Unified pH scale – from concept to applications

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The unified pH (pH_{abs}), originally put forward as a theoretical concept, has now matured into a practical tool.[1–4] It has been embraced both by the European metrology community (Euramet)[5] and by IUPAC.[6] The pH_{abs} scale has the advantage over the conventional aqueous pH scale because pH_{abs} values express acidity in terms of the thermodynamic activity of the solvated proton. Therefore, pH_{abs} values are directly comparable between solvents/media of different compositions. At the same time, pH_{abs} is convenient to use if expressed as "aligned to the aqueous pH scale", denoted as $pH_{abs}^{H_2O}$ (or ${}_{abs}^{w}pH$), as $pH_{abs}^{H_2O}$ values of aqueous solutions are equivalent to the respective conventional pH values.[6]

The advancements in the use of pH_{abs} are in no small part due to developments in measurement methods, first of all differential potentiometry, using potential differences in a symmetric cell with two glass electrode half-cells and almost ideal ionic liquid (IL) triethylamylammonium bis((trifluoromethyl)sulfonyl)imide $[N_{2225}][NTf_2]$ salt bridge with multiple overlapping measurements.[1,5] Using this specific IL is a key factor in success, as it enables to essentially cancel the liquid junction potential between solutions made in a number of conventional solvents and their mixtures.[7,8]

This presentation gives an overview of pH_{abs}, its measurement and current, as well as possible future applications in liquid chromatography, catalytic systems and acidity at interfaces between phases.

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