# Liquid-Liquid Equilibrium for Monoethylene Glycol + Water + xylene

**Thomas PLUOT**

## Introduction

During transportation, oil is under high pressure and low temperature to it can form gas hydrates in pipelines. The latter conditions are often encountered in cold regions and in deepwater offshore fields. The gas hydrates could block the pipelines causing operational, economic and safety problems to the oil industry. Thus, to avoid forming hydrates, thermodynamic inhibitors, such as monoethylene glycol (MEG), are commonly and extensively used. Therefore, phase behaviour exploration of systems containing MEG, water and hydrocarbon is crucial to the petroleum industry. Despite its efficiency as hydrate inhibitor, glycol presents a toxic effect on the environment which must be taken into account. It can be found in water and in refined products going to consumers. Therefore, the solubility of hydrocarbon compounds which are generated during glycol regeneration processes are an important factor, as hydrocarbon can be found in aqueous glycols. The hydrocarbon solubility in water must also be known as regards to environmental legislations.

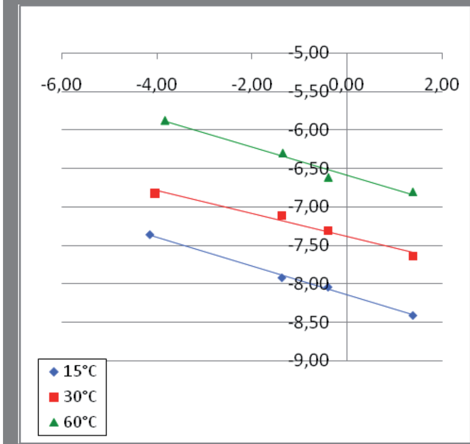
## Experimental methods

In order to establish liquid-liquid equilibrium we used a 300 mL glass cell. The cell was equipped with a magnetic stirrer and a jacket for a circulating fluid to keep the temperature of the liquid mixture constant. The temperature was controlled within 0.1 K. The prepared ternary mixtures of known compositions were introduced to the glass cell. The mixtures were vigorously agitated for 10 h in order to obtain equilibrium and then the two phases were left to settle for 8 h.

## Sampling and Analysis

The samples of the two phases were withdrawn from the equilibrium cell by means of two preheated sampling lines in order to avoid adsorption phenomena. The samples were collected in an auxiliary solvent (methanol or ethanol) in order to maintain their homogeneity. The solvent previously contained an internal standard. We only analyzed minor compounds in each phase. Two different GC apparatus with different columns and injectors system were used in order to analyze the trace amounts of compounds involved in this study
Figure 1 was obtained with the data collected after all analyses at different temperatures and composition of the system monoethylene glycol, water and xylene were carried out. This graph uses the Othmer- Tobias equation at different temperatures (the relation is featured below figure 1).
The Othmer-Tobias equation foresees a linear relation for the evolution of the solubility in a ternary system. Some experimentation was previously made in order to establish the linearity of this equation. This curve shows that the solubility increased with the temperature and also with the composition of the aqueous phase. The same experimentation was used for another hydrocarbon like hexane.

Figure 1 : Othmer-Tobias equation for the xylene for different temperature




## Conclusion

In this work we have presented experimental liquid-liquid equilibrium data in ternary mixtures containing monoethylene glycol, water and xylene (or for hexane) in the temperature range 283.15 K – 333.15 K. No reliable literature data were found in order to check the consistency of our measurements.
In order to complete this work and to start the thermodynamic model, it is necessary to know the solubility of each component of a quaternary solution (monoethylene glycol, water and 2 hydrocarbons).