

Sequestrants

Phosphonates
Codex® PBTC



Sequestrants

Univar is a leading global chemical distributor. Univar's strong **sales and marketing** teams complement chemical producers and **create value** for customers. The company provides **technical** expertise in **application development**, excellence in logistics support, and outstanding **customer service** to help its partners grow their business.

- **Technical expertise** and a dedicated application laboratory
- **Locally focused** sales and marketing excellence across Europe, Middle East and Africa
- Industry-leading **logistical** capabilities
- Comprehensive and diverse portfolio of **speciality** and **commodity** ingredients
- Responsible business practice: **SHE & sustainability**
- Working as a reliable strategic partner for **customers and producers globally**



Among from all Univar's products we can introduce very interesting sequestrant agent – phosphonates:

| | | |
|---|---|---|
| ATMP - Codex 8503 | Na₅ATMP - Codex 9403 | |
| HEDP - Codex 661 | Na₂HEDP - Codex ds | Na₄HEDP - Codex 7101 |
| Na₅EDTMP - Codex 3315 | | |
| DTPMP - Codex 4503 | Na₂DTPMP - Codex 4473 | Na₇DTPMP - Codex 5323 |
| PBTC - PBTC | | |



Chemical Names of Phosphonates

| <i>Codex - Univar</i> | <i>Phosphonate</i> | <i>Chemical Name</i> |
|-----------------------|-----------------------|--|
| Codex 8503 | ATMP | Amino tri methylene phosphonic acid |
| Codex 9403 | Na ₅ ATMP | Penta sodium salt of aminotrimethylene phosphonic acid |
| Codex 661 | HEDP | 1-Hydroxyethylidene-1,1-diphosphonic acid |
| Codex DS | Na ₂ HEDP | Disodium salt of 1-hydroxyethylidene-1,1-disphosphonic acid |
| Codex 7101 | Na ₄ HEDP | Tetra sodium salt of 1-hydroxyethylidene-1,1- diphosphonic acid |
| Codex 3315 | Na ₅ EDTMP | Pentasodium salt of ethylene diamine tetra(methylene phosphonic acid) |
| Codex 4503 | DTPMP | Diethylene triamine pentamethylene phosphonic acid |
| Codex 4473 | Na ₂ DTPMP | Disodium salt of diethylene triamine pentamethylene phosphonic acid |
| Codex 5323 | Na ₇ DTPMP | Heptasodium salt of diethylene triamine pentamethylene phosphonic acid |
| PBTC | PBTC | Phosphono butane tri carboxylic acid |

Phosphonates Applications

| Phosphonate | Codex - Univar | Industrial Cleaning | Institutional Cleaning | Bottle Cleaning | Personal Care | Dyes Stabilizer | Scale Inhibitor | Peroxides Stabilizer | Hypochlorite Stabilizer | Corrosion Inhibitor | Cool Water Conditioner | Heat Water Conditioner | Industrial Water Conditioner | Swimming Pool Water Conditioner | Desalination Sea Water | Scale & Corrosion Inhibitor / oilfield | Metal Ions Chelating | Deflocculation | Textile Industry |
|-----------------------|----------------|---------------------|------------------------|-----------------|---------------|-----------------|-----------------|----------------------|-------------------------|---------------------|------------------------|------------------------|------------------------------|---------------------------------|------------------------|--|----------------------|----------------|------------------|
| ATMP | Codex 8503 | ● | ● | ● | | | ● | ● | | ● | ● | ● | ● | | | | ● | | ● |
| Na ₅ ATMP | Codex 9403 | ● | ● | ● | | | ● | | | ● | ● | ● | ● | | | | ● | | ● |
| HEDP | Codex 661 | ● | ● | | ● | ● | ● | ● | | | ● | ● | ● | ● | | | ● | ● | ● |
| Na ₂ HEDP | Codex DS | ● | ● | | ● | ● | ● | | | | ● | ● | ● | ● | | ● | ● | ● | ● |
| Na ₄ HEDP | Codex 7101 | ● | ● | | ● | | ● | | | | ● | ● | ● | ● | | | ● | ● | ● |
| Na ₅ EDTMP | Codex 3315 | ● | ● | | | | | ● | | | | | | | ● | ● | ● | ● | |
| DTPMP | Codex 4503 | ● | ● | | | | ● | ● | | ● | | | | | | ● | ● | ● | |
| Na ₂ DTPMP | Codex 4473 | ● | ● | | | | | ● | | ● | | | | | | ● | ● | ● | |
| Na ₇ DTPMP | Codex 5323 | ● | ● | | | | | ● | | ● | | | | | | ● | ● | ● | |
| PBTC | PBTC | ● | ● | ● | | | | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | |

