

## AZEOTROPIC DATA FOR BINARY MIXTURES

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Binary homogeneous (single-phase) liquid mixtures having an extremum (maximum or minimum) vapor pressure  $P$  at constant temperature  $T$ , as a function of composition, are called azeotropic mixtures, or simply azeotropes. The composition is usually expressed as mole fractions, where  $x_i$  for component  $i$  in the liquid phase and  $y_i$  for component  $i$  in the vapor phase are identical. Mixtures that do not show a maximum or minimum are called zeotropic. A maximum (minimum) of the  $P(x_i)$  or  $P(y_i)$  curves corresponds to a minimum (maximum) of the boiling temperature  $T$  at constant  $P$  plotted as a function of  $x_i$  or  $y_i$ , [see  $T(x_i)$  and  $T(y_i)$  curves, Types I and II, in Fig. 1]. Azeotropes in which the pressure is a maximum (temperature is a minimum) are often called positive azeotropes, while pressure-minimum (temperature-maximum) azeotropes are called negative azeotropes. The coordinates of an azeotropic point are the azeotropic temperature  $T_{az}$ , pressure  $P_{az}$ , and the vapor-phase composition  $y_{1,az}$ , which is the same as the liquid-phase composition  $x_{1,az}$ .

In the two-phase liquid-liquid region of partially miscible (heterogeneous) mixtures, the vapor pressure at constant  $T$  (or the boiling temperature at constant  $P$ ) is independent of the global composition  $x$ , of the two coexisting liquid phases between the equilibrium compositions  $x^*$  and  $x''$  ( $x' < x''$ )

ration is impossible by ordinary distillation, even with an infinitely large number of stages.

Following eq. (1) azeotropic behavior will always occur in homogeneous binary systems when the vapor pressure ratio  $P_1^s/P_2^s$  is equal to the ratio of the activity coefficients  $\gamma_1/\gamma_2$ .

Various thermodynamic methods based on  $g^E$ -models (Wilson, NRTL, UNIQUAC) or group contribution methods (UNIFAC, modified UNIFAC, ASOG, PSRK) can be used for either calculating or predicting the required activity coefficients for the components under given conditions of temperature and composition (Reference 2).

Because of the importance of azeotropic data for the design of distillation processes, compilations have been available in book form for quite some time (References 3-7). The most recent printed data collection was published in 1994 (Reference 8). A revised and extended version appeared in 2004 (Reference 9).

A collection of approximately 47,400 zeotropic and azeotropic data sets, compiled from 6600 references, are stored in a comprehensive computerized data bank (Reference 10). The references from the above-mentioned compilations and from the vapor-liquid equilibrium part of the Dortmund Data Bank (Reference 11) were supplemented by references found from CAS online

# Azeotropic Data For Binary Mixtures

**Phillip C. Wankat**



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with all the critical data needed to apply them Worked examples troubleshooting tips and numerous tables and charts are provided for easy access to the data The most up to date and complete guide to analytical chemistry available today NEW 3 major chapters on Analysis of Indoor Air Analysis of Pesticides Analysis of Trace Metals **British Chemical Abstracts**, 1926 **British Abstracts**, 1926 Perry's Chemical Engineers' Handbook, 9th Edition Don W. Green, Marylee Z. Southard, 2018-07-13 Up to Date Coverage of All Chemical Engineering Topics from the Fundamentals to the State of the Art Now in its 85th Anniversary Edition this industry standard resource has equipped generations of engineers and chemists with vital information data and insights Thoroughly revised to reflect the latest technological advances and processes Perry's Chemical Engineers Handbook Ninth Edition provides unsurpassed coverage of every aspect of chemical engineering You will get comprehensive details on chemical processes reactor modeling biological processes biochemical and membrane separation process and chemical plant safety and much more This fully updated edition covers Unit Conversion Factors and Symbols Physical and Chemical Data including Prediction and Correlation of Physical Properties Mathematics including Differential and Integral Calculus Statistics Optimization Thermodynamics Heat and Mass Transfer Fluid and Particle Dynamics Reaction Kinetics Process Control and Instrumentation Process Economics Transport and Storage of Fluids Heat Transfer Operations and Equipment Psychrometry Evaporative Cooling and Solids Drying Distillation Gas Absorption and Gas Liquid System Design Liquid Liquid Extraction Operations and Equipment Adsorption and Ion Exchange Gas Solid Operations and Equipment Liquid Solid Operations and Equipment Solid Solid Operations and Equipment Chemical Reactors Bio based Reactions and Processing Waste Management including Air Wastewater and Solid Waste Management Process Safety including Inherently Safer Design Energy Resources Conversion and Utilization Materials of Construction **Chemical Abstracts**, 1926 Analytical Chemistry Handbook John Aurie Dean, 1995 This comprehensive book offers chemists and chemical engineers detailed coverage of the full range of analytical methods including all the conventional wet and instrumental techniques It also provides information on the preliminary operations of analysis preeliminary separation methods and statistics in chemical analysis all essential in the application of any analytical method Molecular Thermodynamics of Fluid-phase Equilibria J. M. Prausnitz, Ruediger N. Lichtenthaler, Edmundo Gomes de Azevedo, 1986 A synthesis of thermodynamics and applied physical chemistry this volume stresses the importance and convenience of using generalized methods to solve chemical engineering problems **Separation Process Principles** J. D. Seader, Ernest J. Henley, D. Keith Roper, 2016-01-11 Separation Process Principles with Applications Using Process Simulator 4th Edition is the most comprehensive and up to date treatment of the major separation operations in the chemical industry The 4th edition focuses on using process simulators to design separation processes and prepares readers for professional practice Completely rewritten to enhance clarity this fourth edition provides engineers with a strong understanding of the field With the help of an additional co author the text presents new information on bioseparations throughout the chapters A new

chapter on mechanical separations covers settling filtration and centrifugation including mechanical separations in biotechnology and cell lysis Boxes help highlight fundamental equations Numerous new examples and exercises are integrated throughout as well *British Chemical and Physiological Abstracts* ,1930 Calculations and Theory of Distillation Arthur Rose,Elizabeth Rose,1957 **Reviews of Petroleum Technology** Institute of Petroleum (Great Britain),1953 *Reviews of Petroleum Technology* ,1953 *A Critical Literature Study on Scaling Laws for Heat Transfer* Rolf Andersen,Vagn S. Pejtersen,1970 *Separation Process Engineering* Phillip C. Wankat,2007 Reviewing core concepts such as equilibrium and unit operations this title introduces a step by step process for solving separation problems It looks at each leading processes including advanced processes such as membrane separation adsorption and chromatography For each process it presents principles techniques equations and examples

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