

## Consistency tests for ternary liquid–liquid equilibrium based on the Van Ness test and Clark–Evans test

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Complete and accurate liquid–liquid equilibrium (LLE) data is critical to the successful design and operation of separation processes such as extractive distillation. The consistency test evaluates the thermodynamic quality of the data set through the constraints of the Gibbs–Duhem equation. Unfortunately, developing a method for determining the quality of the LLE data was in little progress. This work provides three methods to test the ternary LLE data, based on the Van Ness test and Clark–Evans test. Simplified Van Ness test, modified Van Ness test, and Clark–Evans test independently calculates the data set's quality factor. All tests ensure that the quality factor is reasonably affected for all components and data points, and a clear correlation with residuals is guaranteed. This work applied three consistency tests to the experimental ternary LLE data sets, smoothed LLE data sets, and the smoothed data set with random error. As a result, all three tests successfully evaluated the LLE data sets, and the Van Ness tests showed high sensitivity to random errors.