Phosphonate Resistance in Various Chemicals

| Phosphonate | Codex - Univar | Peroxyacetic Acid | Mineral Acids | Hydrogen Peroxide | Sodium Hypochlorite | Sodium / Potassium Hydroxide | Isopropanol |
|-----------------------|----------------|-------------------|---------------|-------------------|---------------------|------------------------------|-------------|
| ATMP | Codex 8503 | | ● | | | ● | ● |
| Na ₅ ATMP | Codex 9403 | | ● | | | ● | ● |
| HEDP | Codex 661 | ● | ● | ● | ● | ● | ● |
| Na ₂ HEDP | Codex DS | ● | | ● | ● | ● | ● |
| Na ₄ HEDP | Codex 7101 | ● | | ● | ● | ● | ● |
| Na ₅ EDTMP | Codex 3315 | | | | | ● | |
| DTPMP | Codex 4503 | | ● | ● | | ● | |
| Na ₂ DTPMP | Codex 4473 | | | ● | | ● | |
| Na ₇ DTPMP | Codex 5323 | | | ● | | ● | |
| PBTC | PBTC | | ● | ● | ● | ● | ● |

Phosphonates Efficiency

| Phosphonate | Codex - Univar | Inhibitor CaCO ₃ | Inhibitor CaSO ₄ | Metal Ions Sequestrant | Steel Corrosion Inhibitor |
|------------------------|----------------|---|---|---|---|
| HEDP | Codex 661 |  |  |  |  |
| Na ₂ HEDP | Codex DS |  |  |  |  |
| Na ₄ HEDP | Codex 7101 |  |  |  |  |
| ATMP | Codex 8503 |  |  |  |  |
| Na ₅ ATMP | Codex 9403 |  |  |  |  |
| Na ₅ EDTMPA | Codex 3315 |  |  |  |  |
| DTPMP | Codex 4503 |  |  |  |  |
| Na ₂ DTPMPA | Codex 4473 |  |  |  |  |
| Na ₇ DTPMPA | Codex 5323 |  |  |  |  |
| PBTC | PBTC |  |  |  |  |

 = Very Good
  = Very Good
  = Good

Sequestering Power - mg CaCO₃ / g sequestrant¹⁾

| Chemical Abbrev. | Product | pH 9 | pH 10 | pH 11 | pH 12 |
|------------------------|-----------------------------------|------|-------|-------|-------|
| HEDP | Codex 661 | 825 | 855 | 855 | 860 |
| ATMP | Codex 8503 | 725 | 890 | 1030 | 1050 |
| Na ₅ EDTMPA | Codex 3315 | 1070 | 1170 | 1170 | 1150 |
| DTPMP | Codex 4503 | 920 | 1130 | 1170 | 1230 |
| PBTC | PBTC | 1000 | 1000 | 1000 | 1000 |
| EDTA | Ethylenedinitrilotetraacetic Acid | 370 | 360 | 350 | 355 |
| NTA | Nitrilotriacetic Acid | 510 | 500 | 515 | 515 |
| STPP | Sodium Tripolyphosphate | 225 | 250 | 250 | 255 |

