Analysis of Boron in High Matrix Seawater Medium with ICP-AES

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ABSTRACT

Many environmental samples contain high dissolved solids. During the analysis of waste waters and seawaters the instrumental analysis was interfered via mass or spectral interferences and/or lack of stability during experiments. Numerous researches have been tested for resolving these problems. The necessity of preparing a correct analytical protocol in high matrix samples along with low concentrations of elements of interest. The presence of strong interfering elements becomes even important in developing technology for recovering valuable metals from seawater. Highly concentrated dissolved substances such as sodium, chloride ···etc··· are the ballast which make it difficult to analyze of a given element by a desired analytical method especially in low concentration. The difficulties arise when the significant suppression of analytes as well as spectral interfere. Boron is present at about 4.4 ppm in natural seawater, and takes two different chemical forms Boric acid, $B(OH)_3$ and borate, $B(OH)_4^-$. Among these, the most predominate form is boric acid, comprising about 70% of the total boron present in seawater. These two forms are considered as interconvert in less than a second, therefore the two forms are in chemical equilibrium with each other in natural environments.

Matrix matching standard preparation is a method that analyzes two similar matrixes of testing treatment, and standard solution. This method is highly recommended when analyzing a highly concentrated solution. In order to precisely measure the boron concentration in seawater, experiment was done by diluting seawater by multiple of x5, x10, x20 with matrixes of solutions and 2% nitric acid to achieve matching matrix. Plotting the measured values as concentrations vs. intensities of each matrix matching solution, the results were examined carefully. The intercept for standard solution using 2% nitric acid was almost zero, but when it came to measuring the intercept for diluted

seawater, as number of multiple decreased, the intercept for each increased by 4000, 700, and 15000. The slope for each matrix (excluding data of 2% nitric acid) was 16060~17775.

Although the slope for each matrix intercept (excluding 2% nitric acid) varied between 16060~17775, in graph the each slope was almost parallel to each other. When the matrix of calibration curve and experimented was separated, observation showed that as the concentration decreased, the percentage of error increased. It also showed that as the difference between matrixes is bigger (especially between the calibration curve of 2% nitric acid and the 5x diluted seawater), percentage of error was greater. However, when the result was observed in a broader scale, no matter how lower the percentage of error was, it was between 7%~51% for high concentrated solution (1ppm) and for low concentrated solution (0.1ppm, 0.5ppm), it was 50~640% 12~112%. For the same matrixes, analysis showed that for high concentrated solution (1ppm), variation was less then 5%. For low concentrated solution, variation of percentage error was; for x5 diluted seawater: 10~30%, for x10: less then 20%, x20: less then 10%.