

Turbidimetric Method¹

Method 10227

150 to 900 mg/L SO₄²⁻ (HR)

TNTplus® 865

Scope and application: For drinking water, wastewater, raw water and process control.

¹ Adapted from *Standard Methods for the Examination of Water and Wastewater*, SM4500-SO₄²⁻-E.



Test preparation

Instrument-specific information

Table 1 shows all of the instruments that have the program for this test. The table also shows the adapter and light shield requirements for the applicable instruments that can use TNTplus vials.

To use the table, select an instrument, then read across to find the applicable information for this test.

Table 1 Instrument-specific information for TNTplus vials

Instrument	Adapters	Light shield
DR6000, DR5000	—	—
DR3900	—	LZV849
DR3800, DR2800	—	LZV646
DR1900	9609900 or 9609800 (A)	—

Before starting

DR3900, DR3800, DR2800: Install the light shield in Cell Compartment #2 before this test is started.

Install the instrument cap or cover on all instruments before the test result is read.

Review the safety information and the expiration date on the package.

The recommended sample pH is 3–10.

The recommended temperature for samples and reagents is 15–25 °C (59–77 °F).

The recommended temperature for reagent storage is 15–25 °C (59–77 °F).

DR1900: Go to All Programs>LCK or TNTplus Methods>Options to select the TNTplus number for the test. Other instruments automatically select the method from the barcode on the vial.

Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

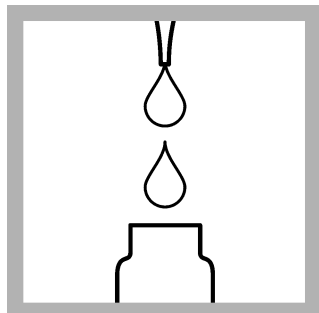
Description	Quantity
Sulfate HR TNTplus Reagent Set	1
Pipet, adjustable volume, 1.0–5.0 mL	1
Pipet tips, for 1.0–5.0 mL pipet	1

Refer to [Consumables and replacement items](#) on page 3 for order information.

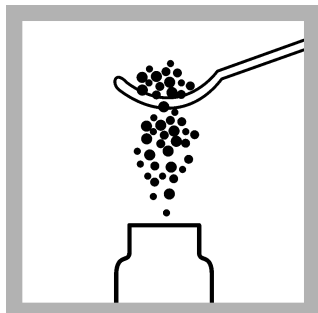
Sample collection and storage

- Collect samples in clean glass or plastic bottles.
- Analyze samples within 3 hours after collection for best results.
- To preserve samples for later analysis, keep the samples at or below 6 °C (43 °F) for up to 28 days.
- Let the sample temperature increase to room temperature before analysis.

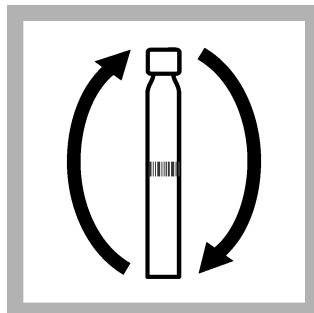
Test procedure



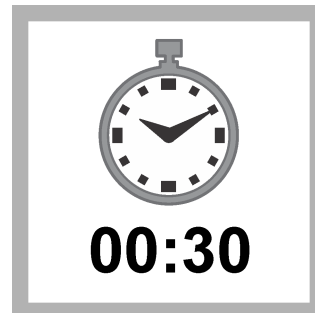
1. Use a pipet to add 2.0 mL of sample to the test vial.



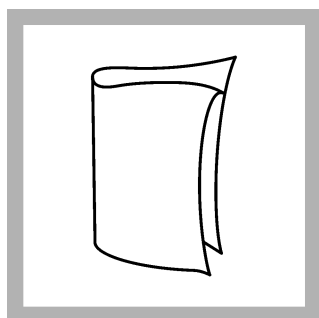
2. Add one level spoonful of Reagent A to the vial.



3. Immediately tighten the cap on the vial and **invert for 1 minute**.



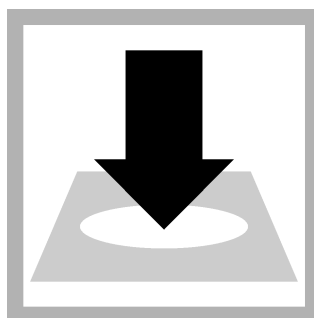
4. Start the reaction time of 30 seconds.



