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Salts Effect on Isobaric Vapor–Liquid Equilibrium for Separation of the Azeotropic Mixture Allyl Alcohol + Water

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Abstract: Allyl alcohol and water can form an azeotrope with the minimum boiling point. To separate the azeotrope of allyl alcohol and water by salt distillation, three salts calcium chloride, calcium nitrate and magnesium nitrate were selected to break the azeotrope. The vapor-liquid equilibrium (VLE) data for the systems allyl alcohol + water, allyl alcohol + water + calcium nitrate, allyl alcohol + water + calcium chloride and allyl alcohol + water + magnesium nitrate were measured at pressure of 101.3 kPa. The results indicated that the relative volatility of allyl alcohol to water increased by adding the salts at the molar fraction of allyl alcohol higher than 0.2. With increasing the concentrations of the salts, the azeotropic point of the system allyl alcohol + water moved. When the concentrations of calcium chloride and magnesium nitrate were 0.10, 0.15, respectively, the azeotropic point was broken. The effect of salts on the azeotropic point of the system allyl alcohol + water follows the order: calcium chloride > magnesium nitrate > calcium nitrate. Moreover, the experimental VLE data were correlated by the NRTL model. All the root-mean-square deviations for the temperature (T) and the mole fraction of the vapor phase (y_1) between the measured and calculated data were less than 0.26 K and 0.005, respectively. Meanwhile, the binary interaction parameters of the NRTL model were regressed.

Keywords: vapor-liquid equilibrium; allyl alcohol; water; azeotrope; salts

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