

Chapter 17

SOLUBILITY IN WATER AS A FUNCTION OF TEMPERATURE

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ABSTRACT

Results for variation of water solubility with temperature are presented 217 hydrocarbons in an easy-to-use tabular format that is especially applicable for rapid engineering usage with the personal computer or hand calculator. The results cover a range of 25-121 C (77-250 F) which includes temperatures encountered in air and steam stripping operations. Correlation and experimental results are in favorable agreement.

INTRODUCTION

Thermodynamic and physical property data are necessary for the design and operation of industrial processes. In particular, water solubility is becoming increasingly important in view of more and more stringent regulations regarding health, safety and environment.

In this article, results are presented for water solubility of hydrocarbons as a function of temperature. Solubility values issuing from the correlation are applicable at ambient and elevated temperatures such as those experienced in air and steam stripping operations.

WATER SOLUBILITY CORRELATION

The correlation for water solubility of hydrocarbons as a function of temperature is based on a series expansion in reciprocal temperature:

$$\log_{10} S = A + B/T + C/T^2 \quad (17-1)$$

where S = solubility in water, parts per million by weight, ppm(wt)
 T = temperature, K
 A, B and C = correlation constants

The correlation constants (A, B and C) are given in Table 17-1. The correlation constants in the table were determined from regression of the data from sources for water solubility. Both experimental values for the property under consideration and parameter values for estimation of the property are included in the source publications (1-194). The presented values are applicable to a wide variety of hydrocarbons (alkanes, naphthenes and aromatics with no, single and multiple substitutions). The tabulation is arranged by carbon number (C5, C6, C7,...) for ease of use in quickly locating data using the chemical formula.

The tabulated values for solubility of hydrocarbons in water apply to conditions of saturation in which the hydrocarbon is in equilibrium with water. For saturation, the system pressure is approximately equal to the sum of vapor pressures of hydrocarbon and water.

A comparison of correlation and actual experimental data values for water solubility is shown in Figures 17-1, 17-2 and 17-3 for representative hydrocarbons (hexane, cyclopentane, and benzene). In the figures, solubility values are plotted at temperatures ranging from 25 C to 121 C. This range covers temperatures encountered in air and steam stripping operations. The graphs disclose favorable agreement of correlation and experimental data.

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REFERENCES – ORGANIC COMPOUNDS

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