

Vapor-liquid phase behaviour of aqueous mixtures containing xylene and NaCl

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The generation of wastes in most industrial process is inevitable. In the petroleum industry, one of the greatest problems for the environment is the huge amount of produced water generated in the fields of oil. This wastewater is a complex mixture and together with the great amounts can be hazardous to the environment without adequate treatment. This research is focused in the analysis of the vapour-liquid behavior of the vaporization processes to respect to the xylene in an aqueous mixture. The experiments have been performed with a synthetic wastewater, carefully prepared with xylene, as contaminant model, in order to simulate the industry wastewater.

The recirculation method has been used to determine the Vapor-Liquid Equilibrium (VLE) data with a modified Othmer ebulliometer [1]. This equilibrium still provides the circulation of the vapor phase and has been specially amplified to determine data at diluted concentrations, see Figures 1 and 2. In order to analyze the vapor and liquid compositions of the diluted aqueous samples, the absorbance and the total organic carbon (TOC) analysis have been used with the required resolution.



Fig. 1. Vapor-liquid equilibrium apparatus for diluted aqueous mixtures, with organic and salt compounds.

The results revealed important phase behavior features. The vapor phase presents higher amount of xylene than the liquid phase, which is the less volatile compound. This result is typical of a mixture that overcomes the azeotropic point [2]. However, these results also showed a stripping behavior, a typical process in these conditions, see Table 1. Furthermore, the salting-out effect has been detected with the synthetic mixtures of water+xylene and water+xylene+NaCl. The thermodynamic modelling

assumed the presence of a two liquid phase system for representing the emulsion mixtures. The study of the equilibrium aids to understand the behavior of these complexes mixtures and further application in separation process design.

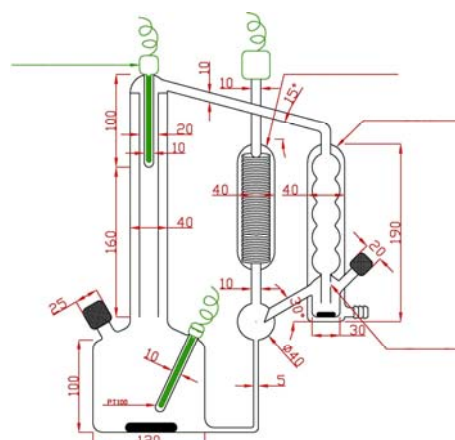


Fig. 2. Vapor recirculation still, specially modified for diluted concentrations; dimensions are in millimetres.

Table 1

VLE data for the xylene+water system at atmospheric pressure (101.325 kPa)

Sample	Absorbance ($\lambda=262\text{nm}$)	[Xylene] ppm	Data Point
Initial Solution	0.1990	117.06	
Liquid phase - X	0.0060	3.53	1
Vapor phase - Y	0.2660	156.47	
Liquid phase - X	0.0030	1.76	2
Vapor phase - Y	0.2810	165.29	
Initial Solution	0.1760	103.53	
Liquid phase - X	0.0060	3.53	3
Vapor phase - Y	0.2560	150.59	
Liquid phase - X	0.0000	0.0000	4
Vapor phase - Y	0.2640	155.29	

References

- [1] Oliveira, H.N. et al. (2002). A Simple Vapor-Liquid Equilibrium Apparatus Based On Vapor Recirculation. Proceedings of the VI Iberoamerican Conference on Phase Equilibria for Process Design, v.1. p.1-10.
- [2] Chivavone-Filho, O. et al. (2009). Experimental study of the vapor-liquid phase behavior of aqueous mixtures containing hydrocarbons and salts. X Petrophase, Rio de Janeiro, Brasil.