

## Properties Of Some Common Food Acidulants

| Property   | Citric Acid<br>$C_6H_8O_7$ | Malic Acid<br>$C_4H_6O_5$ | Fumaric Acid<br>$C_4H_4O_4$ | Tartaric Acid<br>$C_4H_6O_6$ |
|--|----------------------------|---------------------------|-----------------------------|------------------------------|
| Appearance   | White Crystals             | White Crystal Powder      | White Crystal Powder        | White Crystals               |
| Crystal System   | Monoclinic Holohedra       | Triclinic Crystal         | Monoclinic Prisms           | Monoclinic Sphenoidal prisms |
| Taste  | Tart                       | Smooth Tart               | Tart                        | Bitter Tart                  |
| Odour  | None                       | None                      | None                        | None                         |
| Empirical Formula  | $C_6H_8O_7$                | $C_4H_6O_5$               | $C_4H_4O_4$                 | $C_4H_6O_6$                  |
| Molecular Weight   | 192.12                     | 134.09                    | 116.07                      | 150.09                       |
| Equivalent Weight  | 64.04                      | 67.05                     | 58.04                       | 75.05                        |
| Melting Point °C   | 153°                       | 128.5 – 129°              | 286 – 287°                  | 168 – 170°                   |
| Specific Gravity   | 1.542<br>(18°/4°)          | 1.601<br>(20°/4°)         | 1.635<br>(20°/4°)           | 1.7598<br>(20°/4°)           |
| Bulk Density, kg/m <sup>3</sup>  | 900.2                      | 890.6                     | 961.1                       | 804.1                        |
| Solubility in Ethanol<br>g./100ml @ 25°C   | 58.9                       | 39.16                     | 4.3                         | 19.6                         |
| Solubility in Ether<br>g./100ml @ 25°C   | 1.84                       | 1.41                      | 0.56                        | 0.59                         |
| Solubility in Chloroform<br>g./100ml @ 25°C  | <0.01                      | 0.04                      | 0.02                        | 0.04                         |
| Heat of Combustion<br>kcal./mole, 20°C   | -474.5                     | -320.1                    | -320.0                      | -257.1                       |
| Heat of Solution<br>kcal./mole solute  | 3.9                        | 4.9                       | -                           | 3.3                          |
| Viscosity 50% Aq.<br>Solutions, cps., 25°C   | 6.5                        | 6.5                       | #                           | 6.5                          |
| Standard Free Energy of<br>Anion Formation, F°, kcal.,<br>25°C, aq.solutions (4,5) | -278.8                     | -201.98                   | -144.41                     | -                            |
| Sp.Gr.Sat. Aq.Solutions<br>(5°)  | 1.24                       | 1.210                     | 1.000                       | 1.26                         |
| (25°)  | 1.28                       | 1.250                     | 1.000                       | 1.27                         |
| (75°)  | 1.31                       | 1.310                     | 0.989                       | 1.31                         |
| Buffering Index*   | 2.46                       | 3.26                      | 3.46                        | 3.53                         |

# Solubility too limited

\* The slope of the pH-titration curve between pH 3.5-5 for 100ml of 0.01N acid titrated with 0.1N sodium hydroxide. The larger the value, the better the buffering action of the acid and its salt.