



# Isobaric Vapor-Liquid Equilibrium for Binary Systems of Ethyl Methyl Carbonate (and Diethyl Carbonate) + Ethyl Propionate, + Methyl Propionate at 101.3 kPa

Young Min Cho<sup>1,2</sup> · Dong June Ahn<sup>1,3</sup>

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## Abstract

Isobaric vapor-liquid equilibrium (VLE) data were measured for four binary mixtures of ethyl methyl carbonate (EMC) + methyl propionate (MP), EMC + ethyl propionate (EP), diethyl carbonate (DEC) + MP, and DEC + EP at 101.3 kPa. The experimental VLE data for four binary systems were correlated with the Wilson, NRTL, and UNIQUAC activity coefficient models to obtain the interaction binary parameters, respectively. These model parameters were obtained by minimizing a maximum likelihood objective function. The thermodynamic consistency of the experimental data was tested using the Redlich-Kister method and the Fredenslund method, which indicated that the experimental data satisfy the consistency tests. The results associated with the three models agree well with the experimental data, and no azeotropic behavior was observed in these binary systems.

**Keywords** Vapor-Liquid equilibrium · Carbonate · Propionate · Thermodynamic consistency test · Activity coefficient model

## Nomenclature

### Symbols

$A_i$	Extended Antoine Eq. 1st parameter
$B_i$	Extended Antoine Eq. 2nd parameter
$C_i$	Extended Antoine Eq. 3rd parameter
$D$	Redlich-Kister's parameter
$D_i$	Extended Antoine Eq. 4th parameter
$E_i$	Extended Antoine Eq. 5th parameter
$k$	Variables (equilibrium temperature, equilibrium pressure, and vapor/liquid mole fraction)
$M$	Molecular weight (g/mol)

$N$	Number of experimental points
$P$	Pressure (kPa)
$P_c$	Critical pressure (MPa)
$P^s$	Saturated vapor pressure (kPa)
$q$	Surface area of a molecule
$r$	Van der Waals volume
$T$	Temperature (K)
$T_b$	Boiling point (K)
$T_c$	Critical temperature (K)
$V_c$	Critical volume (cm <sup>3</sup> /kmol)
$x$	Mole fraction in the liquid phase
$y$	Mole fraction in the vapor phase
$Z$	Value corresponding to a specific variable (temperature, mole fraction, pressure)

✉ Dong June Ahn  
ahn@korea.ac.kr

Young Min Cho  
choym@korea.ac.kr

<sup>1</sup> Department of Chemical and Biological Engineering, Korea University, Seoul 02841, Korea

<sup>2</sup> R&D Center, Lotte Chemical, Daejeon 34114, Korea

<sup>3</sup> KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul 02841, Korea

## Greek Letters

$\alpha$	Non-random parameter
$\gamma$	Activity coefficient
$\sigma$	Standard deviation

## Abbreviations

cal	Calculation
exp	Experiment