Density and Viscosity of Aqueous Blends of Three Alkanolamines: N-methyldiethanolamine, Diethanolamine, and 2-Amino-2-methyl-1-propanol in the range 303 to 358 K

M.E. Rebolledo-Libreros,[S] R.E. Ortega-Urquiza, and A. Trejo[C]
Instituto Mexicano del Petróleo, Programa de Ingeniería Molecular, Área de Investigación en Termofísica., México D.F., México
atrejo@imp.mx

Aqueous solutions of alkanolamines are widely used in industrial processes for sour gas purification, e.g. natural, refinery, and synthesis gas streams, primarily to eliminate acid gases, such as CO_2 and H_2S. It is well known that in order to select the most adequate concentration of the mixture of two or three alkanolamines that will efficiently eliminate the acid gases from a given hydrocarbon-rich gas stream, it is of the utmost importance to have a reliable body of solubility data for the acid gases of interest in a relatively large range of temperatures and pressures. Recent results from our laboratory on acid gas solubility have shown that selected aqueous solutions of blends of three alkanolamines: a secondary amine, diethanolamine (DEA), a tertiary amine, methyldiethanolamine (MDEA), and a sterically hindered amine, 2-amino-2methyl-1-propanol (AMP), are highly efficient for the absorption of CO_2 and H_2S. In addition to knowing the absorption capacity and selectivity of the aqueous blends of amines of fixed concentration, it is also very important to have experimental results for their different physical properties, in order to carry out the efficient design, simulation, and operation of acid gas treatment equipment.

Experimental values of the density and viscosity for aqueous solutions of three alkanolamines composed of 32.5 mass % MDEA and 12.5 mass % DEA with 2, 4, 6, 8, and 10 mass % AMP have been determined in the temperature range of 303.15 to 343.15 K. We have also studied the system composed of 25 mass % MDEA and 20 mass % DEA with 2, 4, 6, 8, and 10 mass % AMP in the temperature range of303.15 to 358.15 K. The experimental results of the density and viscosity are given as a function of both temperature and AMP concentration. In the range of temperature studied, the experimental density values of the aqueous blends of alkanolamines decrease as the AMP concentration increases, while the viscosity values increase as the AMP concentration increases. Correlation equations were obtained in order to allow for the calculation of density and viscosity for aqueous solutions of MDEA and DEA as a function of AMP concentration and temperature.