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Determination of ethanol concentration of ethanol/water mixture solutions with open ended coaxial method

ABSTRACT

This study presents a simple and non-destructive procedure to determine ethanol concentration of ethanol/water solution at ambient temperature based on HP85070B open ended coaxial dielectric constant measurement. The motivation for this study stems from the fact that the `true' concentration of ethanol in a `labeled' container could be `spoiled' due to hygroscopic nature of ethanol, evaporation and other factors. The dielectric constant measurements of eight samples with different molar fraction were validated with modified Cole-Cole-Debye (3CC) simulations. A 5th degree polynomial calibration equation was developed based on 3CC simulations with R2 = 0.9998 and used to estimate the `true' concentration of three ethanol samples obtained from `labeled' containers kept in laboratory. The ethanol concentrations of two of the samples were found to be much lower than what was indicated on their labels, hence, assumed spoiled.

Keyword: Ethanol concentration; Permittivity; Debye model; Open ended coaxial