VLE Description of Glycerol Containing Systems with the Cubic-Plus-Association (CPA) Equation of State

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Biodiesel is nowadays in Europe the most used biofuel for road transportation. A typical biodiesel production and purification facility contains three major processing sections: a transesterification unit, a biodiesel purification section and a glycerol recovery section. Glycerol impacts negatively on the fuel properties, being the maximum free glycerol value admissible according to the European Standard EN 14214 of 0.02 wt %, and profits from selling it into the commercial glycerol market reduces biodiesel production costs in 22-36 %, improving the economic viability of biodiesel. Different separation and purification processes are required for the glycerol rich streams such as the recovery of the unreacted alcohol and the removal of water. The adequate design of the recovery and purification steps requires the knowledge about the vapor-liquid equilibria data for water + glycerol and alcohol + glycerol systems that are surprisingly scarce. To overcome this lack of information, experimental measurements for water + glycerol and 5 alcohol + glycerol systems were performed. These data were used to evaluate the capability of the Cubic plus Association equation of state (CPA EoS) for modeling these systems. A new association scheme was proposed for the glycerol molecule providing an excellent correlation of all the VLE data measured, with a single, low and temperature independent, binary interaction parameter. Even good pure predictions were achieved with the proposed association scheme.

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