Sequestering Power - mg CaCO₃ / g sequestrant

| Chemical Abbrv. | Product | % con. | % con. as acid | pH 9 | pH 10 | pH 11 | pH 12 |
|------------------------|------------|--------|----------------|------|-------|-------|-------|
| HEDP | Codex 661 | 60 | 60 | 500 | 515 | 515 | 520 |
| Na ₂ HEDP | Codex DS | 95 | 80 | 660 | 680 | 680 | 685 |
| Na ₄ HEDP | Codex 7101 | 29 | 21 | 170 | 176 | 176 | 182 |
| ATMP | Codex 8503 | 50 | 50 | 360 | 445 | 515 | 525 |
| Na ₃ ATMP | Codex 9403 | 40 | 29 | 210 | 255 | 295 | 300 |
| Na ₅ EDTMPA | Codex 3315 | 31 | 25 | 265 | 290 | 290 | 285 |
| DTPMP | Codex 4503 | 50 | 50 | 460 | 565 | 585 | 615 |
| Na ₂ DTPMPA | Codex 4473 | 41 | 38 | 345 | 425 | 440 | 465 |
| Na ₇ DTPMPA | Codex 5323 | 32 | 25 | 235 | 290 | 300 | 315 |
| PBTC | PBTC | 50 | 50 | 500 | 500 | 500 | 500 |
| EDTA Na ₄ | | 85 | | 230 | 225 | 225 | 225 |
| EDTA Na ₄ | | 39 | | 105 | 102 | 102 | 102 |
| NTA Na ₃ | | 80 | | 315 | 310 | 320 | 320 |
| STPP | | 100 | | 225 | 250 | 250 | 255 |

Chelating Factor¹⁾ - CaCO₃

$$CH_R = \frac{\text{Sequestering power [mg]}}{\text{Molecular weight CaCO}_3 \text{ [g/mol]}} \bigg/ \frac{1000 \text{ [mg]}}{\text{Molecular weight of sequestering [g/mol]}} \quad [-/-]$$

For example for EDAT:

$$M.W._{EDTA} = 292 \text{ mg / mol}$$

$$M.W._{CaCO_3} = 100 \text{ mg / mol}$$

$$CH_{R,EDTA}^{pH=9} = \frac{370}{100} \bigg/ \frac{1000}{292} = 1,08$$

Chelating Factor¹⁾ - CaCO₃

| Chemical Abbrv. | Product | M.W. | pH 9 | pH 10 | pH 11 | pH 12 |
|------------------------|-----------------------------------|------|------|-------|-------|-------|
| HEDP | Codex 661 | 206 | 170 | 176 | 176 | 177 |
| ATMP | Codex 8503 | 299 | 217 | 266 | 308 | 314 |
| Na ₅ EDTMPA | Codex 3315 | 436 | 467 | 510 | 510 | 510 |
| DTPMP | Codex 4503 | 573 | 527 | 647 | 670 | 705 |
| PBTC | PBTC | 270 | 270 | 270 | 270 | 270 |
| EDTA | Ethylenedinitrilotetraacetic Acid | 292 | 108 | 105 | 102 | 104 |
| NTA | Nitrilotriacetic Acid | 191 | 97 | 96 | 98 | 98 |
| STPP | Sodium Tripolyphosphate | 258 | 58 | 65 | 65 | 58 |

¹⁾ counts per 100% acid

Chelating Factor¹⁾ - CaCO₃

| Chemical Abbrv. | Product | % con. | % con. as acid | M.W. | pH 9 | pH 10 | pH 11 | pH 12 |
|------------------------|------------|--------|----------------|------|------|-------|-------|-------|
| HEDP | Codex 661 | 60 | 60 | 206 | 103 | 106 | 106 | 107 |
| Na ₂ HEDP | Codex DS | 95 | 80 | 250 | 165 | 170 | 170 | 171 |
| Na ₄ HEDP | Codex 7101 | 29 | 21 | 294 | 50 | 52 | 52 | 54 |
| ATMP | Codex 8503 | 50 | 50 | 299 | 108 | 133 | 154 | 157 |
| Na ₅ ATMP | Codex 9403 | 40 | 29 | 409 | 86 | 104 | 121 | 123 |
| Na ₅ EDTMPA | Codex 3315 | 31 | 25 | 436 | 116 | 126 | 126 | 124 |
| DTPMP | Codex 4503 | 50 | 50 | 573 | 264 | 324 | 335 | 352 |
| Na ₂ DTPMPA | Codex 4473 | 41 | 38 | 683 | 236 | 290 | 300 | 318 |
| Na ₇ DTPMPA | Codex 5323 | 32 | 25 | 727 | 171 | 211 | 218 | 229 |
| PBTC | PBTC | 50 | 50 | 270 | 135 | 135 | 135 | 135 |
| EDTA Na ₄ | | 85 | | 380 | 87 | 86 | 86 | 86 |
| EDTA Na ₄ | | 39 | | 380 | 40 | 39 | 39 | 39 |
| NTA Na ₃ | | 80 | | 191 | 60 | 59 | 61 | 61 |
| STPP | | 100 | | 258 | 58 | 65 | 65 | 58 |



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