5. Clean the vial.



6. DR1900 only: Select program 865. Refer to [Before starting](#) on page 1.



7. Insert the vial into the cell holder. DR1900 only: Push **READ**. Results show in mg/L SO_4^{2-} .

Interferences

[Table 2](#) shows that the ions were individually examined to the given concentrations and do not cause interference. No cumulative effects or influences of other ions were found. Verify the measurement results with sample dilutions or standard additions.

Table 2 Interfering substances

Interfering substance	Interference level
K^+ , Na^+	2000 mg/L
Ca^{2+} , NO_3^- , Cl^-	1000 mg/L
Cd^{2+} , Cr^{3+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , Mg^{2+} , Mn^{2+} , NH_4^+ , Ni^{2+} , Si^{2+} , Sn^{2+} , Zn^{2+}	500 mg/L
Al^{3+} , Pb^{2+} , Hg^{2+} , PO_4^{3-} , CO_3^{2-} , I^- , CN^- , NO_2^-	50 mg/L
Cr^{6+}	20 mg/L
Ag^+	2.5 mg/L

Accuracy check

Standard Solution Method—mixed parameter standard

Use the standard solution method to validate the test procedure, the reagents and the instrument.

Items to collect:

- Wastewater Influent Standard Solution, Mixed Parameter (contains 400 mg/L SO_4^{2-})

1. Use the test procedure to measure the concentration of the standard solution.
2. Compare the expected result to the actual result.

Note: The factory calibration can be adjusted slightly with the standard adjust option so that the instrument shows the expected value of the standard solution. The adjusted calibration is then used for all test results. This adjustment can increase the test accuracy when there are small variations in the reagents or instruments.

Standard Solution Method—prepare standard

Use the standard solution method to validate the test procedure, the reagents and the instrument.

Items to collect:

- Sulfate Standard Solution, 2500-mg/L
- 100-mL volumetric flask, Class A
- 20.0-mL volumetric pipet, Class A and pipet filler safety bulb
- Deionized water

1. Prepare a 500-mg/L sulfate standard solution as follows:
 - a. Use a pipet to add 20.0 mL of a 2500-mg/L sulfate standard solution into the volumetric flask.
 - b. Dilute to the mark with deionized water. Mix well. Prepare this solution daily.
2. Use the test procedure to measure the concentration of the prepared standard solution.
3. Compare the expected result to the actual result.

Note: The factory calibration can be adjusted slightly with the standard adjust option so that the instrument shows the expected value of the standard solution. The adjusted calibration is then used for all test results. This adjustment can increase the test accuracy when there are small variations in the reagents or instruments.

Summary of Method

Sulfate ions in the sample react with barium chloride in aqueous solution and form a precipitate of barium sulfate. The measurement wavelength is 880 nm (DR2800: 890 nm; DR1900: 800 nm).

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Item no.
Sulfate HR TNTplus Reagent Set	1	25/pkg	TNT865

Required apparatus

Description	Quantity/test	Unit	Item no.
Pipet, adjustable volume, 1.0–5.0 mL	1	each	BBP065
Pipet tips, for 1.0–5.0 mL pipet	1	75/pkg	BBP068
Light shield, DR3800, DR2800, DR2700	1	each	LZV646
Light shield, DR3900	1	each	LZV849

Recommended standards

Description	Unit	Item no.
Sulfate Standard Solution, 2500-mg/L SO ₄ ²⁻	500 mL	1425249
Wastewater Influent Standard Solution, Mixed Parameter, for NH ₃ -N, NO ₃ -N, PO ₄ ³⁻ , COD, SO ₄ ²⁻ , TOC	500 mL	2833149

Optional reagents and apparatus

Description	Unit	Item no.
Flask, volumetric, Class A, 100 mL, glass	each	1457442
Sampling bottle with cap, low density polyethylene, 500-mL	12/pkg	2087079
Test tube rack, polyethylene, for 13-mm OD vials, 90 holes	each	2497900
Water, deionized	4 L	27256



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