

HEPPS

HEPPS or EPPS is used as a buffering agent at pH 7.3-8.7 (pKa: 8.00/piperazine ring); i.e in biology and biochemistry.

3-[4-(2-Hydroxyethyl)-1-piperazinyl]propanesulfonic acid hydrate; 4-(2-Hydroxyethyl)piperazine-1-[2-hydroxypropanesulfonic acid) Hydrate
CAS [16052-06-5]; EC [240-198-8]; MW:268.33 (252.3/anhyd.) (Z)
>99% pure; Soluble at 1M in water at 20°C

HEPPSO

HEPPSO (EPSO) is used to buffer at pH 7.1-8.5 (pKa: 7.5)

HEPPSO free acid, ultrapure grade
4-(2-Hydroxyethyl)piperazine-1-[2-hydroxypropanesulfonic acid) hydrate
CAS{68399-78-0}; MW: 268.3(anhydrous)

MES

MES is used as a Good's buffering agent in biology and biochemistry at pH 5.2-7.1 (pKa:6.16). Contains a morpholine ring and a an ethanesulfonic moiety. Melting point is approx. 300 degrees C.

2-(N-morpholino)ethanesulfonic acid, monohydrate; CAS{4432-31-9}; MW: 195.24 (Z)
Purity > 99%; Soluble at 2.1 g/10 ml and up to 0.5M in water.
MOBS
MOBS is an homolog of MES and MOPS with higher pKa/ It is used to buffer solution at pH6.9-8.3 (pKa:7.6)
CAS\{117961-20-3\}; 4-Morpholinebutanesulfonic acid; 3-(N-Morpholino)butanesulfonic acid hemisodium salt; MW: 223.29

MOPS
MOPS is an excellent buffer for many biological systems at near-neutral pH. It is used in biology and biochemistry as a buffering agent at pH 6.5-7.9;
Contains a morpholine ring (pKa\(_{25\text{C}}\):7.28) and a propanesulfonic moiety. Its structure is analog to MES.
It used widely for polyacrylamide gel electrophoresis. e.g. RNA electrophoresis in agarose with formaldehyde gels at 20 mM concentration. Usage above 20 mM in mammalian cell culture work is not recommended.

MOPS, Ultrapure
CAS\{1132-61-2\}; 3-(N-morpholino) Propane Sulfonic Acid, monohydrate; MW: 209.27
Purity > 99%; 2.1 g/10 ml water

MOPS, Na salt, high purity
CAS\{71119-22-7,79803-73-9\}; 4-Morpholinepropanesulfonic acid Sodium salt; MW: 231.25

MOPS, hemiNa salt
4-Morpholinepropanesulfonic acid hemisodium salt;
CAS\{117961-20-3\}; MW: 220.25

MOPSO
MOPSO is used to buffer at pH 6.2-7.6

MOPSO, Sodium salt, biotech grade
3-(N-Morpholino)-2-hydroxypropanesulfonic acid sodium salt, 3-Morpholino-2-hydroxypropanesulfonic acid sodium salt
CAS\{79803-73-9\}; MW: 247.24
Abs. @260nm (2.4%, Water): < 0.04
Abs. @280nm (2.4%, Water): < 0.03
Melting Point: 263 – 271°C
pH (1%, Water) @25C: 5.1 - 6.1
Purity: 97%

MOPSO, free acid
β-Hydroxy-4-morpholinepropanesulfonic acid, 3-Morpholino-2-hydroxypropanesulfonic acid
CAS\{68399-77-9\}; EC Number 269-989-6; MW: 225.26 (Z)

PIPS
PIPS is used to buffer at pH 6.1-7.5 (pKa:6.80)
Piperazine-1,4-bis(2-ethanesulfonic acid);
MW: 335.4 [243(anh.); Xi
Purity > 99%; 3 g/10 ml 1M NaOH

Synonyms: 3-(N-Morpholino)-propanesulfonic acid, 4-Morpholinepropanesulfonic acid
MOPS buffer is prepared by adding NaOH to the free acid solution. MOPS buffer is partly degraded on autoclaving in the presence of glucose and has negligible metal ion binding property.

