

Thermal expansion data for wine

Scope

The following table is a summary of thermal expansion data for wine, obtained from a variety of sources. The data may be used to predict changes in the volume of wine with temperature during storage, and to calculate headspace/ullage volumes required in bottled wine, in order to prevent or minimise leakage.

| Reference | Change in temperature, °C | Alcoholic strength, % v/v | Sugar content. g/L | Thermal Expansion | | |
|---------------------|---------------------------|---------------------------|--------------------|-------------------|----------|------|
| | | | | mL/L | mL/750mL | % |
| Vinkem Pty Ltd | 5 | NA | NA | 1.60 | 1.20 | 0.16 |
| | 10 | NA | NA | 3.33 | 2.50 | 0.33 |
| | 15 | NA | NA | 4.93 | 3.70 | 0.49 |
| | 20 | NA | NA | 6.67 | 5.00 | 0.67 |
| | 25 | NA | NA | 8.27 | 6.20 | 0.83 |
| | 30 | NA | NA | 9.87 | 7.40 | 0.99 |
| Levreau et al. 1977 | 10 | 10 | <2 | 0.90 | 0.68 | 0.09 |
| | 20 | 10 | <2 | 3.00 | 2.25 | 0.30 |
| | 30 | 10 | <2 | 6.30 | 4.73 | 0.63 |
| | 40 | 10 | <2 | 10.40 | 7.80 | 1.04 |
| | 50 | 10 | <2 | 15.20 | 11.40 | 1.52 |
| | 60 | 10 | <2 | 20.50 | 15.38 | 2.05 |
| | 10 | 12 | <2 | 1.10 | 0.83 | 0.11 |
| | 20 | 12 | <2 | 3.40 | 2.55 | 0.34 |
| | 30 | 12 | <2 | 6.80 | 5.10 | 0.68 |
| | 40 | 12 | <2 | 11.10 | 8.33 | 1.11 |
| | 50 | 12 | <2 | 16.20 | 12.15 | 1.62 |
| | 60 | 12 | <2 | 21.80 | 16.35 | 2.18 |
| | 10 | 14 | <2 | 1.50 | 1.13 | 0.15 |
| | 20 | 14 | <2 | 4.00 | 3.00 | 0.40 |
| | 30 | 14 | <2 | 7.50 | 5.63 | 0.75 |
| | 40 | 14 | <2 | 11.90 | 8.93 | 1.19 |
| | 50 | 14 | <2 | 17.20 | 12.90 | 1.72 |
| | 60 | 14 | <2 | 23.00 | 17.25 | 2.30 |
| | 10 | 14 | 100 | 2.10 | 1.58 | 0.21 |
| | 20 | 14 | 100 | 5.20 | 3.90 | 0.52 |
| | 30 | 14 | 100 | 9.00 | 6.75 | 0.90 |
| | 40 | 14 | 100 | 13.80 | 10.35 | 1.38 |
| | 50 | 14 | 100 | 19.20 | 14.40 | 1.92 |
| | 60 | 14 | 100 | 25.30 | 18.98 | 2.53 |
| Tremblay 1984 | 10 | 12 | NA | 3.07 | 2.30 | 0.31 |

In addition to the above references, Vannobel (1990) developed a mathematical formula which may be used to predict the expansion of bottled wine when subjected to an increase in temperature. Using this formula and the geometry of the neck of the bottle one can determine

the appropriate headspace to reduce possible leakage due to internal pressures caused by expansion. The reference is available from the Institute on request.

References

Vinkem P/L Promotional Literature : Wine Expansion Table

Levreau, R; Lefebvre, A; Serrano, M; Ribereau-Gayon, P Etude du bouchage liege 1. Role des supressions dans l'apparitions des`bouteilles couleuses', bouchage sous`gaz carbonique
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Tremblay, J L'influence de la tempurature sur le transport des vins par containers Rev. Fr. Oenol. 24(96) 11-18, 1984

Vannobel, C. Changes in bottled wine volumes. Rev. Fr. Oenol. 125: 41-46; 1990.