

Boron in Seawater and Brine Solutions

0.1 to 2.0 mg/L B Using TNT877

1:5 dilution required due to high salinity interference with the azomethine-H reagent. Actual boron concentrations before dilution for this application are 0.5 to 10 mg/L B.

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Introduction

Boron is present in seawater up to a concentration of ~4.5 mg/L. Other brine solutions like oil and gas produced and flowback waters can contain boron from the crosslinking process during hydraulic fracturing. Common drinking and surface water boron concentrations are rarely above 1 mg/L and the WHO has set preliminary drinking water limit on boron at 0.5 mg/L.

Before Starting

Seawater and highly saline samples must be diluted 1:5 to reduce the salt interference with the azomethine-H reagent. Temperature control is critical for test accuracy, samples should be maintained at 20°C.

Preparation of Saltwater Blank*:

Artificial Seawater 35 ppt salinity (3.5%) - ASTM D 1141, 2003 - *Do not add the Boric Acid from the ASTM formulary:*

NaCl - 24.53 g/L
MgCl₂ - 5.2 g/L
Na₂SO₄ - 4.09 g/L
CaCl₂ - 1.16 g/L
KCl - 0.695 g/L
NaHCO₃ - 0.201 g/L
KBr - 0.101 g/L
SrCl₂ - 0.025 g/L
NaF - 0.003 g/L

*This saltwater blank should be sufficient for both seawater and produced water applications

Procedure

- 1) Select program (see Instrument Setup section below for programming instructions).
- 2) Pipet **1 mL** of **Solution A** into 2 TNT877 boron vials. Label one vial "**Sample**" and one vial "**Blank**".
- 3) Cap the vials and invert several times to completely dissolve the freeze-dried reagent.
- 4) Pipet **2.5 mL** of the diluted seawater sample to be tested into the **Sample** vial. Pipet **2.5 mL** of a seawater or produced water blank (0.08% saltwater, 1:5 dilution of 3.5% saltwater blank from above) containing no boron into the **Blank** vial. (*Note: sample and seawater blank need to be diluted 1:5 to be within the testing range of the TNT877 method*)
- 5) Cap each vial and invert several times to mix.
- 6) When the timer expires, wipe the vial labeled Blank and place it into the cell holder.
- 7) Zero the instrument by pressing the "zero" button.
- 8) Wipe the vial labeled Sample and insert into the cell holder. Press "Read" to obtain the results in mg/L B. Multiply the value obtained by 5 to give the original boron concentration.

Instrument Setup

Program Setup for TNTXXX Method for the Analysis of Boron in Seawater

Follow the display prompts and enter commands for the boron method:

Step	Display Shows	Enter	Select
1	Main menu	User Programs	
2	User Programs	Program Options	
3	Program Options	New	
4	Program Number	Select a Program Number	OK
5	Program Name?	Boron_SW	Next
6	Program Type	Single Wavelength	Next
7	Units	mg/L	Next
8	Wavelength (nm)	414	Next
9	Concentration Resolution	0.001	Next
10	Chemical Form?	B	Next
11	Calibration	Enter Formula	Next
12	Enter Formula	a = 0.017, b = 1.69	OK>Done
13	User Program for number assigned	Upper Limit	Edit
14	Upper Limit	ON 2.000	OK>OK
15	User Program for number assigned	Timer 1	Edit
16	Timers	40.00	OK>OK>Store

Exit and select the Program number assigned for Boron in Seawater from the User Programs Menu to run the test.

Summary of Method

Borate ions react with azomethine-H to form a yellow dye, which is measured colorimetrically at a wavelength of 414 nm.

Removal of Interferences

Filter the sample if it contains suspended particles or is turbid.

Sample and Reagent Conditions

Sample pH = 4 - 9, Sample and reagent temperature = 20°C.

The colorimetric reaction of the boron analysis is temperature dependent; be sure that the temperature of the sample and reagent is at 20°C for accurate analysis. Store reagents at 2 - 8°C.

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