MOBS BP3610, 25g

MOPS N1343A, 25g
N1343B, 100g
M13581, 100g

MOPSO N1420A, 25g
N1420B, 100g

MOPSO, Sodium salt, biotech grade N1420A, 25g
N1420B, 100g

MOPSO, Sodium salt, biotech grade N1420A, 25g
N1420B, 100g

MOPSO, free acid 281481, 100g

PIPS UP061980, 100g
UP061981, 250g
## POPSO

**POPSO** is used to buffer at pH 7.2-8.5 (pKa: 7.8)

<table>
<thead>
<tr>
<th>POPSO, free acid, biotech grade</th>
<th>28149A, 25g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperazine-1,4-bis(2-hydroxypropanesulfonic acid) dihydrate; CAS: 68189-43-5; MW: 362.42 (anhydrous)-398.45 (Z)</td>
<td>28149B, 100g</td>
</tr>
<tr>
<td>Heavy Metals (as Pb) &lt;0.0005%</td>
<td>Purity (Anhydrous) &gt;99%</td>
</tr>
<tr>
<td>Solubility (25%, IN NaOH): PASS</td>
<td>Water (KF): &lt;10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POPSO, sodium salt, ultrapure grade</th>
<th>69223A, 25g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperazine-1,4-bis(2-hydroxypropanesulfonic acid) sodium salt; CAS: 108321-07-9; MW: 406.39 (Z); Soluble at 1M in in NaON</td>
<td>69223B, 100g</td>
</tr>
<tr>
<td>Heavy Metals (as Pb): 0.0005 %</td>
<td>Moisture (KF): &lt;5%</td>
</tr>
<tr>
<td>Purity: 97%</td>
<td>Solubility (10%, Water): PASS</td>
</tr>
</tbody>
</table>

## TABS

**TABS** is used to buffer at pH 8.2-9.6 (pKa:8.9). Homolog of TES and TAPS with higher pKa and similar utility in biological systems.

<table>
<thead>
<tr>
<th>TABS, Na salt, Biotech grade</th>
<th>1F688, inquire</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-tris(hydroxymethyl)methyl-4-amino butanesulfonic acid</td>
<td></td>
</tr>
<tr>
<td>CAS: 54960-65-5; MW: 257.30 (Z)</td>
<td></td>
</tr>
<tr>
<td>DNase: NONE</td>
<td>Heavy Metals &lt;0.0005%</td>
</tr>
<tr>
<td>Identification: PASS</td>
<td>pH (5%, Water) @25C: 3.5 - 6.5</td>
</tr>
<tr>
<td>Protease (P/F): NONE</td>
<td>Purity: 99%</td>
</tr>
<tr>
<td>RNase: NONE</td>
<td>Solubility (5%, Water): PASS</td>
</tr>
<tr>
<td>Water (KF): 1.0%</td>
<td></td>
</tr>
</tbody>
</table>

## TAPS

**TAPS** is used to buffer at pH 7.7-9.1 (pKa:8.49)

<table>
<thead>
<tr>
<th>TAPS, Na salt, Biotech grade</th>
<th>705011, 100g</th>
</tr>
</thead>
<tbody>
<tr>
<td>[(2-Hydroxy-1,1-bis(hydroxymethyl)ethylamino)-1-propanesulfonic acid</td>
<td></td>
</tr>
<tr>
<td>CAS: 91000-53-2; MW: 243.28 (Z)</td>
<td></td>
</tr>
<tr>
<td>Soluble 1M in water at 20°C</td>
<td></td>
</tr>
<tr>
<td>DNase: NONE</td>
<td>Heavy Metals &lt;0.0005%</td>
</tr>
<tr>
<td>Identification: PASS</td>
<td>pH (5%, Water) @25C: 3.5 - 6.5</td>
</tr>
<tr>
<td>Protease (P/F): NONE</td>
<td>Purity: 99%</td>
</tr>
<tr>
<td>RNase: NONE</td>
<td>Solubility (5%, Water): PASS</td>
</tr>
<tr>
<td>Water (KF): 1.0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TAPS, free acid, high purity</th>
<th>T3169 inquire</th>
</tr>
</thead>
<tbody>
<tr>
<td>[(2-Hydroxy-1,1-bis(hydroxymethyl)ethylamino)-1-propanesulfonic acid; N-Tris(hydroxymethyl)methyl-3-ammonopropanesulfonic acid</td>
<td></td>
</tr>
<tr>
<td>CAS: 29915-38-6; MW: 243.28 (Z)</td>
<td></td>
</tr>
</tbody>
</table>

## TAPSO

**TAPSO** is used to buffer at pH 7.0-8.2 (pKa:7.6)

<table>
<thead>
<tr>
<th>TAPSO, free acid</th>
<th>28150A, 25g</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Hydroxy-3-[tris(hydroxymethyl)amino]-1-propanesulfonic acid; CAS: 68399-81-5; MW: 259.28 (Z); Xi</td>
<td>28150B, 100g</td>
</tr>
<tr>
<td>Assay: ≥99% (titration)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TAPSO, sodium salt</th>
<th>705291, inquire</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS: 68399-81-5; MW: 281.26 (Z)</td>
<td></td>
</tr>
</tbody>
</table>
Tricine is used to buffer at pH 7.4-8.8 (pKa: 8.16). It is a buffer component for separation of low molecular weight peptides.

**Tricine**

Piperazine-N,N'-Bi[2-Hydroxypropanesulfonic Acid] Dihydrate; CAS: [68189-43-5]; MW: 380.44 (Z)

**Related products**

Buffering agents and Buffer solutions [BC002b]