

Practical application and statistical analysis of titrimetric monitoring of water and sludge samples

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Abstract

Titrimetry offers the possibility of simultaneous measurement at low cost of several (buffering) components. A first step in the study towards practical application of the titrimetric technique was the titrimetric analysis by up- or down-titration of standard solutions, standard mixtures, solids digester samples and water samples coming from autotrophic nitrogen-removal reactors. The resulting raw data were further processed with an Excel-based program. This program first converts the raw data into a buffer curve upon which a linear buffer capacity model is fitted to the experimental data by estimating the (buffer) concentrations and corresponding pKa values. As such the type of component and the concentration can be determined. As a second step the resulting calculated concentrations were analysed statistically to assess the accuracy and precision of the titrimetric technique. For this purpose, the data were paired, i.e. the difference between the concentration obtained with titrimetry and the concentration obtained with another technique such as colorimetry or gas chromatography was calculated. First the normality of the paired data was assessed. Then, a paired t-test (normal data) or a paired Wilcoxon test (normal data) was used to statistically compare the results obtained with the titrimetric technique to either the stock solution concentration or measurements with another method (colorimetry or gas chromatography). The statistical tests showed that, depending on the titrant concentration, concentrations from 50 mg/l to 3 000 mg/l could adequately be measured with the titrimetric technique.

Keywords: titrimetric monitoring, water treatment, modelling, statistical analysis