

Online Boron Monitor (prototype)

Purpose:

The Japanese effluent standard of boron was established in 2001; it is 10 mg/L for terrestrial waters and 230 mg/L for coastal waters, respectively. Since the conventional measurements of aqueous boron, e.g., inductively coupled plasma (ICP) spectrometry and colorimetric analyses employ an expensive stationary equipment or a time-consuming pretreatment, they are difficult to carry out in the field. Thus, a simple and rapid determination method which can be conducted on-site is required even if the accuracy of determination is sacrificed to some extent. We focused on the potentiometric measurement with a commercial tetrafluoroborate ion (BF_4^-) selective electrode and succeeded in reducing the measurement time by analyzing the kinetics of boron conversion ($\text{H}_3\text{BO}_3 + 4\text{NaF} \rightarrow 4\text{Na}^+ + \text{BF}_4^- + 3\text{OH}^-$), which was awarded 14th Environmental Chemistry Technology prize by Japan Society for Environmental Chemistry. Based on this method, DKK-TOA Corp. and CRIEPI are developing an automated measuring equipment for monitoring boron in environmental waters and process effluents, which is referred to as online boron monitor. We have already established a prototype and the long-term demonstration test is now under way in coal-fired power plants in order to launch an online boron monitor into the market in 2006. Now CRIEPI has prototype monitors to provide potential users with an on-site demonstration use.

Main Specifications:

- Principle of measurement: potentiometric determination with a commercial BF_4^- selective electrode. In the conversion of H_3BO_3 to BF_4^- by adding NaF to the sample, a great reduction in the measurement time is achieved by analyzing the reaction kinetics.
- Determination range: 1-300 mg/L (the range is controlled by adjusting the dilution ratio of the sample).
- Determination time: less than 15 min.
- Automation of all procedures required for the measurement, i.e., sampling of a solution, addition of the chemicals, data acquisition, data analysis, and calibration.
- Mode of operation: manual/automatic
- Utility required: power source 100 V, 500 VA; pure water (deionized water) 0.5-5 L/min; compressed air 0.4-0.7 MPa.
- Size: 500 mm(W) \times ~500 mm(D) \times ~1500 mm(H)

Location and Date of Installation

Abiko campus, March 2005



External (upper) and internal (lower) view of online boron monitor