

UNIFIED pH_{ABS} MEASUREMENTS OF ACID SOLUTIONS IN LOW-POLARITY SOLVENT, 1,2-DICHLOROETHANE

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Using pH_{abs} to express solution acidity can offer significant benefits in catalysis, liquid chromatography, sustainable energetics, and rationalizing acid-base processes. These advantages would be especially evident in solvents with low polarity, where traditional methods of measuring solution acidity may be problematic. 1,2-dichloroethane (DCE) is a solvent with low basicity but adequate polarity, making it suitable for preparing solutions of polar and ionic compounds with known concentrations. This property makes it ideal for studying acids and superacids [1].

In the past, pK_a measurements of acids were determined using UV-vis spectrophotometric titration methods [2]. However, the pK_a scale is solvent-specific, and a direct experimental comparison of the actual acidities of solutions in terms of pH has not been performed across different solvents. To link the scales, this study used a different approach to determine the absolute pH differences (pH_{abs}) between acid solutions in 1,2-DCE, which allows a direct comparison of acidity-related processes in different solvents, leading to a better understanding of solvent properties and acid behavior. Differential potentiometry and the " pH_{abs} ladder" method were employed to measure and determine pH_{abs} values. The potential differences between glass electrodes immersed in solutions separated by an ionic liquid as a salt bridge were measured using an electrometer.

The results indicated that pH_{abs} values of acids with large anions and delocalized charge were consistent with the pK_a values reported using the UV-vis spectrophotometric titration method. On the other hand, acids with small sizes and localized charges showed the most significant deviation, especially those prepared with triflic acid. Therefore, for future measurements of pH_{abs} values of solutions in 1,2-DCE, it is recommended to use acids with large anions and delocalized charges.

References

1. E. Paenurk et al., 2017, *Chem. Sci.*, 8, 6964-6973.
2. A. Kutt et al., 2011, *J. Org. Chem.*, 76, 391-395.



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