International journal of advances in engineering and management (IJAEM)
Volume 3, issue 6 June 2021, pp: 2276-2277 www.ijaem.net ISSN: 2395-5252

Vapour Liquid Equlibrium for Aniline + P-Xylene Isomer

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Submitted: 05-06-2021 Revised: 18-06-2021 Accepted: 20-06-2021

ABSTRACT:-
The thesis deals with accurate measurement of vapour liquid equilibrium data for binery system at local atmospheric pressure and estimation of binary interaction parameters for Wilson,NRTAL and UNIQUAC models. Many different types of apparatus are proposed in literature for VLE data .In the present work the development of Dynamic type VLE apparatus and their important features are reviewed in detail . The VLE data of Aniline +P-Xylene isomer were measured at local atmospheric pressure of 93.13 KPA using Dynamic recirculation type apparatus. The experimental VLE data were found to be thermodynamically consistent according to point to point consistency test of Van Ness.

I. INTRODUCTION

The vapour liquid equilibrium is a condition where liquid and its vapour are in equilibrium with each other, A condition or a state where rate of vapourization is equal to rate of condensation on a molecular level such that there is no net vapour liquid interconversion. The concept of equilibrium is based on assumption that vapour leaving on each stage is in equilibrium with liquid leaving on each stage .very few systems are known to form ideal solutions, where in VLE can be calculated by Raoult'slaw.The accurate VLE data is very important in process equipment design such as distillation columan design. It has wide application in modeling and simulations of separation process. It is also useful for finding Thermodynamical properties such as activity coefficient, fugacity coefficient ,Gives free energy. The apparatus used for measurement of VLE data are of two types ,Dynamic type and Static type. In dynamic type, both liquid and vapour phases are recirculated through the boiling chamber and separated in equilibrium chamber. In static type, both liquid and vapour phases are in bolilng chamber and no circulation takes place . In the present work, the isobaric VLE data for Aniline+P-Xylene isomer were measured at local atmospheric pressure of 93.13 KPA

APPARATUS AND EXPERIMENTAL DATA

The apparatus comprised of boiling chamber, a Cottrell tube with vaccum jacket, an equlibrum chamber with vaccum jacket, a condenser ,a condensate receiver and equilibrium liquid vapour condensate mixture . Temperature measurement are provided everywhere when it is needed. In a equilibrium chamber, vapour and liquid seperates and vapour heads towards the condenser and get condensed with suitable cooling medium.The vapour condensate is collected in a receiver and overflows to the mixing chamber where is mixed with the liquid from the equilibrium chamber. Both the vapor condensate receiver and the mixing chamber, are provided with magnetic stirrers to avoid any concentration gradient. The mixed liquid flows back to boiling chamber to complete circulation loop. Sufficient time is given to liquid vapour circulation so that equilibrium is achieved whivh is indicated by constant temperature in equilibrium chamber. Once a constant temp is achieved, samples are collected for equilibrium liquid from equilibrium chamber and equilibrium vapour from condasate receiver. For sample analysis, refractometer from Atago
Model -RX-7000i with accuracy of +/-0.0001 was used. Antoine constants for Aniline + p-xylene is A = 6.11543 B = 1453.43 C = -54.840.

Measured refractive indices at 293.15k for various p-xylene mole fraction are,

X_1	0.0000	$_{nD}$	1.5858
X_2	0.0649	n_D	1.5779
X_3	0.0912	n_D	1.5750
X_4	o.2051	n_D	1.5632
X_5	0.2790	n_D	1.5547

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VLE data for Aniline + p-xylene at 93.13kpa

T\K	X_1	Y_1	γ_1	γ_2
454.20	0.0000	0.0000	-	1.0000
447.05	0.0357	0.1791	1.942	1.033
441.90	0.0749	0.3118	1.809	1.043
432.71	0.1645	0.4890	1.599	1.120
427.15	0.2592	0.6112	1.451	1.138
422.84	0.3614	0.6890	1.306	1.207
419.25	0.4806	0.7572	1.182	1.299
417.28	0.5569	0.7952	1.127	1.370
414.77	0.6580	0.8419	1.1078	1.487
412.60	0.7718	0.8890	1.028	1.683
410.61	0.8846	0.9409	1.001	2.012
409.47	0.9412	0.9692	1.0001	2.013
408.37	1.000	1.000	1.000	-

Point to point consistency test result –

Binary result	y	p
p-xylene+aniline	0.0024	1.2499

II. CONCLUSION

Isobaric VLE data generation and thermodynamic modelling for binary system is studied. Different types of binary systems were selected for which VLE data is not available. The present apparatus seems to be most preferred for VLE data for atm pressure and below atm pressure. Heat losses area avoided in apparatus. The activity coefficient models were fitted to VLE data generated , binary interaction parameters were evaluated by suitable guesses, it has been seen that the fit of model was quite good for generated VLE data for different binary composition of which the generated data is of good quality.

REFERENCE

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