Evaluation of weak ion association between tetraalkylammonium ions and inorganic anions in aqueous solutions by capillary zone electrophoresis

Author(s)

Julius Mbuna,
Toshio Takayanagi,
Mitsuko Oshima,
Shoji Motomizu*

Abstract

The evaluation of weak ion association between eleven (11) inorganic anions (charge −1 to −3) and five *n*-tetraalkylammonium ions, R_4N^+ (R: methyl, Me; ethyl, Et; propyl, Pr; butyl, Bu; pentyl, Am) in aqueous media at 25 °C was studied. The analysis of ion association equilibria was carried out under acidic condition (formate buffer, pH 3.5) at low separating potential (−10 kV) using a coated capillary with suppressed electroosmotic flow (μ=4×10^{-5} cm^2 V^{-1} s^{-1}). Direct UV detection was done at anode (λ=220 nm). The combination of the aforementioned conditions ensured that ion association constants, K_{ass}, between *n*-tetraalkylammonium ion and the small inorganic anions were reliably determined after a non-linear least squares (NLLS) treatment of the measured anion's mobility. Like their larger counterparts, small anions showed increased interaction with an increase in size of pairing ions. Moreover, for a specific cation, the interaction of small anions increased with an increase in size of the hydrated anions as reflected by the relationship between the K_{ass} and the Stokes' radius. A favourable comparison exists between the results presented in this work and those previously documented from other analytical techniques like conductometry. Qualitatively, the mobility of the anions appeared to obey the Hückel's model more closely than the more elaborate Zwanzig and Hubbard–Onsager models.

Keywords

Ion association constants;
Stokes' radius;
Weak ion association;
Tetraalkylammonium ions;
Inorganic anions