This article was downloaded by:
On: *25 January 2011*
Access details: *Access Details: Free Access*
Publisher *Taylor & Francis*
Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK

Separation Science and Technology
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713708471

Use of Antoine Equation to Relate T to Y-X Equilibrium Composition

H. K. Abdel-Aal[a]
[a] CHEMICAL ENGINEERING DEPARTMENT, KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS, DHAHRAN

To cite this Article Abdel-Aal, H. K.(1995) 'Use of Antoine Equation to Relate T to Y-X Equilibrium Composition', Separation Science and Technology, 30: 15, 3087 — 3088
To link to this Article: DOI: 10.1080/01496399508013131
URL: http://dx.doi.org/10.1080/01496399508013131

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.informaworld.com/terms-and-conditions-of-access.pdf

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

SEPARATION SCIENCE AND TECHNOLOGY, 30(15), pp. 3087–3088, 1995

TECHNICAL NOTE

Use of Antoine Equation to Relate *T* to *Y–X* Equilibrium Composition

H. K. ABDEL-AAL
CHEMICAL ENGINEERING DEPARTMENT
KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
DHAHRAN 31261, SAUDI ARABIA

Downloaded At: 11:58 25 January 2011

INTRODUCTION

The current practice followed in drawing isobaric y–x phase diagrams for a binary mixture (say Components 1 and 2) is based on data for the vapor pressure of the components as a function of temperature, T.

Calculations are initiated by first assuming a T, then finding the corresponding values for P_1 and P_2. Equilibrium data for x and y are computed next for a given total pressure, π:

$$X_1 = \frac{\pi - P_2}{P_1 - P_2} \tag{1}$$

$$Y_1 = X_1 \frac{P_1}{\pi} \tag{2}$$

The procedure is repeated by picking different values for T.

PROPOSED RELATIONSHIP

The *vapor pressure* P_i of Component i is a unique property of the component and is a direct function of temperature. Thus, it increases with an increase in temperature, and a material having a higher value at a given temperature than another component is said to be *more volatile*.

Copyright © 1995 by Marcel Dekker, Inc.

Vapor pressure and temperature are commonly related by means of the well-known Antoine equation:

$$\log P_i = A_i - \frac{B_i}{C_i + T} \tag{3}$$

where A, B, and C are constants for a particular compound over a relatively narrow temperature range (up to 100°C). Values of these constants for various compounds and the applicable temperature range are given in many references (1, 2).

Now, if the values of P_1 and P_2 appearing in Eqs. (1) and (2) are replaced using the Antoine equation, the following relationships are obtained:

$$X_1 = \frac{\pi - e^{\gamma_2(T)}}{e^{\gamma_1(T)} - e^{\gamma_2(T)}} \tag{4}$$

and

$$Y_1 = X_1 \frac{e^{\gamma_1(T)}}{\pi} \tag{5}$$

where

$$\gamma_1(T) = [A_1(C_1 + T) - B_1]/(C_1 + T)$$

$$\gamma_2(T) = [A_2(C_2 + T) - B_2]/(C_2 + T)$$

Equations (4) and (5) thus establish direct relationships between T and both vapor/liquid equilibrium composition for a binary system using Antoine constants.

REFERENCES

1. API Project No. 44, *Selected Values of Physical and Thermodynamic Properties of Hydrocarbons and Related Compounds*, Carnegie Press, Pittsburgh, 1953.
2. R. R. Dreisbach, "Physical Properties of Chemical Compounds I, II and III," *Am. Chem. Soc. Adv. Chem. Ser.*, *15* (1955); *29* (1961).

Received by editor November 30, 1994

Downloaded At: 11:58 25 January 2011